This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

[illegible]

Arnold Arboretum Library

THE GIFT OF

FRANCIS SKINNER
OF DEDHAM

IN MEMORY OF

FRANCIS SKINNER
(H. C. 1862)

Received April 1918.

THE

SUPPLEMENT

TO THE

PENNY CYCLOPÆDIA

OF

THE SOCIETY

FOR THE

DIFFUSION OF USEFUL KNOWLEDGE.

VOLUME I.

ABATI——GYROSTEUS.

LONDON:
CHARLES KNIGHT AND Co., 22, LUDGATE STREET

MDCCCLI.

Price Twelve Shillings, bound in cloth.

Ref
Encyc
P37
1851

COMMITTEE.

Chairman—The Right Hon. LORD BROUGHAM, F.R.S., Member of the National Institute of France.
Vice-Chairman—The Right Hon. EARL SPENCER.
Treasurer—JOHN WOOD, Esq.

William Allen, Esq., F.R. and R.A.S.
Captain Beaufort, R.N., F.R. and R.A.S.
George Burrows, M.D.
Peter Stafford Carey, Esq., A.M.
John Conolly, M.D.
William Coulson, Esq.
The Right Rev. the Bishop of St. David's, D.D.
J. F. Davis, Esq., F.R.S.
Sir Henry De la Beche, F.R.S.
The Right Hon. Lord Denman.
Samuel Duckworth, Esq.
The Right Rev. the Bishop of Durham, D.D.
T. F. Ellis, Esq., A.M., F.R.A.S.
John Elliotson, M.D., F.R.S.
The Right Hon. George Evans.
Thomas Falconer, Esq.
John Forbes, M.D. and F.R.S.
Sir I. L. Goldsmid, Bart., F.R. and R.A.S.
Francis Henry Glodsmid, Esq.
B. Gompertz, Esq., F.R. and R.A.S.
J. T. Graves, Esq., A.M., F.R.S.
G. B. Greenough, Esq., F.R. and L.S.
Sir Edmund Head, Bart., A.M.
M. D. Hill, Esq., Q.C.
Rowland Hill, Esq., F.R.A.S.
Right Hon. Sir J. C. Hobhouse, Bart., M.P.
Thos. Hodgkin, M.D.
David Jardine, Esq., A.M.
Henry B. Ker, Esq.
Thomas Hewitt Key, Esq., A.M.
Sir Charles Lemon, Bart., M.P.
George C. Lewis, Esq., A.M.
James Loch, Esq., M.P., F.G.S.
George Long, Esq., A.M.
H. Malden, Esq., A.M.
A. T. Malkin, Esq., A.M.
Mr. Sergeant Manning.
R. I. Murchison, Esq., F.R.S., F.G.S.
The Right Hon. Lord Nugent.
W. S. O'Brien, Esq., M.P.
Richard Quain, Esq.
P. M. Roget, M.D. Sec. R.S., F.R.A.S.
R. W. Rothman, Esq., A.M.
Sir Martin Archer Shee, P.R.A., F.R.S.
Sir George T. Staunton, Bart., M.P.
John Taylor, Esq. F.R.S.
A. T. Thomson, M.D. F.L.S.
Thomas Vardon, Esq.
Jacob Waley, Esq., B.A.
Jas. Walker, Esq., F.R.S., Pr. Inst., Civ. Eng.
H. Waymouth, Esq.
Thos. Webster, Esq., A.M.
Right Hon. Lord Wrottesley, A.M., F.R.A.S.
J. A. Yates, Esq.

LOCAL COMMITTEES.

Alton, Staffordshire—Rev. J. P. Jones.
Anglesea—Rev. E. Williams.
  Rev. W. Johnson.
  — Miller, Esq.
Barnstaple.— — Bencraft, Esq.
  William Gribble, Esq.
Belfast—Jas L. Drummond, M.D.
Birmingham—Paul Moon James, Esq., *Treasurer.*
Bridport—James Williams, Esq.
Bristol—J.N. Sanders, Esq., F.G.S. *Chairman.*
  J. Reynolds, Esq., *Treasurer.*
  J. B. Estlin, Esq., F.L.S., *Secretary.*
Calcutta—James Young, Esq.
  C. H. Cameron, Esq.
Cambridge—Rev. Leonard Jenyns, M.A., F.L.S.
  Rev. John Lodge, M.A.
  Rev. Prof. Sedgwick, M.A., F.R.S. & G.S.
Canterbury—John Brent, Esq., Alderman.
  William Masters, Esq.
Carlisle—Thomas Barnes, M.D., F.R.S.E.
Carnarvon—R. A. Poole, Esq.
  William Roberts, Esq.
Chester—Henry Potts, Esq.
Chichester—C. C. Dendy, Esq.
Cockermouth—Rev. J. Whitridge.
Corfu—John Crawford, Esq.
  Plato Petrides
Coventry—C. Bray, Esq.
Denbigh—Thomas Evans, Esq.
Derby—Joseph Strutt, Esq.
  Edward Strutt, Esq., M.P.
Devonport and Stonehouse—John Cole, Esq.
  John Norman, Esq.
  Lt. Col. C. Hamilton Smith, F.R.S.
Durham—The Very Rev. the Dean.
Edinburgh—Sir C. Bell, F.R.S.L and E.
  J. S. Traill, M.D.
Etruria—Josiah Wedgwood, Esq.
Exeter—J. Tyrrell, Esq.
  John Milford, Esq. (*Conver.*)
Glamorganshire—Dr. Malkin, Cowbridge.
  W. Williams, Esq., Aberpergwm.
Glasgow—K. Finlay, Esq.
  Alexander McGrigor, Esq
  James Couper, Esq.
  A. J. D. D'Orsey, Esq.
Guernsey—F. C. Lukis, Esq.
Hitcham, Suffolk—Rev. Professor Henslow, M.A., F.L.S. & G.S.
Hull—Jas. Bowden, Esq.
Leeds—J. Marshall, Esq.
Lewes—J. W. Woollgar, Esq.
  Henry Browne. Esq.
Liverpool Loc. As.—J. Mulleneux, Esq.
  Rev. Wm. Shepherd, L.L.D.
Maidenhead—R. Goolden, Esq., F.L.S.
Maidstone—Clement T. Smyth, Esq.
  John Case, Esq.
Manchester Loc. As.—G. W. Wood, Esq., M.P., *Ch.*
  Sir Benjamin Heywood, Bt., *Treasurer.*
  Sir George Philips, Bart., M.P.
  T. N. Winstanley, Esq., *Hon. Sec.*
Merthyr Tydvil—Sir J. J. Guest, Bart., M.P.
Minchinhampton—John G. Ball, Esq.
Neath—John Rowland, Esq.
Newcastle—Rev. W. Turner.
  T. Sopwith, Esq., F.G.S.
Newport, Isle of Wight—Ab. Clarke, Esq.
  T. Cooke, Jun., Esq.
  R. G. Kirkpatrick, Esq.
Newport Pagnell—J. Millar, Esq.
Norwich—Richard Bacon, Esq.
  Wm. Forster, Esq.
Orsett, Essex—Corbett, M.D.
Oxford—Ch. Daubeny, M.D. F.R.S. Prof. Chem.
  Rev. Baden Powell, Sav. Prof.
  Rev. John Jordan, B.A.
Pesth, Hungary—Count Szechenyi.
Plymouth—H. Woollcombe, Esq., F.A.S., *Ch.*
  Wm. Snow Harris, Esq., F.R.S.
  E. Moore, M.D., F.L.S., *Secretary.*
  G. Wightwick, Esq.
  Dr. Traill.
Presteign—Rt. Hon. Sir H. Brydges, Bart.
  A. W. Davis, M.D.
Ripon—Rev. H. P. Hamilton, M.A., F.R.S., G.S.
  Rev. P. Ewart, M.A.
Ruthin—Rev. the Warden of
  Humphreys Jones, Esq.
Ryde, I. of Wight—Sir Rd. Simeon, Bt.
Salisbury—Rev. J. Barfitt.
Sheffield—J. H. Abraham, Esq.
Shepton Mallet—G. F. Burroughs, Esq.
Shrewsbury—R. A. Slaney, Esq.
South Petherton—John Nicholetts, Esq.
Stockport—H. Marsland, Esq., *Treasurer.*
  Henry Coppock, Esq., *Secretary.*
Sydney, New S. Wales—W. M. Manning, Esq.
Swansea—Matthew Moggridge, Esq.
Tavistock—Rev. W. Evans.
  John Rundle, Esq., M.P.
Truro—Henry Sewell Stokes, Esq.
Tunbridge Wells—Yeats, M.D.
Uttoxeter—Robert Blurton, Esq.
Virginia, U. S.—Professor Tucker.
Worcester—Chas. Hastings, M.D.
  C. H. Hebb, Esq.
Wrexham—Thomas Edgworth, Esq.
  Major Sir William Lloyd.
Yarmouth—C. E. Rumbold, Esq.
  Dawson Turner, Esq.
York—Rev. J. Kenrick, M.A.
  John Phillips, Esq., F.R.S., F.G.S.

THOMAS COATES, Esq., *Secretary*, No. 59, Lincoln's Inn Fields.

SUPPLEMENT

TO

THE PENNY CYCLOPÆDIA

OF

THE SOCIETY FOR THE DIFFUSION OF USEFUL KNOWLEDGE.

[The abbreviations P. C. and P. C. S. signify the Penny Cyclopædia and Penny Cyclopædia Supplement.]

ABATEMENT OF LEGACIES. [Legacy, P. C., p. 391.]

ABA'TI, or ABBA'TI, NICCOLO', was born at Modena in 1512. He is more frequently called Dell' Abate, but erroneously, according to the showing of Tiraboschi, as his family name was Abati. Before Tiraboschi, Niccolò's surname was supposed to be unknown, and the name of Dell' Abate was given to him from the circumstance of his being less known for his own works than as the assistant of Primaticcio, who was called L'Abate by the Italians after he was made Abbé of St. Martin near Troyes, by Francis I. of France. Abati executed in fresco the Adventures of Ulysses and other works from the designs of Primaticcio, for the palace of Fontainebleau, the decoration of which was intrusted to Primaticcio after the death of Il Rosso. Prints from the Adventures of Ulysses, by Van Thulden, were published in Paris in 1630: the original works were destroyed with the building, in 1738, to make room for a new structure.

Abati's own works however, in Modena and Bologna, were productions of the greatest merit, according to the Carracci; and in the celebrated sonnet of Agostino, which is a sort of recipe for making a great painter, he is mentioned in conclusion as combining in himself all the required excellences:—

> 'Ma senza tanti studi e tanto stento
> Si ponga solo l' opere ad imitare
> Che qui lasciocci il nostro Niccolino.'

There are few of Abati's works remaining, and these are chiefly frescoes; he seems to have painted comparatively little in oil. It is not known who his master was, or whether he had any other master than his father Giovanni Abati, who was an obscure painter and modeller of Modena. From a similarity in his works to the style of Correggio, some have supposed that he was a pupil of Correggio; he is also said to have studied under the sculptor Begarelli: if so, he was probably well acquainted with Correggio, with whom Begarelli was intimate.

His earliest essays upon his own account were in partnership with another painter, Alberto Fontana, a practice not unusual at that period in Italy, when there was little or no distinction between artists and artisans in the manner of employing them or estimating their works. In 1537 he painted with Fontana, at Modena, some frescoes in the butchers' market, by which he obtained some reputation; and he acquired great distinction by some frescoes in the Scandiano Palace, from Ariosto and the Æneid of Virgil, which are still extant; they have been engraved by Gajani. These, with some conversation-pieces and concertos in the Institute of Bologna, a Nativity of Christ under the portico of the Leoni Palace, and a large symbolical picture in the Via di San Mamolo, in the same city, are the only frescoes now extant by Abati; and his oil-pictures are likewise very scarce. Of the works in the Institute Zanotti has written an account—'Delle Pitture di Pellegrino Tibaldi e Niccolo Abbati,' &c., in which there are engravings of them: Malvasia also has given a laudatory description of them: they have been compared with the works of Titian. The Nativity of the Leoni Palace, which has been engraved by Gondolfi, is mentioned in the highest terms by Count Algarotti, who discovered in it 'the symmetry of Raphael, the nature of Titian, and the grace of Parmegiano.' Of his easel-pictures in oil the most celebrated is the Martyrdom of St. Peter and St. Paul, a large picture on wood, which was painted for the Church of the Benedictines at Modena, in 1546. It is now in the Dresden Gallery, and has been engraved by Folkema for the 'Recueil d'Estampes après les plus célèbres Tableaux de la Galerie de Dresde.'

From about 1546 until 1552, when he accompanied Primaticcio to France, Abati lived in Bologna, and his Bolognese works were painted during this interval: he died in Paris, in 1571.

Abati's principal faculty was painting in fresco, in which he had surprising facility. According to Vasari he never retouched his works when dry, which cannot be said of many fresco-painters; yet, says Vasari, the paintings of an entire apartment were executed with such uniformity that they appeared to be the work of a single day. Abati excelled in landscape, for his period: there is a Rape of Proserpine in the Duke of Sutherland's collection, of which the background is an extensive landscape; it was formerly in the Orleans Gallery, and was sold at the sale in this country for 160*l*.

Several of Abati's relations also distinguished themselves as painters: his brother Pietro Paolo was a clever horse and battle painter; his son Giulio Camillo, his grandson Ercole, and his great-grandson Pietro Paolo the younger, were all painters of ability, especially Ercole, who was born in Modena in 1563, and died in 1613; he executed, with B. Schidone, the frescoes of the council-hall of Modena.

(Vedriani, *Vite de' Pittori di Modenesi*; Tiraboschi, *Notizie de' Pittori, &c. di Modena.*)

ABERCROMBIE, JOHN, M.D., Fellow of the Royal Colleges of Physicians and Surgeons of Edinburgh, &c., was born on the 11th of November, 1781. He was the son of the Rev. Mr. Abercrombie, for many years one of the town-ministers of Aberdeen. Edinburgh was at the time the most distinguished seat of medical education in the empire. Applying his mind to that branch of professional knowledge, Abercrombie studied in the Scottish metropolis, and took his degree there on the 4th of June, 1803. He entered into practice subsequently in Edinburgh, and became a Fellow of the Royal College of Surgeons in the year 1805, thus qualifying himself to teach surgery, and taking the highest professional rank in that class. However, though he so far combined the practice of a surgeon with that of a physician even in his early career, according to a common Scottish custom, his disposition was better suited to the pursuits of the pure physician; and into these he fell altogether soon after the decease of the celebrated Dr. Gregory in 1821. Dr. Abercrombie from that time began to occupy the most prominent position as a practising and consulting physician, not only in Edinburgh but in all Scotland, and he was often called to great distances in the country. He became a licentiate of the Royal College of Physicians in 1823, and in 1824 was admitted a Fellow of the body. While receiving subsequent honours from his colleagues, his high position in after-life also gained for him many complimentary distinctions from other quarters. In 1834 the University of Oxford marked their estimation of his character and talents by conferring on him the honorary degree of Doctor of Medicine—a somewhat rare mark of respect to the alumni of Scottish universities. In the year 1835 Dr. Abercrombie was elected Lord Rector of the venerable Marischal College of Aberdeen. Of the other honours bestowed on him by public and private bodies, we need only notice his appointment to the vice-presidency of the Royal Society of Edinburgh, and to the office of physician in ordinary to her Majesty for Scotland. The numerous subsidiary places which he held, most of which were connected with benevolent societies, need not be enumerated. Dr. John Abercrombie died suddenly on Thursday, November 14, 1844, at his house in York Place. On a post-mortem examination, it was found that the bursting of the coronary artery of the heart had been the immediate cause of death.

The writings of Dr. Abercrombie contributed no less to the establishment and maintenance of his fame than his singularly useful career as a practical member of his profession. In the early part of his course he confined his literary labours to the 'Edinburgh Medical and Surgical Journal,' and other periodicals in his own department of science. His first distinct work of moment, leaving out of consideration published cases of disease and similar minor treatises, was one entitled 'Pathological and Practical Researches on Diseases of the Brain and the Spinal Cord,' Edinburgh, 1828, 8vo. In this work, which is characterised by no ordinary degree of purely scientific knowledge, he also gave an indication of the bent of his genius to the study of mind and its relations to the body. He published about the same time another professional volume, and one which elevated him still more highly among the modern cultivators of medicine, styled 'Pathological and Practical Researches on the Diseases of the Intestinal Canal, Liver, and other Viscera of the Abdomen,' Edinburgh, 1828, 8vo. Dr. Abercrombie seems now to have directed his thoughts to higher objects; and his two subsequent works form the most permanent monument to his memory. He began to throw together the medical facts accumulated in the course of his extensive experience and reading, and to examine their bearings on the various metaphysical and moral systems that have been established. The result of his labours is to be found in two works: the one entitled 'Inquiries concerning the Intellectual Powers and the Investigation of Truth,' Edinburgh, 1830, 8vo.; and the other called 'The Philosophy of the Moral Feelings,' London, 1833, 8vo. The latter is in some measure a sequel to the first, and the whole composes a view of human nature intellectually and morally, in which the facts of science and the revelations of religion are combined together in peculiar harmony. The best of these two works in every respect is perhaps that on the Intellectual Powers. It is not so much the product of profound original research, as the result of the quiet meditations of a superior mind aided by all the advantages of much reading and large practical experience. The work is more reflective than penetrative or suggestive. In particular the light thrown by the author on those curious cases of spectral illusions which have so long interested the medical profession, is a proof at once of Dr. Abercrombie's powers and skill in his profession, and of his capacity for investigating the difficulties of mental philosophy. In so brief a sketch as the present it is impossible to do full justice to such a man as Dr. Abercrombie. For range of acquirements, solid as extensive, he stood unequalled among the Scottish physicians of his day. He earned by his writings a name that will not be forgotten, and he will long be remembered, as a private individual, for his singular piety and benevolence.

ABERDEENSHIRE, a maritime county in the east of Scotland, bounded on the north-east and east by the North Sea, on the south-east by Kincardineshire, on the south by Forfarshire, on the south-west by Perthshire, on the west by Inverness-shire, and on the north-west by Banffshire. Its form is irregular, having its greatest length from east-north-east to west-south-west, from Rattray Head between Peterhead and Fraserburgh to the junction of the three counties of Perth, Inverness, and Aberdeen, 88 or 89 miles; and its greatest breadth at right angles to the length, from the border of the county of Banff, near the town of Banff, to the mouth of the Dee, 38 miles. A small part of Banffshire (the parish of St. Fergus) is insulated by this county and by the sea near Peterhead. The area of Aberdeenshire, including the few lochs, which are small, is estimated at 1970 square miles (some statements make it rather less); it is in size the fifth of the Scottish counties, being 668 square miles less than Perthshire, the next county above it, and 169 miles greater than Sutherlandshire, the next below it. The population at the different enumerations in the present century was as follows:—1801, 123,082; 1811, 135,075; increase in ten years 10 per cent.; 1821, 155,387, increase 15 per cent.; 1831, 177,657, increase 14 per cent.; 1841, 192,283, increase 8·2 per cent. In the ten years from 1821 to 1831 the rate of increase slightly exceeded the average of Scotland; but during the rest of the period it has been below the average. According to the census of 1831, which we retain to facilitate comparison, there were 90 persons to a square mile. It was then the third of the Scottish counties in amount of population, being exceeded only by Lanarkshire and Edinburghshire; and the thirteenth in density of population, being next below Kinross-shire and next above Elginshire. According to the census of 1841 it retains its place in the scale both of amount and density of population: it had then betwen 97 and 98 inhabitants to a square mile.

Coast-line.—The coast of Aberdeenshire has a tolerably regular outline, for the most part convex to the sea. From the mouth of the Dee, which separates the county from Kincardineshire, it proceeds in a tolerably direct line for 12 miles north by east or north-north-east to the mouth of the Ythan. The Don and several smaller streams fall into the sea in this part of the coast: the mouth of the Don is about two miles north of the mouth of the Dee; the outfal of the other streams is more to the northward. From the Ythan the coast at first runs a little more to the eastward, but turns gradually to the north, north-west, and west, forming nearly a semicircle of about 55 miles, measured along the shore to the mouth of the little stream which separates the county from Banffshire. In this semicircular sweep the coast has several headlands, but of little prominence: they are White-ness, Briggs-head, Bows-ness, Boddam or Buchan-ness, Invernetty-point or Salthouse-head, Inchkeith-point (the last three in Peterhead parish, and near the town of that name), Rattery or Rattray-head, Tillyduff-point, Cairnbulg-point (all three between Peterhead and Fraserburgh), and Kinnaird's-head near Fraserburgh. Fergus-head or Scotstown-point is in the detached part of Banffshire, between Inchkeith-point and Rattray-head. Buchan-ness and Inchkeith-point are the easternmost points of the mainland of Scotland: they are in 1° 45′ W. long. There is a lighthouse 118 feet high, built of granite, with what is termed 'a flashing light,' on Buchan-ness. The bays between the mouth of the Ythan and the point where the boundary between this county and Banffshire meets the coast, are—Cruden bay, between Briggs-head and Bows-ness; Invernetty or Sandford bay, between Buchan-ness and Salthouse-head; Peterhead bay, between Salthouse-head and Inchkeith-point; St. Fergus bay between Scotstown-point (in the detached part of Banffshire) and Rattray-head; Strathbeg or Strabeg or Rattray bay (which at low water becomes a loch, communicating with the open sea by a narrow passage adjacent to Rattray-head on the north-west); Fraserburgh bay, between Cairnbulg-point and Kinnaird's-head, Fingus bay, west of Kinnaird's-head; and Aberdour bay, near the Banffshire boundary.

The coast from the border of Kincardineshire northward to the mouth of the Ythan is comparatively low and shelving: from the mouth of the Ythan it assumes a bolder character, being skirted in some places by rocks rising 170 or 200 feet above the level of the sea. These rocks are penetrated by some remarkable fissures and caverns which formerly afforded great facilities for the concealment of smuggled goods. The rocks are chiefly of black basalt, gneiss, mica slate, or red granite. About Peterhead they form mural precipices. Some of the bays which indent this generally bold coast have a flat beach of sand or pebbles. North of the Ugie, which joins the sea just to the north of Peterhead, the shore loses its abrupt and lofty character, and presents a line of clay hills covered with an accumulation of drift sand; near Rattray-head there is a ridge of rocks projecting into the sea, by which at high water they are covered. Beyond Rattray-head the coast is low and sandy to Kinnaird's-head, a promontory of considerable height; westward of which the coast is sometimes sandy, sometimes lined with rocks, in which are some remarkable caves. One of these caves served as a hiding-place to Lord Pitsligo after the battle of Culloden in 1746. There are no islands on the coast deserving of notice.

Surface and Geology.—The county is generally hilly; in the south-western part it is mountainous. The crest of the principal range of the Grampians forms, for a considerable distance, the southern boundary, separating Aberdeenshire from Perth, Forfar, and Kincardine shires. A branch of the Grampians, thrown off from the principal range at Badenoch forest in the south-western extremity of the county, forms for a short distance the western boundary, and separates Aberdeenshire from Banffshire. From this branch another branch is thrown off towards the north-east; and although no distinctly marked chain of hills can be traced far, the elevation of the surface in this direction is apparent from the course of the waters; the upper waters of the Don, the Ythan, and the Ugie, flowing down the south-eastern slope, and several streams flowing down the north-western slope into the Dovern or Doveran, which belongs chiefly to Banffshire. The principal summits in the main range of the Grampians, on the southern boundary, enumerated in their order from west to east, are—Scarsoch, Craigan Loch, Gelly Cairn, Ben Uarn, Cairn Leay, Ben Barrow, Glash Mell, Aught Hill, Cairn Tagart or Taggart (about 3000 feet high), Loch na Gar (3815 feet), Hill of Mark, Mount Kean (3126 feet), Braid Cairns, Cockairns, Hill of Cat, and Mont Battack. The principal summits of the branch on the western boundary are—Cairn Toul (4220 feet), Breriach, close to Cairn Toul, and about the same height, and Ben Macdhui, or Bennamuickduidh (4390 feet), ascertained by the Ordnance Survey to be 20 feet higher than Ben Nevis, hitherto regarded as the highest mountain in Great Britain. On the branch thrown off from that just mentioned, and running to the north-east, are Bennabuird (3940 feet), Ben Aven or Ben Avon, and Morven (2934 feet).

The mountain district of Braemar, in which or the neighbourhood most of these peaks are included, is chiefly granitic: the mountains frequently present tabular summits with steep precipitous sides. Ben Macdhui has on its sides precipices of more than 1000 feet high. Conical summits are not so frequent, but Cairn Toul and Loch na Gar have this form. The sides of the mountains vary in character, presenting sometimes mural precipices, sometimes slopes more or less steep: at the foot of the precipices or steeper slopes considerable masses of granitic débris are observable. The granite of Braemar is chiefly pure; the mica is the least of its constituent minerals: the felspar and quartz are in about equal proportions. Some of the granite is porphyritic. In the upper part of the valley of the Dee a large mass of syenite is found; but this belongs chiefly to Perthshire, if not entirely.

The neighbourhood of Aberdeen, extending for some miles round that city, especially towards the west, is occupied by granite. The limits of this granite district do not appear to be well ascertained, but it extends westward as far as Midmar parish, and is found even as far as Coull and Tarland parishes. The principal mass of granite forms rounded hills west of Aberdeen between the Don and the Dee, and extends to the northward of the Don. The granite is neither very coarse nor very fine grained. It is quarried in large quantities (chiefly of grey granite), and shipped at Aberdeen for London and other places.

Granite is found in various other parts of the county; in the parishes of Keig, Premnay, Monymusk, Oyne, Daviot, and Chapel of Garioch, near the banks of the Don, and of the Urie, which flows into the Don; in those of Udny, Ellon, and Tarves, near the banks of the Ythan; in those of Huntly, Drumblade, and Glenbucket, near the Doveran; and in those of Fraserburgh, Longside, and Peterhead, near the coast. It is quarried in Drumblade and Peterhead parishes. The granite is frequently found disintegrated, at least in so friable a state as to be easily dug into by the pickaxe and spade; yet large blocks of fine building-stone, capable of resisting the action of the weather, are frequently quarried in the midst of a mass of disintegrated rock.

Syenite is found in various parts, especially in the parishes of Peterhead and Lonmay near the coast; in Alford and Methlick parishes in the interior; and in Strathdon and Glenbucket, near the head of the Don. Gneiss is found in the districts adjacent to the granite, but not in great quantity. The predominant rock in the county is mica slate. In the parts adjacent to the granite it is quartzose and very compact, showing a tendency to pass into gneiss, or alternating with that rock. Serpentine and primitive limestone are found in a few places. Clay slate, grauwacké, and grauwacké slate are found in the parishes of Aberdour, Turriff, and King Edward, in the northern part of the county, adjoining Banffshire. Red sandstone (apparently the old formation) is found in the same three parishes, and in the adjacent parish of Monquitter. Magnesian limestone is said to be found in the parish of Tough. Trap rocks are of continual occurrence in the inland and hilly parts of the county; and veins or dykes of trap are observed in parishes near the east coast. (Boué, *Essai Géologique sur l'Ecosse; New Statistical Account of Scotland.*)

Hydrography and Communications.—The principal rivers of the county are the Dee, the Don, the Ythan, the Ugie, and the Deveron or Dovern or Doveran, with their respective tributaries. We have enumerated them in the order of their outfal from south to north and west, from Kincardineshire to Banffshire.

The Dee rises in the south-western part of the county, in the mountains which there separate Aberdeenshire from Inverness-shire. It rises high up the side of the mountain Breriach, at an altitude of above 4000 feet, and flows for about 11 or 12 miles in a south-south-east direction to the junction of the Geonly or Geauly, a stream 10 miles long. From the junction of this stream its course is east by north for about 12 miles to Newton, below the castle of Braemar. In this part of its course it receives several mountain-streams, as the Lui and the Queich or Coich, each about 10 miles long, on the left bank, and the Ey and the Clunie or Cluanadh, about the same length, on the right. In the upper part of the Dee there are several falls, or as they are termed 'linns,' of which the principal, not from its height, but its turbulence, is the Linn of Dee; the river here forces its way by four successive falls or rapids through a passage of rock, so narrow in some places that some persons have been hardy enough to step across it. The falls of Coirmulzie and Garvalt, both below the Linn of Dee, are also much admired. From Newton the Dee flows about 7 miles north by east to the kirk of Crathie, and then turning to east by north, flows, with some slight variations, in that direction about 60 miles to its outfal at Aberdeen. Its whole course is above 90 miles. In the 'Gazetteer of Scotland,' published by Fullarton and Co. of Glasgow, and in Chambers's 'Gazetteer of Scotland,' its length is estimated at 96 or 97 miles. About 24 miles above its outfal it quits Aberdeenshire to enter Kincardineshire; but after flowing about ten miles through Kincardineshire, returns to the border of Aberdeenshire, and for the rest of its course separates the two counties. It receives the Gairden or Gairn, 18 miles long, on the left bank, about six miles below Crathie kirk; and the Muick, 12 miles long, on the right bank, about two miles lower down. In the upper part of the Muick are two small but picturesque lakes. Dhu-loch, 'the Black Lake,' is supposed to obtain its name from its being overshadowed by the lofty cliffs of Craig Dhu-loch, which rise from its southern border to a height of more than 1000 feet. A mountain rill falls into it on the north side from a height of more than 200 feet. Loch Muick is about two miles long, from south-west to north-east, and half a mile broad. It receives a stream from Dhu-loch and others from the surrounding mountains; and its waters are remarkable for their coldness even in the midst of summer. There is a small island near its south-western end, where seagulls are always to be found. A little below the Muick, another stream falls into the Dee on the left bank: this stream is the outlet of two small lakes; Loch Connor, surrounded by birch-woods and studded with small islands, and Loch Dawan. The Dye, the largest feeder of the Dee, with the Aven its tributary, belong chiefly to Kincardineshire: the Dye joins the Dee on the right bank in Kincardineshire. Two small lakes, Loch Drum and Loch Skene, are connected with the Dee by streams which flow into it on the left bank, after it again touches the border of the county.

The Dee is, from the declivity of its bed, which has a fall of 4000 feet in less than 80 miles, a rapid stream. Its average fall from Aboyne, 30 miles above its outfal, to Aberdeen, is about ten feet in a mile. Its inundations sweep away the good soil of the country through which it flows, and leave instead of it an unproductive sand. It is chiefly valuable for its salmon fishery, the yearly produce of which is estimated at 8000*l*. The mouth forms the harbour of Aberdeen.

The Don rises just on the western border of the county, in the parish of Strathdon; its source is elevated about 1640 feet above the level of the sea: its course is very winding; first north-east, to the neighbourhood of Kildrummy kirk, 30 miles; then eastward, about 28 miles, to Inverury; and then south-east, about 20 miles, to its outfal in the North Sea at Old Aberdeen. Its whole course is about 78 miles. In the Gazetteers already quoted it is called 62, which we believe is much too little. The Don rises in a peat moss: in the upper part of its course it is a very rapid river, shallow, and subject to inundations, of which that of 1829 was very destructive. It receives several mountain-streams in the upper part of its course, and at the manse of Strathdon is 70 feet wide: it affords excellent angling for small trout. At Keig, midway between Kildrummy and Inverury, it is 140 feet broad; but still very shallow. At Inverury it receives the Urie or Ury, its most important tributary. Its course is here very slow; but it is still liable to overflow, and this liability has been increased of late years by the number of drains cut for agricultural purposes. The Don was formerly much frequented by salmon of excellent quality: they ascended the stream at the end of September, and returned to the sea about the beginning of April. The salmon fisheries at Kintore, about 12 miles above its mouth, were of considerable value; but a great proportion of the fish are now intercepted by stake-nets at and near the mouth of the river. The salmon fishery of the Don is of less value than that of the Dee. Pearls are said to have been found in the Don formerly, but none are obtained now. It is navigable only to the bridge of Old Aberdeen, and that only for small craft. The Urie, the most important feeder of the Don, rises in Gartly parish, and flows by Culsamond and Rayne into the Don, which it joins on the left bank at Inverury: its course is about 24 miles. The tributaries next in magnitude are the Earnon or Ernan, the Noughty or Nochtie, and the Bucket, all of which join it on the left bank in the order of enumeration, above the junction of the Urie; and the Leochel or Leochal, which joins it on the right bank at Alford below Kildrummy.

The Ythan rises in the parish of Forgue near the north-western border of the county; and flows first 4 miles eastward, then 5 miles north-east to Towie, the antient seat of the Barclays, and from thence its course is, with some variation, south-east, by Fyvie kirk, the village of Ellon, the kirk of Logie Buchan, and the village of Newburgh, 28 miles into the North Sea. Its whole course, by measurement on Arrowsmith's Map of Scotland, is about 37 miles: in the 'New Statistical Account of Scotland' it is stated at above 27 or 28 miles in one place (Account of Ellon Parish) and 31 in another (Account of Fyvie Parish); but we consider both these statements as below the truth. The Ythan is a slow and gentle stream; but from the more extensive system of drainage adopted in the lands through which it flows, it is subject to rise more suddenly than in former years. It has a considerable volume of water; but near the sea it spreads out into a wide shallow basin, so as to be navigable only for small craft, except just within the mouth. The entrance is obstructed by a bar; and the shifting sands in the channel render the navigation dangerous. Vessels of 70 to 90 tons go up to Newburgh, which is scarcely a mile up the river, and flat-bottomed lighters of from six to twelve tons get up with the tide almost to the village of Ellon, four miles higher, and carry coals, lime, and bones to different landing-places. It is thought that the navigation might be considerably extended and improved. The river abounds with fish, as trout of various kinds, including salmon-trout and bull-trout; finnock, eels, flounders, and salmon. The salmon and sea-trout ascend the river in summer, and return to the sea in March and April of the following year. The salmon fishery has been less successful of late years: there are two fishings, one at the mouth of the river, the other at the village of Ellon, about five miles up the stream; but the latter has become of little consequence from the introduction of stake-nets along the coast. Seals have been occasionally seen in the river near the kirk of Logie Buchan, about two or three miles above the mouth. Many hundred tons of mussels and cockles are taken yearly. The pearl-mussel is found, and the pearl fishery was formerly thought of sufficient importance to be the subject of a grant by patent. There is a prevalent tradition that the large pearl in the Scottish crown was found in the Ythan, or in the Kelly, one of its tributaries; and about the middle of the last century a gentleman of Aberdeen received 100*l.* from a London jeweller for pearls found here. But few of any value are found now: it is a favourite amusement for schoolboys to fish for them in summer when the water is low. The tributaries of the Ythan are all small; the Blackwater or Littlewater or Water of Gight joins it on the left above Methlick kirk; the water of Kelly on the right below Methlick kirk, the Ebrie on the left between Methlick kirk and the village of Ellon, and another stream from Udny kirk on the right a little above Ellon. The first and the last two are each about eight miles long, the third about twelve miles long.

The Ugie is formed by two streams, of which the North Ugie rises to the south of Aberdour and flows south-east by the kirk of Strichen; the South Ugie rises between Strichen and Monquitter kirks, and flows east by south. The streams have a course, the first of about 15, the second of from 18 to 20 miles above their junction. Their course below the junction is about 5 or 6 miles into the North Sea at Buchan Haven near Peterhead. From the trifling declivity and winding course of its channel the Ugie is a very slow stream: it is apt to overflow after falls of rain, where pains have not been taken to deepen its channel or to restrain its waters by embankments. It contains an abundance of black or burn trouts; but few salmon are found in it. It is navigable just at the mouth, but might be rendered navigable, at a small expense, for some miles higher up.

The Deveron or Dovern or Doveran belongs partly to Banffshire, partly to Aberdeenshire; and sometimes separates the two counties. Its source and upper part for about seven or eight miles, in which its course is northward, belong to Aberdeenshire: it is augmented in this part by a number of small streams. After flowing about 5 miles north by east through Banffshire, it touches the border of the two counties, along which it flows for 2 or 3 miles, still north by east, and then enters Aberdeenshire. Its course now becomes circuitous, first turning eastward and then northward, till after flowing for about 13 miles through Aberdeenshire (in which, near the town of Huntly, it receives on the right bank the Bogie Water, one of its principal tributaries, which flows northward 17 miles by Achindore, Kearn, and Gartly kirks), it returns to the border. The remainder of its course, about 23 miles first eastward and finally northward, is partly in Banffshire, partly on the border. Its whole length is about 51 miles. It is a rapid stream, flowing for a considerable part of its course through a deep narrow vale, and is subject to serious floods. Both the Bogie and the Deveron contain excellent trout; pearls of trifling value are sometimes found in the Deveron, in which, near the mouth, a considerable salmon fishery is carried on. The burns of Turriff and King Edward (13 miles and 9 miles long respectively), which join the Deveron on the right bank, belong to Aberdeenshire; the more important tributaries, the Blackwater and the Cantly, which join it on the left, belong wholly or chiefly to Banffshire.

Of smaller streams, the Cruden, about 8 miles long, flows into the North Sea between the Ythan and the Ugie; and the Rathen, 11 miles long, between Cairnbulg Point and Kinnaird's Head, near the town of Fraserburgh.

Aberdeenshire does not contain any lakes of importance. Dhu-loch, and Lochs Muick, Cannor, Dawan, Drum, and Skene, have been already mentioned in our notice of the river Dee.

The only canal in the county is the Aberdeenshire canal, which begins in the harbour of Aberdeen and runs up the valley of the Don parallel to the course of that river and near to it on the right bank, and terminates at Port Elphinstone in Kintore parish, but close to the town of Inverury. This canal was formed under acts obtained in 1793 and 1796, and was opened in 1807: its length is 18½ miles; its width was originally 17 feet and its depth 3 feet, but these dimensions have been enlarged, so that it is now from 21 to 23 feet wide and 3½ feet deep. Another statement gives the breadth as averaging 25 feet, the depth 3¾ feet. The expense of the construction and enlargement was nearly 40,000*l.* There is a tide-lock connecting the canal with the harbour of Aberdeen, and seventeen other locks, the greater number of which are at the lower end of the canal within 3 or 4 miles of Aberdeen. The total fall is about 133 feet to high-water mark in Aberdeen harbour. The trade of the canal has been on the whole increasing: lime, coal, dung, bones, and bark are carried up; and stone, slate, grain, and meal brought down. A passage-boat runs daily from Aberdeen to Port Elphinstone.

The principal roads are as follows: 1. From Edinburgh by Montrose to Aberdeen (entering the county at Dee bridge near Aberdeen), continued by Ellon and Cruden to Peterhead, and from thence to Fraserburgh. There is a shorter road from Ellon to Fraserburgh, more inland than the road by Peterhead. 2. From Aberdeen by Old Meldrum, Turriff, and King Edward to Banff. 3. From Aberdeen by Kintore, Inverury, and Huntly, to Elgin and Inverness. 4. From

Aberdeen up the valley of the Dee by Peterculter, Drumoak, Kincardine O'Neil, Ballater, and Tulloch, to Castletown of Braemar; and from thence southward across the Grampians to Blair Gowrie and Perth. 5. From Peterhead by Longside and Old Deer to Banff.

Soil and Agriculture.—The soil of the county varies much. Our notices of it and of the state of agriculture, being derived from the New Statistical Account of Scotland, refer to particular parishes, of which we shall select those which may be considered as representing those districts of the county in which they are respectively placed.

The united parishes of Braemar and Crathie, containing about 200,000 acres, or 312 square miles, comprehend the highlands about the source of the Dee. This district has a variable but healthy climate, and is watered by a number of mountain-streams, affluents of the Dee, which flows eastward through the middle of the parish. The soil is loamy, generally dry, resting sometimes on dry yellow clay, but more frequently on gravel. By far the greater part of the parish is uncultivated, and from 10,000 to 11,000 acres are covered with wood. The natural woods consists of birch, alder, poplar, and mountain ash; there are no oak coppices. The planted woods are chiefly larch and Scotch firs; other species of the fir are less common. Some of the Scotch firs are of immense size, and are reputed to be from 300 to 400 years old. The fir timber of the forest of Mar is, for size and quality, the first in the British Islands. This forest is well stocked with red-deer and roes: it affords also good pasturage. The quantity of cultivated land is but small. The black-faced or Linton is the prevalent breed of sheep; and the small black-horned breed of cattle. The adjacent highland parish of Strathdon (about 67,300 acres, or 105 square miles) has less natural wood; and the wood is chiefly birch. The soil in the strath or valley of the Don is good deep loam, resting chiefly on gravel. On the tops of the hills are peat-mosses of considerable extent. The quantity of arable land is about 4500 Scotch acres, and there are 3000 acres of plantation, chiefly larch and Scotch fir. Agriculture has been making steady progress for many years; and much land has been brought into cultivation by trenching and drainage. Lime is the general manure, an abundance of it of good quality is dug in the parish, and each farm has commonly its lime-kiln. The usual rotation of crops occupies seven years; oats are grown for two successive years, and are succeeded by turnips or some other green crop; the green crop is followed by bear or bigg, and hay; and the land is used for pasture for the two remaining years. No wheat and but little English barley is grown; the Angus and Scotch birley oats, and the green and red topped yellow turnips, are the favourites. The turnip crops are excellent: the soil suits the potato, but the danger of ruin to the crop from the early frosts prevents the cultivation of it. Leases are generally for nineteen years. The farm-houses are commodious, and the offices are generally of a superior description, built of stone and lime, with slated roofs. There are several thrashing-mills in the parish, in which water is the moving force.

The parishes of Lumphanan, Kincardine O'Neil, Alford, and Tough occupy a considerable district between the Don and the Dee, midway between the sources of those rivers and their outfal. The area of these parishes may be stated in round numbers at 40,000 acres, probably more; of which 16,000 acres, or about two-fifths, are under the plough, and about 6300 acres are occupied by plantations. The principal farms are held on lease for nineteen years; and the rent of arable land may be stated at an average of from 14s. to 21s. per imperial acre, in the several parishes the two nearest the Dee, Kincardine O'Neil and Lumphanan being the highest. The farms are from 50 to 150 acres, the generality of them about 100; besides which there are a number of 'crofts,' or small farms, of from 3 to 6 and occasionally of 10 or even 20 acres, held either of the landowners or by sub-lease, and often for a shorter term than nineteen years. The principal manure is lime, imported from Sunderland into Aberdeen. Bone manure is a good deal used, sometimes with dung. The rotation of crops occupies seven years; turnips are succeeded by bear or more commonly oats with grass seeds; then the land is laid down to grass for three years, the first of the three years affording a crop of hay from red and white clover and rye grass: then two successive crops of oats are taken. Some new leases bind the tenant to a six-years shift, one oat crop being omitted. The Angus, Scotch birley, and red oats are those chiefly grown. Drains both open and covered have been executed to a considerable extent: they are cut three or four feet deep, or more if requisite; rough stones are shot in and covered with heath and then with earth. Trenching is but little resorted to except in bringing fresh land into cultivation. The farm-houses and offices are most of them tolerably substantial and commodious, built of stone, and roofed in some cases with slates, in others with straw or heath, which forms a more durable thatch than straw. A light plough with two horses or oxen has superseded the old heavy plough with its five or six yokes of oxen. A considerable part of the arable land is enclosed and divided by dry stone walls. Thorn hedges have been introduced within the last few years, and are extending. Much of the arable land is still unenclosed. Thrashing-mills and machines are common. The number of sheep and pigs reared is not great. The sheep are of the Leicester or of a merino cross breed; there are a few of the black-faced sheep on the hills. A considerable quantity of lean stock is reared for the English markets. The cattle are pastured in summer: from October to May they are housed and fed with turnips and oat straw, so as just to keep them in growing condition. They are usually brought to market at three years old, sometimes at four years. The cattle are chiefly the long-horned black or brown Aberdeenshire breed; crossed sometimes with the West Highland and occasionally with the Teeswater breed; sometimes with the Galloway bull. The horses are of the old small-sized hardy breed of the country, or of larger breeds introduced from the south of Scotland or from England. The plantations are chiefly of the Scotch fir and larch: those of the Scotch fir have frequently been unsuccessful from the prevailing error of planting too close; but though the error has not been rectified, its effects are to a considerable extent counteracted by greater attention to early thinning.

Cruden, Slains, and Foveran lie on the coast, south of Peterhead, near the mouth of the Ythan; and Logie Buchan and Ellon adjoin them on the inland side. Of the area of these five contiguous parishes we have no estimate: they form a district extending along the coast for about 14 miles; and stretching in some parts 8 or 9 miles inland: if we calculate their area at about 100 square miles, or 64,000 acres, we shall not greatly err: probably four-fifths of this area are under cultivation. The woodlands are unimportant: it is likely they do not exceed 250 or 300 acres, chiefly in the parish of Ellon, the most inland of the five parishes. The wood is chiefly larch and Scotch fir, which thrive tolerably well in Ellon, but not in the immediate neighbourhood of the coast. The soil varies much: in the northern part of Ellon it consists chiefly of a loose black peaty earth, with a plentiful admixture of white sand, resting on a white gravelly subsoil, and of a very unproductive character. In the eastern part of the same parish the soil is a deep clay, retentive and unproductive, but in the southern part near the banks of the Ythan and its affluents the soil is more fertile. In the parish of Slains the soil is chiefly clay; but there is a considerable tract of fertile loam. Leases are generally for nineteen years; and the rent of land varies very much. Inferior arable land lets at 10*s*., 15*s*., or 20*s*. per Scotch acre, better land at from 2*l*. to 2*l*. 10*s*., and near the villages at 4*l*. and 5*l*. per acre: the Scotch acre is equal to about an imperial acre and a quarter. Sometimes the rent is paid in grain. Great improvements have taken place in husbandry, which is generally very good. 'Perhaps no part of the country possesses a more industrious or enlightened tenantry, and there are certainly few districts in which the state of agriculture exhibits a healthier or more improving aspect.' (*New Statistical Account*—Parish of Ellon.) Draining; enclosing, partly by ditches, partly by stone dykes; the introduction of new manures, the substitution of the scythe for the sickle, the use of thrashing-mills and machines, and of improved ploughs and other agricultural implements, and the erection of better farm-houses and offices, are the principal improvements. Some years ago the usual rotation of crops was a five-years shift, comprehending a succession of turnips, grain, pasturage for two years, and grain: but experience has led many farmers to substitute a seven-years shift, comprehending a green crop (usually turnips); oats, or sometimes bear; pasturage for three years; and oats for two years, or occasionally oats for one year, succeeded by bear. The cultivation of wheat was attempted to some extent about thirty years since, but as it was found not to ripen except in favourable seasons, its cultivation has been given up. Peas were formerly grown as a variety of the green crop, but are now seldom sown. Sometimes only one grain crop is taken after the three years' pasturage, and the rotation is thus reduced to six years. Very little hay is made. The cultivation of turnips has been greatly extended in consequence of the facilities afforded by steam-navigation for conveying fat cattle to the

London market, and the consequent increase of stock; and this extended cultivation has been aided by the introduction and general use of bone-dust, which is found to answer admirably as a manure for light soils that have been long under cultivation. English lime is extensively used for manure in the clayey soils, and on the lighter soils in combination with bone-dust. The kinds of turnips grown are the green-tops and red-tops, with yellow bottoms; the ruta baga, chiefly for feeding in May and June; and a few tankard turnips. The cultivation of oats is much greater than of bear, especially in the inland parishes. The breed of horses has been improved by the introduction of superior Clydesdale mares and other west-country breeds. The cattle were formerly chiefly of the Aberdeenshire horned and Angus polled breeds, but of late years the Teeswater short-horned cattle have been gaining ground, being valued as attaining to earlier maturity and greater size. Sheep-farming is not much attended to. The farm-houses of modern erection are generally of two stories, built of stone and lime and covered with slate, neatly finished and comfortably fitted up, approached by smooth roads of easy ascent, in place of the steep and rugged tracks that formerly led to them. The formation of new turnpike-roads and the improvement of other roads have been important aids to the general advancement of agriculture.

Divisions, Towns, &c.—The county comprehends the five antient districts of Mar, Formartin, Buchan, Garioch, and Strathbogie, which are not at present recognised for any administrative purposes. Mar, sometimes written Marr, comprehends that part of the county which lies south of the Don: it is subdivided into Brae-mar, Mid-mar, and Cro-mar. Mar gives the title of earl to a branch of the family of Erskine. Formartin or Formartine comprehends the country on the coast between the Don and the Ythan, and extends inland up the right bank of the Ythan to the border of Banffshire: it gives the title of viscount to the earl of Aberdeen. The district of Buchan comprehends that part of the county which lies north and north-east of the Ythan; but the earldom of Buchan appears to have also included Formartin. The title of earl of Buchan still belongs to a branch of the Erskine family. Garioch is an inland district, about the Urie and its feeders, not so extensive as the modern district and presbytery of Garioch. Strathbogie is an inland district, comprehending, as its name indicates, the valley of the Bogie, one of the affluents of the Deveron, and also including part of the valley of the Deveron itself near the junction of the Bogie. At present the county is divided for administrative purposes into the eight districts of Aberdeen, Alford, Deer or Buchan (comprehending only a part of the more antient district of Buchan), Ellon, Garioch (more extensive than the antient Garioch), Kincardine O'Neil, Strathbogie (less extensive than the older Strathbogie), and Turriff or Turreff. These modern districts are nearly coincident with the several presbyteries of the same name. The population of these districts at the enumerations of 1831 and 1841 was as follows:—

	1831.	1841.	Movement of Population in ten years.	
Aberdeen district, including the city and burgh of Aberdeen . . .	69,778	76,938	7,160	increase
Alford district . . .	11,923	12,091	168	do.
Deer or Buchan do. . .	30,475	34,345	3,870	do.
Ellon	12,831	14,418	1,587	do.
Garioch	15,787	16,852	1,065	do.
Kincardine O'Neil . .	15,415	14,987	428	decrease
Strathbogie . . .	9,718	9,762	44	increase
Turriff or Turreff . .	11,730	12,994	1,264	do.
	177,657	192,387	14,730	do.

The county contains the city and royal and parliamentary burgh of Aberdeen, the population of which, in 1841, within the parliamentary boundary, was 63,288 [ABERDEEN]; the royal and parliamentary burghs of Inverury, Kintore, and Peterhead; the burghs of barony of Charlestown, Fraserburgh, Huntly, Old Meldrum, Rosehearty, and Turriff.

Inverury is in the district of Garioch, 16 miles north-west of Aberdeen, on the left or north bank of the Don, in the angle formed by the junction of the Urie. There is a substantial modern bridge over each stream. The town consists of a long straggling street, running from south-south-east to north-north-west. The church, built in 1775 for 700 persons, is insufficient for the increased population; and a new church of Gothic architecture, sufficient for more than 1300 persons, was in 1842 in course of erection: there are a neat Episcopalian chapel, built in 1842; and places of worship for Independents and Methodists. The population of the burgh, which includes the town and the suburb of Port Elphinstone (which is in Kintore parish), was, in 1841, 1619; that of the whole parish (including Port Elphinstone), 2020, having been quadrupled within the present century: the burgh had 289 houses, namely, 274 inhabited, 10 uninhabited, 5 building. The opening of the Aberdeen Canal has much promoted the prosperity of the place. It has twenty large horse, cattle, and sheep fairs in the year, held every fortnight in winter and every month in summer. About sixty hand-looms are employed in weaving linen. Lime and coals are brought from Aberdeen by canal, and grain, slates, and timber sent down. Inverury was probably a burgh as early as the reign of William the Lion, near the end of the twelfth century: its privileges were renewed by a novodamus, A.D. 1558; and it was made, in 1663, head of the earl of Mar's regality of Garioch. The burgh has a provost, three baillies, a dean of guild, a treasurer, and three councillors. It is included in the Elgin district of Parliamentary burghs, and had in 1835-6 a constituency of 78, and in 1839-40 of 94. There are in the parish, the parish school, with about 90 scholars on the average; and five other schools, chiefly kept by females, for reading, sewing, and knitting. There is a savings'-bank.

Kintore is in the district of Garioch, 12 miles north-west of Aberdeen, in the peninsula formed by the Don (which here flows in a very winding channel to the south-east), the burn of Tuach, which joins the Don on the right bank, and the Torry burn, which flows into the Tuach. The town consists chiefly of one street, running from a bridge over the Tuach burn from east-south-east to west-north-west. There is a bridge over the Torry burn, and two bridges over the Aberdeen Canal. The church, which was built in 1819, and will accommodate 700 persons, stands in the town, and there is a town-house, a respectable building. The burgh, which comprehends the town, contained, in 1841, 102 houses, namely, 98 inhabited, 3 uninhabited, and 1 building; and a population of 464 persons: the whole parish had a population of 1299, including the population of Port Elphinstone (112 persons), which is in this parish, though comprehended in the burgh of Inverury, and the population returned with it. The trade of Kintore is promoted by the Aberdeen Canal, which passes close to the town, and upon which there is a wharf: lime is brought up from Aberdeen, and granite carried down. There are several good shops in the town, and at Port Elphinstone are a number of grain-mills, two saw-mills (one moved by steam, the other by water), and some granaries, timber-yards, and storehouses. The burgh is very antient: tradition states that it originated in the time of Kenneth II., but this is utterly unlikely: there is a charter of confirmation granted by James IV. or V. The earl of Kintore and his ancestors had, before the Burgh Reform Act (which did not affect this burgh), held the provostship for a century and a half, and paid all the burgh expenses. Kintore is a contributory borough to the Elgin district of Parliamentary burghs, and had in 1835-6 a constituency of 35, and in 1839-40 of 36. There are a parochial school and several private schools in the parish: a school at Port Elphinstone has a school-house built by government, but no endowment: in all the schools together there are about 200 scholars, two in thirteen of the whole population. There are two Sunday-schools, one at Kintore and one at Port Elphinstone. There are a circulating library and a savings'-bank at Kintore.

This little place gives the title of earl to a junior branch of the Keith family. The earl was made a baron of the United Kingdom in 1838. Near the town on the south are the remains of Hall-forest Castle, said to have been built by King Robert Bruce, and to have been a hunting-seat of the kings of Scotland: it is a square building of considerable height, and there are traces which show that it was once of larger dimensions.

Peterhead is in the district of Deer, on the east coast, 32 miles north-north-east of Aberdeen. It stands on a peninsula running south-eastward into the North Sea, on the south side of the mouth of the Ugie: the two harbours, the New North Harbour and the South Harbour, are near the south-eastern extremity of the peninsula, in opposite sides of which they are excavated or otherwise formed. The South Harbour is the oldest, having been formed in 1773, according to a plan of Mr. Smeaton, afterwards extended by Mr. Rennie, and covers about six and a half standard acres; the New North Harbour was formed in 1818, from a plan of Mr. Telford, and covers almost eleven acres: both harbours are furnished with quays and protected by piers. The town occupied, in 1840, a site of about seventy acres; and had, in 1841, within the burgh limits (which include the suburb of Ronheads and the village of Buchan-haven, both inhabited chiefly by fishermen), 785 houses, namely, 757 inhabited, 21 uninhabited, and 7 building; the population of the burgh was 4586, and that of the whole parish (which has an area of above 9000 acres) was 7619. The streets of the town have been much improved of late years, and have side-paths, paved in some parts with dressed granite: they are lighted with gas. The houses are generally of granite, which is quarried near the town. The principal public building is the town-hall. The market-cross is a granite pillar of the Tuscan order. The church (built in 1803) is near the entrance of the town on the west or land side, and has a spire of granite 118 feet high: there is a large Episcopalian chapel (a Gothic building erected in 1814), and there are smaller places of worship for the Associate Seceders, Independents, and Methodists. There is but little manufacture carried on: some woollen cloth and some cordage are made. The trade of the town is considerable: the chief exports are grain, meal, butter, pork, herrings, codfish, pork and eggs: the imports are lime, wool, timber, salt, flour, and general merchandise. A custom-house has been lately established. The number of vessels belonging to the port on the 1st of January, 1837, was 82, with an aggregate tonnage of 11,122 tons. The whale fishery employed, from 1820 to 1825, 15 or 16 vessels belonging to this port, but since 1825 the number has gradually decreased, and in 1836 was only 11. The herring fishery, which has grown up since 1820, has gone on steadily increasing. There is a salmon fishery in the Ugie. The herring and cod and general fishery is also carried on at the village of Boddam, 3 miles distant. Brick-earth is dug near the town, and granite of excellent quality is quarried. There is a weekly market on Friday; and two antient half-yearly markets or fairs. Peterhead is a burgh of barony, erected by charter of the Earl Marischal in A.D. 1593. By the Burgh Reform Act the municipal government is vested in a council of twelve, who choose from their own number a provost, three baillies, and a treasurer. Peterhead is a parliamentary burgh in the Elgin district: the constituency in 1835-6 was 207; in 1839-40 it was 241. There are a parochial school, and an endowed school, called 'the town school,' taught in the town-house, and several private schools; there are several Sabbath-schools which are numerously attended, particularly by females; there are also a 'Reading Society,' with a library of 1500 volumes, a Scientific Association, a news-room, and several charitable societies.

A part of the parish has been formed into a separate parish 'quoad sacra;' connected with the church of which is a congregational library of 240 volumes. Peterhead is frequented as a bathing-place: it has several mineral-springs of some reputation. Near the town are the remains of two antient castles, Ravens'-crag and Boddam: the former is the more antient. The Pretender landed at Peterhead in disguise in the rebellion of 1715.

Charlestown or Charleston, distinguished as Charleston of Aboyne, is in the parish of Aboyne and Glentaner, in the district of Kincardine O'Neil, near the Don, 20½ miles west of Aberdeen. It is a very small place, having, in 1841, 56 houses, namely, 51 inhabited and 5 uninhabited, with a population of 260: the population of the whole parish was 1138. The village has a few shops, a commodious inn, and a post-office: there are five great markets in the year, held on a green near it. The church is about a quarter of a mile west of the village, and will hold above 600 persons. Near it is a suspension-bridge over the Don, erected by the Earl of Aboyne at his own expense, in the place of one destroyed by the great floods in 1829: the suspension part is 230 feet long, and there are two trussed iron arches of 50 and 60 feet span respectively and two stone arches of 20 and 30 feet. The parish school had, in the winter of 1841-2, 140 scholars. There is a pretty extensive parochial library.

Fraserburgh is in the district of Buchan, on the north coast of the county, 42 miles north of Aberdeen, 18 miles north-north-west of Peterhead, and 22 east of Banff, to all which places there are excellent turnpike-roads. The town is built on the western side of the small bay of Fraserburgh, bounded on the south-east by Cairnbulg Point, and on the north-west by Kinnaird's Point. The parish was originally called Philorth, but a town and harbour having been built, and a burgh of regality erected by charter obtained by Sir Alexander Fraser of Philorth, it took from him the name of Fraserburgh. The town consists of streets crossing at right angles, clean, and in good condition. The number of houses in the parish, exclusive of the village of Broadsea, was, in 1841, 725, of which 714 were inhabited, 7 uninhabited, and 4 building; the population was 3289, or including Broadsea 3615. The town was not, in the return, distinguished from the rest of the parish. Many of the houses in the town are comfortable and even elegant. The town-house, the market-cross, and the tolbooth (the last now falling into ruins) were all erected by Sir Alexander Fraser mentioned above. The cross is a stone pillar, 12 feet high, erected on an hexagonal base, and is surmounted by the British arms and the armorial coat of Fraser of Philorth. The parish church is in the middle of the town; it was built in 1802, and will hold 1000 people: it has a spire. There are an Episcopalian chapel and an Independent meeting-house. The harbour is formed by three piers: a north pier 300 yards long, begun in 1807 and finished in 1812; a south pier of the same extent, built under an act obtained in 1818; and a middle pier erected since, broader and 'superior to the other two.' The extent of the harbour is above six Scotch acres; the depth of water at the pier-heads six feet at low-water and twenty feet at high-water of spring-tides. The bay affords good anchorage. There is a lighthouse on Kinnaird's Head. A little rope and sail making is carried on in the town; barley, oats, and potatoes of good quality, cattle, and dried and pickled cod and herrings are exported; and timber, coals, lime, bricks, salt, and general merchandise are imported. Eight vessels of from 45 to 155 tons burden, belong to the port; and there are 220 boats engaged in the herring fishery, which employs 1600 people. This branch of industry was first extensively prosecuted in 1815; it begins in July and lasts till September; and during its continuance the population of the place is augmented by 1200 persons from other parts, and the town and harbour present an aspect of unwonted bustle. Some freestone is quarried in the parish, of which the piers and some of the houses are built; and there are mineral-springs, one of which is in some repute as a tonic. There are in the parish the ruins of two antient chapels, one of which, called 'the College,' belonged to the Cistertian abbey at Deer. There is also at the west end of the town an old quadrangular building of three stories, designed by Sir Alexander Fraser for a college; he had obtained a charter from the crown in 1592, for the institution and endowment of a college and a university; but the plan was never carried into effect. All the proprietors of houses in the parish are feuars of the borough, of which Lord Saltoun is the superior, with the authority of provost, and the right of nominating the council and magistrates with the advice and consent of the existing council. The burgh officers are two baillies, a dean of guild, a treasurer, and seven councillors. There are in the parish a parochial school, with an average attendance of 100 scholars, 20 to 30 of them girls; and several day-schools, chiefly female or dame schools: there are about 500 children at the day-schools, including the parochial; or about one in seven of the whole population; and about 300 attend the Sunday-schools, of which there are eight. There are a savings'-bank and a parochial library.

Huntly is in the district of Strathbogie, on the south-east side of the Deveron or Doveran, in the angle formed by the junction of the Bogie, 38 miles north-west of Aberdeen on the road to Inverness. It is a burgh of barony under the earls (now marquises) of Huntly. The town is surrounded by hills, and consists of streets regularly laid out and lighted with gas, the two principal intersecting each other at right angles, with a square or market-place at the intersection. It had, in 1841, 596 houses, namely, 576 inhabited, 18 uninhabited, and 2 building; with a population of 2731. The population of the whole parish was 3642. The parish church, built in 1805, will accommodate 1800 persons; and a new church, which will hold nearly 1000, was erected in 1840; there are Roman Catholic and Episcopalian chapels, and meeting-houses for Independents and Associate Seceders. There are two good bridges, namely, an antient bridge of one arch, over the Doveran, and a bridge of three arches over the Bogie. Near the town stands the now deserted Huntly Castle, built in 1602, out of the ruins of the more antient Strathbogie Castle adjoining to it. There is also Huntly Lodge, now enlarged to a handsome house, and occupied by the Dowager Duchess of Gordon. There are in or near the town a bleach-field, a tanyard, a distillery, and three banks. There is a weekly market on Thursday. Butter, eggs, cheese, pork, poultry, and game are sent from the town and neighbourhood. There are about 12 yearly fairs or great markets: those at Whitsuntide and Martinmas, for hiring servants, are the largest: the other fairs are for horses, cattle, and other things. There are in the town the parish school, which has about 140 scholars at the most favourable time of the year, the 'new school' connected with the new church, with 128 scholars, an infant-school with 80 scholars, and a sewing-school with 30 scholars; these are all held in a building erected for educational purposes by the Duchess of Gordon. There are besides an excellent girls' boarding-school with 40 pupils, and several other private schools chiefly kept by females. There are about 530 children at school in the best season, or nearly one in five of the population. There are also several Sunday-schools in connexion with the Established churches, or with the Independents and Roman Catholics. The country parts of the parish are not so well provided with schools. There are a farmers' club, under the presidency of the Duke of Richmond, who is proprietor of nearly the whole town, a farmers' agricultural library, an evangelical subscription library, a coffee and reading room supplied with one or two provincial papers, a dispensary (one account says two dispensaries), a savings'-bank, and a friendly society connected with the total abstinence society.

Old Meldrum is in Meldrum parish, in the district of Garioch, 18 miles north-north-west from Aberdeen on the road to Banff. The parish had, in 1841, 427 houses, namely, 420 inhabited, 6 uninhabited, and 1 building; with a population of 1873. The town is not distinguished in the return from the rest of the parish. Old Meldrum was erected into a burgh of barony by charter obtained in 1672, but there are no magistrates or burgh officers now. The town-house and the town-hall are respectable buildings. The parish church is close to the town: it was built in 1710, and has been since enlarged so as to hold 700 persons; but it is still too small for the parish. In or close to the town are an Episcopalian chapel and an Associate Secession meeting-house. There are a distillery and a brewery in the town, and two weaving-shops for cotton goods, rented by manufacturers at Aberdeen, in which some of the young people are employed at hand-loom weaving. There is a second distillery in the parish. There is a good weekly market for provisions, and a corn and cattle market every fortnight in winter and spring. There are a parochial school in the town, and three private schools, one of them for girls, in the parish: a Sunday-school in the town has a small endowment. There is a savings'-bank. On a farm called Chapel House, in the parish, there are the remains of a Roman Catholic chapel standing in a burial-ground, which has only been disused within living memory. The traces of a small Roman camp have been obliterated lately.

Rosehearty, in Pitsligo parish, in the district of Buchan or Deer, is on the northern coast of the county, about 4 miles west of Fraserburgh. It was created a burgh of barony by royal charter in 1681. Mr. Dingwall of Bracklaw and Corsindae is superior, but the burgh has no magistrate or public officer, and the tolbooth has become private property. There is however some property belonging to the burgh, which is managed, with the concurrence of the feuars, by private individuals; and there is a debt of 200*l*. The parish church, built in 1634, has a spire, and will hold about 500 or 600 persons. It is not stated whether it is within the burgh limits: but there is a meeting-house for the Associated Seceders in the burgh. The burgh in 1841 had 188 houses, namely, 182 inhabited, 3 uninhabited, and 3 building; with a population of 750. The population of the whole parish was 1582. There is a good harbour for vessels not exceeding 70 tons. It has 9 feet water in neap and 14 feet in spring tides: and three vessels belong to the port, besides fishing-boats. The herring fishery employed, in 1838, 40 boats with five men each, or four men and a boy, besides seven vessels to attend the fishery. Cod, ling, haddocks, skate, saith, poddlies, and a small black fish called cole, are caught. The fish are sent to London, Edinburgh, or Glasgow. In March several of the fishing-boats resort to the Isle of Tyree in the Hebrides to fish for cod, and sell their cargoes at Glasgow, from whence they bring back coals. Salt and timber are also imported; and grain is exported. A fishing-harbour has been lately formed at Sandhaven in the parish east of the burgh. There is a weekly market at Rosehearty on Saturday, and a post-office, a branch of that at Fraserburgh. The parochial school has a library of 100 volumes connected with it. There are in this parish six other schools (five of them taught by females), with an average of 30 scholars each. There are several friendly societies in the town.

Turriff, in the parish and district of Turriff, is about 11 miles south of Banff, on the Turriff burn, which joins the Doveran. In 1841 it had 312 houses, namely, 306 inhabited and 6 uninhabited; with a population of 1309. The population of the whole parish was 3146. The parish church, a handsome structure, was built in 1794, and has been since enlarged. The remains of the old church, which was built before the Reformation, are still standing in the parish burial-ground, and near the burial-ground gate are the vaults of an antient tower. There are an Episcopalian chapel and an Independent meeting-house. A cross of considerable antiquity stands in the principal street: it is a stone pillar on a base of circular steps rising to a height of 20 feet from the ground. There are several considerable mansions in the neighbourhood, especially Delgaty Castle and Towie Barclay; and there are two bridges, one close to the town, over the Turriff burn, and one over the Doveran, a little distant. Some linen-bleaching is carried on, but not so extensively as formerly. There is a small woollen cloth manufacture: some silk and woollen dyeing are done; and some worsted stockings are knitted. There are some good shops. There are three banks, a gas company, and a local post-office. There are eight yearly fairs for horses, cattle, and sheep; and 'feeing markets' at Whitsuntide and Martinmas for hiring servants. Turriff was created a burgh of barony by charter in A.D. 1511, with a grant for markets and fairs. The parochial school has generally more than 100 scholars, and there are several dame or other private schools. There are about 400 children, or one in eight of the population, at school. There are five Sunday-schools, three in the town and two in other parts of the parish. There are a parish library with 100 subscribers and 600 volumes, an agricultural association, and a savings'-bank. The sheriff substitute holds a small debt court quarterly; and there is a small lock-up house for temporary confinement. The first blood drawn in the great civil war of Charles I. was at what is called 'the Trot of Turriff,' when the Royalist nobles and gentry in 1639 dispersed 'the Committee of the tables' assembled in the town.

The following villages may be briefly noticed. Ballater, in Glenmuick parish, 41½ miles west of Aberdeen, on the north bank of the Dee, is of recent origin, and is much resorted to on account of the beauty of the situation and the mineral-springs of Pananick in the neighbourhood: the houses are regularly built and neatly fitted up for lodgers, and amounted in 1841 to 73, namely, 69 inhabited and 4 building; the population was 371. The parish church is in the village, and there is a post-office. The springs or wells of Pananick, about two miles east of the church, are four in number, all chalybeate, stimulant, and tonic: there are lodgings at the wells, also hot, cold, and shower baths. The resort of visitors in the summer is very considerable, and it is at present the most fashionable bathing-place in the north of Scotland. Two stone bridges of five arches, over the Dee, have been carried away within the last half-century by the floods to which the river is subject; the first was destroyed in 1799, the second in the great floods of 1829: at present there is a neat substantial wooden bridge of four arches. Boddam or Boddan, 3 miles south of Peterhead and in Peterhead parish, in the district of Buchan, is near Buchan-head, on which there is a lighthouse of granite 118 feet high. It was built A.D. 1824, and has a flashing light. This lighthouse is on an island connected with the mainland by a beach of round stones, separating the north and south boat-harbours of Boddam: the south harbour will receive ships of a moderate draught of water. The population (526 in 1841) of Boddam consists chiefly of fishermen and their families. Newburgh, in Foveran parish, in the district of Ellon, 10 miles north of Aberdeen, in 1841 had 94 houses (namely, 91 inhabited, 2 uninhabited, and 1 building), and a population of 393. The New Statistical Account of Scotland makes the houses 120 and the population 450. Several of the houses are substantial and commodious, and the appearance of the place is much improved. The village stands on the burn of Foveran near its junction with the Ythan, the mouth of which forms the port of Newburgh, to which eight vessels, with an aggregate tonnage of 646 tons, belong. They import coal, lime, timber, and bones; and export grain and cattle, the latter to London. There is some fishing. There are a bone-mill, several granaries, a savings'-bank, and a shipmasters' friendly society. Newbyth or New Byth, in the parish of King Edward and the district of Turriff, 13 miles south-east of Banff, consists of two streets crossing at right angles. It is the centre of a quoad sacra parish, which in 1841 had 326 houses, namely, 310 inhabited, 10 uninhabited, and 6 building; with a population of 1369, of whom about 300 are in the village. There are in the village a chapel of the establishment, a subscription library, two inns, and a distillery: there are three fairs in the year. Strichen, Mormond, and New Leeds are in the parish of Strichen, in the district of Buchan. Strichen is well built, and has a neat town-house, a commodious church, a branch bank, a savings' bank, and a post-office. There are five yearly fairs; one was established for the sale of yarn, but the cultivation of flax and the sale of yarn, formerly extensive, have much declined. Mormond was laid out in 1764, and is regularly built, with a number of good, commodious, slated houses. Weaving is carried on to some extent. The population of New Leeds in 1841 was 203; that of the other villages was not distinguished in the return. Stuartfield, or Stewartfield, in the parish of Old Deer, in the district of Buchan, had, in 1841, 182 houses, namely, 174 inhabited and 8 uninhabited; and a population of 614. Several persons are employed in the manufacture of linen yarn in the village; and in it or in other parts of the parish are lint-mills, mills for making woollen cloth and yarn for stockings, a dye-house, a fulling-mill, and a savings'-bank: there are five fairs in the year, two of them horse and cattle fairs of some consequence, the other three are unimportant.

Divisions for Ecclesiastical and Legal Purposes.—The county is for the most part included in the jurisdiction of the Synod of Aberdeen, which comprehends, in addition, nearly the whole of Banffshire and part of Kincardineshire. The Synod of Aberdeen comprehends the following eight presbyteries: Aberdeen, which includes that portion of Kincardineshire that is under the synod; Alford, which extends into Banffshire; Deer, Ellon, Fordyce, which last is wholly in Banffshire; Garioch, Kincardine O'Neil, which extends into Kincardineshire, and Turriff. The Presbytery of Strathbogie, which is under the Synod of Moray, is partly in Aberdeenshire, partly in Banffshire and Elgin or Morayshire. The number of parishes wholly or partly in this county according to the Population Returns of 1841 is 90. These are parishes both for ecclesiastical and civil purposes. There are besides 14 'quoad sacra' parishes, that is, districts dismembered from the above, and constituted distinct parishes for ecclesiastical purposes alone; 10 of these quoad sacra parishes have been formed in the city of Aberdeen. Dissenters from the establishment are found chiefly in and about Aberdeen, and in the district and presbytery of Deer or Buchan; in other parts they are not numerous; they consist of Associate or other seceding Presbyterians, Episcopalians, Independents, and a few Roman Catholics and Unitarians, the last in the city of Aberdeen, where they have a place of worship.

There are two universities, namely, King's College in Old Aberdeen, founded in the fifteenth century, by Bishop Elphinston; and Marischal College in New Aberdeen, founded by George Keith, fifth Earl Marischal, in the sixteenth century. [ABERDEEN, P. C.] The shire is well supplied with schools: nearly two hundred are enumerated in the table given at the end of the county in the New Statistical Account; but this amount is far below the truth, as the whole city of Aberdeen, and about twenty-six parishes in other parts, are omitted in it.

There are a county prison and a bridewell at Aberdeen. There are small burgh prisons at Old Aberdeen, Old Meldrum, Inverury, Kintore, Peterhead, and Fraserburgh; but these are used only occasionally and for very brief confinement. There is a new prison at Peterhead, which town is the seat of a sheriff court; but the prison had not been completed at the time of the Fourth Report of the Board of Directors of Prisons, presented to parliament in 1843. It was then in the contemplation of the Board to provide small prisons at Fraserburgh, Huntly, and Tarland, as the small burgh prisons were not under their direction. The gaol of Aberdeen is built in a substantial manner and in a healthy situation; it is secure, clean, well ventilated, and dry: it contained in 1836 ten day-rooms and sixty cells. The discipline and management at the time of the First Report of the Inspectors of Prisons (1836) were not satisfactory; but considerable changes have taken place since then, and the separate system, for which the building affords opportunity, has been carried out successfully. The bridewell of Aberdeen is a substantial building, in an apparently healthy site; it affords a sufficient number of cells for separate confinement, but the construction of the cells is not such as to render the separation perfect. The management at the time of the Prison Inspectors' Second Report (1837) was decidedly good.

The amount of crime in Aberdeenshire is less in proportion to the population than in other districts, and, notwithstanding the great increase of population, there are fewer cases of atrocious crime, especially of murder, than formerly. The uttering of forged bank-notes has also diminished; but the cases of bastardy and of robberies committed by farm servants on each other had increased. Drunkenness, one of the great causes of crime, is believed not to have increased in proportion to the population, though it is still prevalent. The police about Aberdeen has been much improved.

(*Reports of Inspectors of Prisons*, especially *First* and *Second*, and of *the Board of Directors of Prisons.*)

The county of Aberdeen returns one member to Parliament. The number of electors of all qualifications was, in 1835-36, 2986; in 1839-40, 3181. The city of Aberdeen returns one member; the constituency in 1835-36 consisted of 2242; in 1839-40, of 2189. Peterhead, Inverury, and Kintore are included in the Elgin district of burghs, which returns one member; the other burghs of the district are Elgin, Cullen, and Banff. The constituency has been already given in our notice of the burghs.

History and Antiquities.—At the earliest historical period Aberdeenshire was occupied by the Taezali (Ταΐζαλοι) of Ptolemy. The promontory of the Taezali (Ταιζάλων ἄκρον) of the same writer may be probably identified with Kinnaird's-head near Fraserburgh; his rivers Celnius (Κέλνιος) and Deva (Δηούα), with the Doveran and Dee respectively; and his city Devana (Δηουάνα) has been identified by General Roy with Old Aberdeen, and by others with Norman Dykes on the Dee, a few miles above Aberdeen. The south-western part of the county was probably included in the territory of the Vacomagi (Οὐακομάγοι) of Ptolemy; as Tamea (Τάμεια), one of the towns which he ascribes to them, is by some identified with Castletown of Braemar. The Ituna of Richard of Cirencester may be identified with the Ythan, and his position Ad Itunam with some place on its banks.

Of the most antient period of its history Aberdeenshire contains various monuments; such as cairns, barrows, Druidical stones, and the structures sometimes called Picts' houses. There are also some antient camps, some of which are supposed to be Roman. A singular monument called the Maiden Stone is found in Chapel of Garioch parish. It is a stone pillar, ten feet above ground, and supposed to be imbedded six feet below the surface; it is nearly three feet broad and one thick, marked with hieroglyphic or other characters, supposed to be Danish. Its name is connected with a tradition which ascribes the origin of the monument to a love tragedy of the middle ages. There are in the parish of Aboyne and Glentaner remains of a 'Pict's house,' a circular enclosure of stones regularly laid without cement, and partly imbedded in the rock. The enclosure, which is 83 feet in diameter, is on the top of a hill called Knockbeg: this monument is connected with others of a similar character by two parallel dykes forming an enclosed way or avenue, the main line of which may be traced for nearly fifty miles, near the north bank of the Dee; some branches diverge in a direction traversing the river and the Grampian Mountains.

The principal events of the middle ages and of later days were—the battle of Cruden, in the beginning of the eleventh century, between the Scots under Malcolm II. and the Danes under Canute, afterwards king of England. In the early part of the fourteenth century King Robert Bruce marched into Aberdeenshire to chastise Comyn, or Cumin, earl of Buchan, by whom he was surprised when sick in his camp near Inverury, but whom he defeated, and whose country (Buchan) he subjected to the most fearful devastation. In 1411, during the captivity of King James I. and the regency of the duke of Albany, the bloody battle of Harlaw, in Chapel of Garioch parish, was fought between 10,000 highlanders, under Donald, Lord of the Isles, and the royal forces (lowlanders), under the earl of Mar, in which Donald was completely defeated. In the great civil war of Charles I., A.D. 1644, Montrose defeated the Covenanters under Lord Burley, not far from Aberdeen, which he entered. Monk occupied Aberdeen in 1651; and the troops of the Pretender, under Lord Lewis Gordon, occupied it and levied contributions on it in 1745. A detachment of the royal forces, sent from the north by Lord Loudoun to relieve the town, was defeated by the rebels at Inverury in the latter part of that year. The duke of Cumberland was at Aberdeen next year, when he marched northward previous to the battle of Culloden.

The principal memorials of the middle ages are the ruins of feudal castles. On the north coast, between Fraserburgh and Banff, in the parish of Aberdour, are the remains of the antient castle of Dundargue, situated on a red-sandstone rock which rises from the sea to the height of above 60 feet, and is connected with the mainland at high-water only by a narrow ledge of rock. Here Henry de Beaumont, the English earl of Buchan, was besieged by Sir Andrew Murray, regent of Scotland during the captivity of King David II. On the same coast, near Banff, in the parish of King Edward, are the remains of Ken-Edgar Castle, once the seat of the Comyns, or Cumins, earls of Buchan. Pitsligo and Pitullie castles are both on the coast near Fraserburgh. Craigston Castle, in the same neighbourhood, built in the seventeenth century by one of the Urquharts of Cromarty, is a fine old building in good preservation. Fedderatt Castle, near New Deer, was a fortress of considerable strength. On the eastern coast are the ruins of Slains Castle, once the seat of the earls of Errol, demolished in 1594, after the rebellion of the earl of Huntly, by order of James VI.; and on the north-eastern bank of the Ythan stands Fyvie Castle, one of the finest Gothic edifices in the county. There are numerous other ruins of antient castles or towers. Huntly Castle has been noticed. The monastic and other ecclesiastical remains are very few. Near the village of Old Deer are the ruins of a Cistertian abbey, built in the beginning of the thirteenth century, by one of the Comyns, earls of Buchan. The remains show that it has been a very extensive building. In Fyvie parish are the remains of a priory of Tyronenses, said to have been founded by Fergus, earl of Buchan, near the close of the twelfth century.

(*New Statistical Account of Scotland*; *Gazetteer of Scotland*, published by Fullarton and Co., of Glasgow; *Parliamentary Papers*.)

ABINGER, LORD. [SCARLETT, JAMES.]

ABLAIKIT (*i. e.* the Convent of Ablai), the name of some ruins in the steppe of the Middle Horde of the Kirghis, about 60 miles from the towns of Buchtarminskaja and Ust-Kamenogorskaja, both built on the banks of the upper course of the river Irtish. The place is in 49° 20′ N. lat. and 83° 5′ E. long. These ruins are situated near the base of the range of mountains called the Ablaikit Mountains, which rise about 3000 feet above their base; and in the vicinity there are very fine and extensive pasture-grounds, which however at present are little used. In the beginning of the last century, when the Russians were erecting the fortress of Ust-Kamenogorskaja, some of their people fell in unexpectedly with these ruins. They consisted of four buildings of different sizes. The largest was an oblong square, the longer side being 500 fathoms, and the shortest about half as much. This is considered to have been the convent, in which the priests of the Buddhist religion were lodged. A smaller building had evidently been a temple, as was proved by a great number of idols, pictures on the walls, and manuscripts, which were found there. The fragments of the idols showed clearly that they had reference to the religion of Buddha. Among them were also found some wooden boards, with raised figures on them resembling some letters in the manuscripts: whence it was concluded that they had been used for printing. Some of the manuscripts found in the temple were written with golden letters on black paper, and were of great beauty; others were written on common paper, or on the interior bark of the beech-tree. Some of these manuscripts were sent to Peter the Great, but without any information respecting the place where they had been found, and he wished to know their contents. Not finding in his dominions a person who was able to understand them, he sent them to Paris, whence he soon obtained a translation, or rather a paraphrase, which however, on closer examination, turned out to be a fabrication, and it was evident that the translator did not understand one word of the language in which they were written. It was afterwards ascertained that the manuscripts were written in the Tangut language, and referred to the tenets of the Buddhist religion. The third building was rather small, and appeared to have been the printing-establishment. The fourth was of a diminutive size, and evidently had been used as a kitchen. All these buildings, though they had no great architectural beauty, were very regular, and constructed of excellent bricks. On two sides the buildings were protected by almost perpendicular rocks, and on the two other sides by a wall about ten feet high and eight feet thick. This was also of brick, but at the time when the ruins were discovered it was in a state of decay. The place thus enclosed was very spacious, and evidently destined to receive a great number of tents or temporary huts. It was ascertained that this place had been built about the middle of the seventeenth century, by Ablai, one of the khans of the Songares, a great branch of the Mongols; and apparently he had destined it to be one of his temporary residences. He soon afterwards (1670) was engaged in a war with the Galdan, the khan of the Proper Olöth [SONGARIA, P. C.], in which he was unsuccessful, and by which he was at last obliged to abandon his country precipitously. The state of the buildings, which still contained much furniture, evidently showed that they had been suddenly abandoned. Ablai and those who still remained faithful to him went westward to the banks of the Ural and Wolga rivers, where he frequently surprised and plundered the Calmucks, until he was taken prisoner, and brought to Astrakhan, where he lived to an old age. Modern travellers who have visited these ruins have found them in a state of rapid decay.

(Müller, *Sammlung Russischer Geschichten*; Fischer, *Siberische Geschichte*; Von Ledebour, *Reisen nach dem Altai Gebirge*; Ritter, *Erdkunde von Asien*, vol. i.)

ABORTION. [INFANTICIDE, P. C., p. 469.]

ABSENTEE. The P. C. contains under this head a statement of the arguments which have been urged in support of the opinion that absenteeism is no injury to the country from which the rent or income of the absentee is derived. It must be admitted that the evil is not so serious as many people suppose, and if we take everything into the account, it may be that the evil is inconsiderable. So complicated are the relations of modern society, that any restraint upon the mode in which a man spends his income would probably do much more mischief, even to the country from which an absentee derives his income, than the absenteeism itself does, whatever that amount of mischief may be.

Still, as a mere scientific question, the opinion of those who maintain that absenteeism is no loss to the country of the absentee, requires some limitation. It is easy to show that its direct effect is to diminish accumulation in the country of the absentee, and it is not easy to show that this direct effect is counteracted to its full amount in any indirect way.

It cannot be proved, as it has been maintained, that the absentee's consumption of foreign goods abroad is equivalent to an importation of foreign goods into England or any other country from which he derives his income, whatever it may be, and that such consumption produces a correspondent exportation of English goods to the foreigner. The absentee is enabled to receive his rent abroad because a foreign trade already exists; and it is not necessary, in order that he shall be able to receive his rent in money abroad, that a trade should exist between his native country and the country of his residence. There must be a foreign trade somewhere, in order that he may receive his income abroad in money, but a man may live in a part of Europe which has no trade with Great Britain, and he will receive his money by an indirect route, and by means of the trade of England with some other foreign country. But it does not follow that the foreign trade of Great Britain is increased by the consumption of an absentee abroad so as to produce an exportation of English goods to the amount of his foreign consumption. And if we admit that the absentee's consumption of foreign goods abroad produces all the effect that has been attributed to it, this will not remove the whole difficulty. Many of the things which he consumes abroad are not the peculiar products of the foreign country, which he would or might consume whether he was in England or that foreign country. He consumes and uses many things abroad which he would consume or use in England, and which must be furnished by the country in which he is residing.

Accumulation, or the increase of wealth in a country, can only arise from savings or from profits. All persons who supply the demands of others obtain a profit by the transaction; at least the obtaining of a profit is the object with which a demand is supplied, and the actual obtaining of a profit is the condition without which a demand cannot be permanently supplied. All persons who have an income to spend may in one sense consume it unproductively, as it is termed, that is, the income may be spent merely for the purpose of enjoyment, and not for the purpose of profitable production. But no income which is received in money can be spent without indirectly causing profitable production, for every person who supplies the wants of the spender of the income receives a portion of the spender's money, part of which portion is the profit of the supplier. If this income is spent in France or in Belgium, persons in France or in Belgium derive a profit from supplying the absentee, and this profit enables them to accumulate. What is thus spent in France or in Belgium produces a profit to a Frenchman or a Belgian, and enables him to accumulate, and this profit is something taken from the profits of those who would supply the demands of the consumer in England. If all the persons who come to settle in London, and require commodious houses, servants, meat, fruits, vegetables, and so forth were to settle at Brussels, the houses which are now built in London, and the grounds which are employed as kitchen-gardens round the metropolis, would not exist, and the profit derived from this employment of capital would not exist. It would be transferred to Brussels and to Belgian capitalists. This would be the immediate effect of the wealthy residents in London removing to Brussels. The removal of these residents to Brussels would be the withdrawal of one of the means of profitably employing capital, and would so far be a loss to the national wealth. Nor can it be shown that the capital which is now employed in and about London in building houses and cultivating garden-ground could be employed with equal profit in some other way; for to assert this would be equivalent to asserting that it is always possible to employ capital under all circumstances in a manner equally profitable. It may be rejoined, that if all or most of the wealthy residents of London removed to Brussels, English capital would be required in order to accommodate them with houses, and to provide some of their necessaries. This may be admitted, and yet it does not remove all the difficulty, for if the residents were to remove to various towns of Italy, the employment of English capital would not be required to the same degree as if they were all to remove to one place, such as Brussels.

But this is only part of the question. There are numerous sources of profit arising from the supply of the ordinary wants of a man and his family, which accrue to the people of the place in which a man fixes his residence: these are the ordinary retail profits of trade. This is obvious in the case of a number of families quitting a provincial town to reside in London: the provincial town decays, and that source of profit which is derived from supplying the wants of the families is transferred to the tradesmen of their new place of residence. This, which is true as to one place in England compared with another, is equally true as to England compared with Belgium or France. If we take into account merely the amount of wages which a large body of absentees must pay to their domestic servants, this will form a very considerable sum. The savings of domestic servants in England from their wages are invested in various ways; and such savings are no small part of the whole amount of the deposits in savings' banks. It will hardly be maintained that all those who would be employed as domestic servants in London, if the absentees in France were to come to live in London, are employed with equal profit to themselves while the absentees are abroad. London is supplied with domestic servants from the country, many of whom would be living at home and doing nothing, if there were no demand for their services in London; and everything that diminishes such demand, diminishes the savings of a class whose accumulated earnings form a part of the productive capital of Great Britain.

Those then who maintain that absenteeism has no effect on the wealth of the country from which the absentee derives his income, maintain a proposition which is untrue. Those who maintain that the amount which a man spends in a foreign country is so much clear loss to the country of the absentee, are also mistaken. There are many ways in which the loss is indirectly made up; but whatever may be its amount, it would be unwise to check absenteeism by any direct means, and it is not easy to see how it can be checked indirectly in any way that will produce good.

Since writing this we have seen 'Five Lectures on Political Economy,' delivered before the University of Dublin, in Michaelmas Term, 1843, by J. A. Lawson, LL.B., in which the subject of absenteeism is discussed, though from a somewhat different point of view. Mr. Lawson does not agree with those economists who think that a country can sustain no injury from the residence abroad of landlords and other proprietors of revenue. He is of opinion that, so far at least as Ireland is concerned, absenteeism is an economical evil. His views on the effects of absenteeism are contained in Lecture V., pp. 122-131.

ABSORPTION OF LIGHT is that quality in an imperfectly transparent body, or at a polished surface, by which some portion of an incident pencil of light is retained within the body, while the rest is either transmitted through it or reflected from it.

The different colours exhibited by bodies in ordinary light are caused by the transmission, or reflexion, of such of the rays as give rise to the perceptions of the colours, the other rays being absorbed. A body absorbing all the light which falls upon it would appear to be entirely black, or would be invisible; while a body reflecting unchanged all the light incident upon it would seem to be entirely white. No bodies in nature possess however the qualities of absorption or reflexion perfectly; for the most opaque bodies known permit some light to pass through them, and the blackest permit some to be reflected from them: while those which appear to be the most white, or the most transparent, absorb much of that which falls upon or enters them; and the same body, when in different states, absorbs or transmits light with different degrees of facility.

When light enters into a homogeneous medium, it is probable that its intensities, at depths which are in an arithmetical progression from the surface of incidence, decrease in a geometrical progression; for it is reasonable to imagine that, in indefinitely thin portions, of equal depths perpendicularly to that surface, the quantities absorbed will bear nearly a constant ratio to those which enter. With this assumption, let a represent the quantity of light which falls on the surface of a body, and let the quantity absorbed be $\frac{1}{n}$th of that which enters; then, $\frac{1}{n}a$ being absorbed in the first portion, the quantity which emerges from thence will be represented by $a-\frac{1}{n}a$, or $\frac{n-1}{n}a$. Again, $\frac{1}{n}$th of this quantity being absorbed in the second portion, there will emerge from thence a quantity represented by $\frac{n-1}{n}a-\frac{1}{n}\cdot\frac{n-1}{n}a$, or $\left(\frac{n-1}{n}\right)^2a$, and so on, the emerging quantities being thus represented by geometrical progression whose common ratio is $\frac{n-1}{n}$. It may readily therefore be conceived why, if a portion of any medium be rendered extremly thin, like foam on the surface of a liquid, so little light may be absorbed in passing through it as to cause it to appear colourless, while the quantity which emerges from a thick mass of the like medium may be scarcely sensible.

Some transparent media allow the rays of certain colours in an incident pencil of compounded light to pass through them more freely than others: thus, in proportion as the thicknesses of the media are greater, the rays transmitted through green glass become more homogeneous; and those which pass through glass which, of a certain thickness, is yellow, appear, as the plate is successively thicker, to be green, brown, and red.

In POLARIZATION OF LIGHT, P. C., it has been stated that when common light passes perpendicularly through a plate of tourmaline (a doubly refracting crystal) whose surfaces are parallel to the geometrical axis of the natural prism, one of its refracted pencils is partly and the other almost wholly absorbed; and it follows that the emergent pencil has less than half the intensity of that which is incident on the plate. Dr. Wollaston was probably the first who discovered (*Phil. Trans.* 1804) that the light transmitted in a direction parallel to the axis of the crystal had a colour different from that of the light which was transmitted perpendicularly to that axis; and M. Biot (*Traité de Physique*, tom. iv. 1816), having inferred from the *ordinary* image of a white object, transmitted through the thinner part of a prism of tourmaline, being greenish, while the *extraordinary* image is white, that the difference of colour did not arise from the different coloured rays being unequally divided between the two pencils, since then the colours of the two images should be complementary to one another, concluded that the blue and violet rays which are wanting in the ordinary image are more easily absorbed in the crystal when they are polarized parallel to its axis than when polarized perpendicularly to it. Previously however to the publication of Biot's work, Dr. (Sir David) Brewster had discovered like phenomena in plates of agate, in mica, and in carbonate of barytes. (*Phil. Trans.* 1814.)

The quantity of light absorbed in tourmaline depends upon the thickness of the plate, and it is found that the absorption takes place gradually, as the pencil passes through; for if a plate of tourmaline be ground to the form of a wedge, whose sides make with each other a very acute angle, and whose edge is parallel to the axis of the crystal, on looking through the sides of the wedge at a candle it is observed that, near the edge, the images produced, both by the ordinary and the extraordinary refraction, have nearly the same degree of brightness and tint: then, on moving the wedge so as gradually to bring the thicker part between the eye and the candle, the ordinary image diminishes as gradually in intensity, and at length becomes extremely faint; while the extraordinary image increases in brightness and in the depth of its tint. Sir David Brewster has discovered that a like property exists in different degrees in most of the doubly refracting crystals. (*Phil. Trans.* 1819.)

The oxides on the surfaces of metals consisting, according to the supposition of Newton, of glassy films, it should follow that light falling on such media at particular angles of incidence must, in being reflected from thence, become polarized; while that which, after passing through the film, is reflected from the metal, has little or none of that quality: this is found to be the fact; and to the absorption caused by the light being polarized in the plane of reflexion, or perpendicularly to it, Sir David Brewster ascribes the blue colour of a pencil of common light which has been reflected successively between two plates of indigo-coloured steel, and the bright yellow tint of that which has been reflected from steel of a straw colour; the red rays having been absorbed in the one case, and the blue rays in the other.

Sir David Brewster has also ascertained that the proportions of different coloured rays which are absorbed in certain media depend on the temperature of the latter. In general the tints gradually increase in intensity by the application of heat, and return to their original state when the body is cooled. Some glasses, he observes, change from red to green in the former case, and again become red in the latter; the blue rays, which were capable of being transmitted in the heated state of the glass, being absorbed when the latter was cold. The same philosopher has however found that, in some doubly refracting crystals, heat produces permanent changes in the degrees of absorption to which the two pencils of light are subject. Several crystals of topaz in which, when cold, the absorption of both pencils was alike, acquired, on being heated, the property of absorbing the two pencils unequally; and he possessed some in which, when cold, the extraordinary pencil was yellow, and the other of a pink colour, which, on being subject to a red heat, became colourless. In cooling, the yellow of the former pencil was entirely absorbed; while the pink of the latter was but little changed, and the pink tint thus alone remaining, could not be removed even by the application of the most intense heat.

Bodies which absorb light become heated by the absorption; and, with a given quantity of light, the temperature of a body is said to be nearly proportional to its absorbing power.

ABSTRACT OF TITLE. [Vendor and Purchaser, P. C., p. 204.]

ABSTRACTION AND ABSORPTION OF HEAT is that power by which caloric, or heat, is made to pass from any body to whatever surrounds it, or to any conducting substance with which it is in contact, it being understood that the temperature of the medium, or of the substance in contact, is lower than that of the body from which either of these receives the heat. The abstraction may take place either by radiation from the surface of the heated body, or by an immediate communication between the particles of caloric and those of the bodies by which it is given and received; and the freedom with which the heat is propagated in the body receiving it is designated the conducting power of that body.

The cause of this power is involved in obscurity, or rather, is quite unknown. It has been supposed that the particles of caloric mutually repel each other, and that an attraction exists between these and the particles of the body into which they enter; but it may also be conceived that the particles of caloric, on approaching those of a body whose temperature is lower than that of the body which is the source of heat, impart to them some of their own properties; that these thereby acquire the power of acting in a similar manner on those which are immediately beyond them, the last on others more remote, and so on. Whatever be the cause, it was a principle assumed by Newton, that, within any short interval of time, as one second, the heat lost by a body and acquired by one which is in contact with it, is in a constant ratio to the excess of the temperature of the former body above that of the latter at the commencement of the interval; and if the law were strictly correct, it would follow that, when a body is hotter than the surrounding air, the quantities of caloric abstracted by radiation at the end of equal intervals of time must constitute a decreasing geometrical progression. For an outline of the law by which heat is conceived to be distributed in conducting bodies, see Heat, P. C., p. 88.

The heat emitted by bodies depends in part on the nature of their surfaces; such surfaces as have a certain degree of roughness allow it to pass off more abundantly than those which are smooth or polished; and the experiments of M. Biot show that the propagation of caloric along a rod of iron does not extend to a distance from the heated body greater than about three feet and a half, before it becomes inappreciable by the thermometer. The conducting power differs however in different substances; and, among metals, that which possesses it in the highest degree is silver: below this, in order, are copper, brass, platinum, iron, tin, zinc, and lead. Among solid bodies, the worst conductors are stones, earthenware, and glass. The conducting power of gold is not well known: by Franklin it was found to be less than that of silver and copper; while, from the experiments of Despretz (*Annales de Chimie*, &c. xxxvi.), it appears to be higher than that of any other metal. Count Rumford has proved that the imperfection of the power in solid bodies depends in a great measure on the quantities of air contained within their interstices. He moreover ascertained by experiment that lint, sheep's wool, raw silk, beaver's fur, and hare's fur, were successively lower than each other in conducting power.

Liquids are very imperfect conductors, yet heat passes through them with considerable rapidity. This arises from the freedom with which the particles of a liquid move among one another, and from their expansion by heat, in consequence of which they become lighter; thus, being easily displaced by the colder particles about them, they rapidly carry with them the caloric which they have received from their contact with a body of higher temperature. Count Rumford found that, on mixing with water different substances by which its fluidity, or the freedom of motion among its particles, was diminished, the velocity with which the heat was propagated through it became less; and the retardation increased as the motion of the particles of liquid was more impeded. For reasons similar to those which have been mentioned, heat is rapidly transmitted through the atmosphere and other aëriform fluids, though these, as conductors, are probably less perfect than liquids, and far less than solid bodies.

The experiments of Sir David Leslie established the fact that surfaces from which heat radiates with the greatest freedom absorb it most readily, but the late Dr. Ritchie contrived a species of differential thermometer from which, by direct experiment, he was enabled to prove that the power of radiation from any surface is exactly equal to that of absorption at the same surface. A hollow air-tight cylinder of tin, having one half of its exterior surface bright and the other covered with lampblack, was fixed in a vertical position at each extremity of a bent glass tube containing a coloured spirit; and midway between these was placed a vessel similar to the others, and like them coated on half its surface. When the instrument was to be used, the middle vessel was filled with boiling water; then the bright side of one of the first-mentioned cylinders being turned towards the coated side of that which contained the water, while the coated side of the other was turned towards the bright side of the latter, the rarefaction of the air within the cylinders at the extremities of the tube, in consequence of the heat absorbed by them, was proved to be equal by the coloured spirit remaining stationary in the tube. (*Journal of the R. Inst.* No. V. December, 1831.) It is evident, here, that if the quantity of heat which radiated from the bright side of the middle cylinder were represented by $\frac{1}{n}$th of that which issued from the coated side; the bright side of the cylinder at one extremity of the tube absorbed $\frac{1}{n}$th of the latter quantity, while the coated side of the cylinder at the other extremity absorbed all the former, that is, an equal quantity.

ABUTMENT, in machinery, is a term applied to a fixed point from which resistance or re-action is obtained. In an ordinary steam-engine, for example, each end of the cylinder acts alternately as an abutment for the force of the steam, which, being unable to expand itself in the direction of the fixed obstacle, *i. e.* the end of the cylinder, expands the whole of its elastic force in the opposite direction, against the moveable obstacle, or piston. In like way the breech of a gun forms an abutment for the expansive force of the ignited powder; although in this case, the abutment not being absolutely a fixed point, its recoil occasions some loss of power. Even a rotatory steam-engine, with a continuous circular action, must have an abutment to render the force of the steam effective, though in the primitive rotatory steam-engine of Hero of Alexandria, which is described by Lardner and most writers on the history of the steam-engine, especially by Stuart (who, in his 'Historical and Descriptive Anecdotes of Steam-engines,' p. 12, quotes the original account from 'Heronis Spiritualium Liber a Commandino,' Amst. 1680, p. 66), and in some modern machines on the same principle, the air is made to supply the necessary resistance, and therefore may be termed the abutment of the machine. Springs, whether used to impel machinery, as in the case of a watch, or to measure or control force, as in the various contrivances alluded to under Spring-Balance, P. C., p. 385, must have their abutments or points of resistance; as also must all mechanical combinations in which power is transmitted by means of screws, of which it is sufficient to cite as an example the nut in the fixed head of an ordinary screw-press. [Screw-Press, P. C., p. 111.] In all these cases an analogy may be traced with the use of the term in architecture, explained under Abutment, P. C., p. 51. With a similar meaning the name is applied in carpentry to a joint in which two pieces of timber meet so that the fibres of one piece run in a direction oblique or perpendicular to the joint, and those of the other parallel with it.

ABYDE'NUS ('Αβυδηνός), also called Abidenus by Eusebius, a Greek historian who is known to us only as the author of a history of Chaldæa, or, as it is commonly called, of Assyria ('Ασσυριακά), which is lost, with the exception of some fragments preserved in Eusebius, Cyrillus, Syncellus, and Moses of Chorene. From the manner in which these writers mention Abydenus, we must infer that he was an historian of considerable authority. The time at which he lived is not certain: he must however belong to a later period than Berosus, who lived about B.C. 250; for in one of the fragments still extant, Abydenus mentions Berosus among his authorities. The fragments of the history of Abydenus are collected in Scaliger's work, 'De Emendatione Temporum,' and more completely in J. D. G. Richter, 'Berosi Chaldaei Historiae quae supersunt,' &c., Leipzig, 1825, 8vo. p. 38, &c. and p. 85, &c.

ABYSSINIA. Since this article was written in the P. C., Abyssinia has been visited by many Europeans, who have entered it partly by the road previously known, which leads from the Red Sea at Massówa to the table-land of Tigré, and partly from Zeila and Tajurrah, on the gulf of Aden. From the gulf of Aden the route has been to Shoa, which route was pointed out in this work twelve years ago as that by which the southern parts of Abyssinia might be reached without much risk [Abyssinia, P. C., p. 57]; and so it has turned out. The accounts of these travellers have thrown a new light on the physical geography of this country, and though there are some large portions which have not been visited, we can now form a tolerably correct idea of the great natural features of all this country.

Abyssinia is a large tract in Eastern Africa. The greater part of it is drained by the principal branches of the Nile. It lies between 8° 30′ and 15° 40′ N. lat. and between 35° and 42° E. long.

Abyssinia is an elevated table-land. The greater part of it is more elevated above the sea than the general level of the table-land of Anahuac in Mexico. The north-eastern edge of the table-land is directed towards the Red Sea, and is from 30 to 60 miles from its shores. Those who navigate that sea observe an apparently uninterrupted chain of high mountains from the harbour of Massówa (15° 40′ N. lat.) to Cape Rackmah (13° 40′ N. lat.). These mountains form the descent of the table-land to the flat country on the Red Sea. Isolated peaks are also seen from Cape Rackmah to the Straits of Bab-el-mandeb, but they appear to belong to a ridge which descends on both sides to a low country. From Cape Rackmah the edge of the table-land runs westward, but we are not acquainted with its actual position, as the countries through which it runs are inhabited by tribes which are among the most inhospitable in Northern Africa. In the vicinity of Lake Haik (near 11° 25′ N. lat. and 40° E. long.) the edge of the table-land runs south and north. In these parts however it is not so steep as along the Red Sea, but rises with a gentle acclivity over a considerable tract until it reaches the watershed between the rivers that flow eastward to the Hawásh and those that run westward to the Abái. From the Lake Haik it runs nearly due south, and becomes steeper as it proceeds in that direction, until it terminates near 9° N. lat., about 30 miles from Ankóbar, at some distance from the banks of the river Hawásh in the mountains of Bulga. The wide and level valley through which the Hawásh flows may be considered as lying at the base of the table-land on the south. At the ford of Melki Kuya, where the river is crossed by the road leading from Tajurrah to Ankóbar, its level is about 2200 feet above the sea. As its course is not rapid, it is probable that the swamps in which the Hawásh originates are not more than 5000 feet above the sea. From the valley of the Hawásh the country rises gradually to a ridge which may be between 7000 and 8000 feet above the sea, and constitutes in these parts the edge of the table-land. It runs from the mountains of Bulga westward to the sources of the Hawásh. West of the sources of the Hawásh there are tracts with which we are not acquainted. In these parts the table-land of Abyssinia appears to be connected with the elevated but unknown region of Inner Africa.

On the east of the table-land runs the Bahr-el-Azrek from south to north. The country on its eastern banks and to a great distance from the river is a dead flat and only slightly elevated above the bed of the river. As the river in these parts is hardly more than 1200 feet, certainly not 1500 feet, above the sea-level, it is probable that the edge of the table-land is a great distance from the river, probably near 36° E. long., and as no high range appears to exist in these parts, the country probably rises very slowly, until it attains an elevation of about 7000 feet, about 40 or 50 miles west of Lake Tzana or Zana. It is not possible to determine the termination of the table-land on the north-west. In this direction, according to all accounts, it falls off in inclined plains of immense extent to the north-west and west, until it terminates on the banks of the Nile in Shendy (between 16 and 18° N. lat.).

Physical Geography.—The most mountainous part of the table-land is east of Lake Tzana, comprehending the countries which are drained by the upper course of the river Tacazze or Takkazie and its numerous affluents. It lies between 11° 30′ and 12° 30′ N. lat., and between 38° and 39° 30′ E. long. The mountains of Samen or Semien are a continuation of this mountain-region: they extend on the west side of the river Takkazie to 13° 30′ N. lat., and rise to a great elevation above the common level of the table-land. From the source of the river Takkazie a mountainous region extends south-east to the edge of the table-land in the vicinity of Lake Haik. These extensive mountain-tracts divide the table-land of Abyssinia into two parts, the *north-eastern* and the *western* and *southern* region.

1. The *North-eastern Table-land* is also called the *Table-land of Tigré*, because it has frequently been under one government, which has been called the kingdom of Tigré, from the name of one of its provinces. This country extends from 11° 30′ to 15° 40′ N. lat., and between 42° and 39° E. long. The edge of the table-land towards the Red Sea is crowned with a ridge of hills, which rise from 500 to 1000 feet higher than the table-land itself. Where the road leading from Massówa to Axum reaches the table-land, its elevation at the village of Halai is 8628 feet above the sea, but the hills through which the upper extremity of the Taranta Pass leads rise from 500 to 1000 feet above Halai. From the base of the hills which crown the edge of the table-land, the country descends gradually to the west, as is shown by the watercourses, which run in that direction. In most parts it is strongly undulating, so that it may sometimes be called hilly, but here and there it is intersected by small plains. The beds of the rivers are considerably depressed below the general level of the country, and are dry for the greater part of the year. This tract suffers from want of water, and is therefore sparingly inhabited. It supplies pasture for a great number of cattle, black sheep, and fine goats; asses and mules are also kept, and these animals constitute the wealth of the inhabitants, as cultivation is limited to the base of the hills, on which the villages are generally built. Hardly any thing except barley is raised. Near the range of hills the country is partially overgrown with large trees (Juniperus virginiana); but at some distance from it no trees are seen, and the higher country is only interspersed with isolated clumps of acacia. The depressions of the watercourses contain good meadows. In proceeding westward the country becomes more level, and it is said that the rivers of this tract, after running for some distance westward, reach a level country of great extent, which is called Maleb, and which during the rainy season is converted into a deep swamp. As this swamp has no channel for the discharge of its waters, this tract is very unhealthy, and uninhabited. The country between this swampy country and the edge of the table-land is called Hámasien, and constitutes the most northern and the narrowest portion of Tigré.

South of 15° N. lat. the hills which are on the edge of the table-land occupy a much greater extent in width, or rather they form two ranges, which enclose a longitudinal valley. The western range, which runs from north-north-west to south-south-east, may be called the Debra Damo range, from a monastery of that name, which is built on one of its highest and most inaccessible pinnacles. This range does not appear to rise in general more than 500 feet above its eastern base, though a few summits may attain even 1000 feet, but it constitutes a continuous ridge, and the waters originating on its declivity descend eastward, and run towards the Red Sea. These waters traverse the eastern range by several gorges, and are lost in the sandy soil of the low country of the Danákil. [Adal, P. C. S.] The eastern ridge, which is cut by deep defiles, appears in general to be as high as the western, but some of the summits rise higher. The declivities of these ridges are partly covered with low bushes and partly with grass. The space enclosed by these two ridges consists of a succession of table-lands several miles in extent, and of small valleys. The descent into tho valleys is very steep. The table-lands are partly bare and partly overgrown with bushes and grass. Some of them afford good pasture, and in some places cultivation is carried on to a considerable extent, but in general it is limited to a few spots. The whole tract is destitute of trees; its elevation is probably not less than 8000 feet above the sea-level; Ategerat, situated not far from its southern extremity, is 8181 feet above the sea.

Not far south of Ategerat, near 14° N. lat., is a mountain-tract, which is connected on the east with the eastern edge of the table-land, traverses the country from east to west, and extends westward to the vicinity of the river Takkazie. It is several miles in width, and consists of steep hills with deep depressions between them. Only a small portion of this tract is available for pasture, as the hills are generally rocky and bare, and there is little cultivation. South of this tract lies the Plain of Antálo, in which the capital of Tigré is built on the declivity of a range of hills. This plain stretches from the above-mentioned mountain-tract southwards to the river Zamra, a distance of about 40 miles, and occupies more than double that space from east to west. That portion of the plain which extends eastward from the village of Chelicut is imperfectly known. It appears to consist mostly of a level tract interspersed with short ridges of hills and isolated summits, and is partly cultivated and partly covered with high grass and acacia-bushes. That portion of it which surrounds the town of Antálo is considered the best part of Tigré. It has a black soil, twelve feet deep, which yields abundant crops of grain. Except a ridge of high hills which stands between Chelicut and Antálo, it is level or undulating, but in proceeding farther to the west it appears rather hilly, which is owing to the channels of the rivers being deeply depressed below the surface of the plain, and bounded on each side by steep slopes. Agriculture extends over the acclivities of the hills, and even their flat tops are sometimes cultivated. In some places there are fine groves of large trees, which in most parts of Abyssinia are rarely met with. A few tracts which have a less generous soil are overgrown with acacia and brushwood. The superiority of the soil of this tract must be ascribed to its resting on a substratum of basalt. In the hilly tract which lies north of the plain is a volcanic hill, called Alequa, whose summit rises about 800 or 1000 feet above the village of Ategerat, or about 9000 feet above the sea-level. The elevation of the Plain of Antálo has not been ascertained, but it is probably greater than that of Ategerat. The western portion of the plain is much less fertile. Near the village of Cali, about 25 miles from the banks of the Takkazie, begins the descent towards the river, which is so rapid, that Salt observed that the difference of the temperature below Antálo and Cali amounted to 15 degrees. At the same time cultivation ceases almost entirely, and the country is covered with dark brushwood full of game. It improves a little farther on, showing more signs of cultivation, and rich pastures with numerous herds of cattle. But another considerable descent leads to a sandy and barren district overgrown with thorny bushes and mimosas, resembling the low country along the Red Sea: the pasture is scanty and bad, and cultivation limited to a few spots. By descending two terraces more, which consist almost of bare rocks, the bed of the Takkazie is reached. Here Salt found the temperature as high as 95°, whilst at Antálo it had been 65°; which shows the great depression of the bed of the river below the plain. It is probable that at this place the Takkazie is about 3500 feet above the sea, as Rüppel found it at the ford of Ber Agowe, which is about 20 miles farther down, only 3084 feet above the sea-level. Along the southern limits of the Plain of Antálo runs the Zamra river, which is bordered on its northern side by a ridge of hills not much elevated above the plain, and of little fertility, the soil being partly stony and partly sandy, and very dry: it only produces thorny bushes.

North of the Plain of Antálo, and west of the Haramat Mountains, on which the monastery of Debra Damo is built, is another plain of great extent. It is however much less elevated than the Plain of Antálo, which is proved by the long and rather steep descent by which it is entered from the south. This descent is known as the Pass of Atbara, and lies near 17° N. lat. and 40° 25′ E. long. The difference between the level of this plain and that of Antálo is probably more than 2000 feet. For Rüppel determined the elevation of Takkarákira, which lies on a hill of some elevation, at 6348 feet above the sea; and he observes that the Haramat Mountains are at least 1200 feet above the level of the plain. Pearce also observes that the natives, in ascending the Pass of Atbara, say that they pass from the warm into the cold country. This plain, which, from the name of one of the provinces which it contains, may be called the Plain of Tembien, extends from the base of the Haramat Mountains to the Takkazie, from east by north to west by south, more than 60 miles, and continues along the northern banks of the river for at least 30 miles farther, so that the whole length is about 100 miles. It is narrower at the base of the mountains, and grows wider towards the river. Its average width may be 30 miles; so that it may cover a surface of 3000 square miles. It occupies the whole space between the Pass of Atbara and the towns of Axum and Adowa. This large plain is in general not fertile. At the base of the Haramat Mountains is a tract whose soil rests on basalt, and consists of a black mould, and nearly the whole of it is under cultivation. There is another rich agricultural tract near the heights over which the Pass of Atbara passes, where wheat and barley are extensively cultivated; and two crops are annually obtained from those fields which can be irrigated; but these tracts are not extensive. The greater part of the plain consists of low sandstone hills, and the soil is sandy and unfit for cultivation. In other places there is clay slate, usually in perpendicular strata, and these tracts are still less fertile, as the water sinks down between the strata. Trees do not occur, and in most places only shrubs and bushes of stunted growth are found, among which the Euphorbia Canariensis is common. In the middle of the plain there is an extensive tract which constitutes a fine pastoral country, and is interspersed with trees. Here and in some lower depressions cultivation is also carried on to some extent. The beds of the rivers, which generally contain water even in the dry season, are considerably depressed below the general surface of the country; their bottoms are wooded, but these bottoms are very narrow. In approaching the river Takkazie the level of the plain lowers by steep and long descents, which constitute several terraces. This lower tract is a very poor country. At a place called Ber Agowe, situated nearly at the most southern part of the plain, Rüppel found the level of the Takkazie 3084 feet above the sea.

North of the Plain of Tembien are those of Shiré and Serawé. They are more elevated than the first-mentioned plain, and at the base of the ascent by which they are reached are situated the towns of Axum and Adowa. The first place is 7092 feet and the second 6216 feet above the sea-level. Hence we may conclude that these plains are at least 7000 feet above the sea. The south-western portion is called the Plain of Shiré, and the north-eastern that of Serawé; but we are not acquainted with the line which separates them from one another, nor with their extent to the north and west. The first appears to extend to the country of the Shangalla, and the last to the swampy region of Maleb. The Plain of Serawé is celebrated in Tigré for its flowery meadows, shady groves, and rich valleys. That portion of it however which was traversed by Rüppel, and which extends along the banks of the Takkazie, does not answer this description. From the banks of the river, which is at Haita 2775 feet above the sea-level, one long and steep ascent brings the traveller to the plain, whose surface is composed of sandstone, and on which a great number of volcanic cones rise to some height. The soil, consisting of the decomposed volcanic matter, is partly covered with low bushes, between which there is a fine turf that makes excellent pasture. In some glens there are trees, and among them date-trees. One of the volcanic hills, called Alequa, rises 800 feet above its base. The western portion of the

Plain of Serawé, or that which is contiguous to that of Shiré, does not differ much from it in aspect. On the plain, which is generally level, and consists of sandstone, several ridges of basaltic hills, and a few isolated ones composed of volcanic matter, rise to a small elevation above the general level of the country. The greatest part of the plain is covered with bushes, between which there are excellent pasture-grounds. The herds of cattle met with on this plain are large and numerous; but agriculture is limited to a few places. The hilly ground along the southern edge of the table-land is covered with bushes and the Euphorbia Canariensis. The eastern part of the Plain of Serawé, or that which approaches the mountains with which the edge of the table-land of Tigré is crowned, is somewhat different. Its upper surface consists of small table-lands whose surface is either bare sandstone or a thin layer of poor soil. Between the table-lands are some valleys, from half a mile to a mile in width, which are partly used as pasture-grounds and partly cultivated.

The Plain of Serawé is separated from the Haramat Mountains by a hilly tract about 50 miles in length by 30 wide. As this tract constitutes the principal part of the province of Tigré, which has given its name to this great division of Abyssinia, it may be called the hilly region of Tigré. The rivers which originate in it run westward, and form by their union the Mareb. This tract presents a great variety of surface and productive powers. Hills and short ridges are numerous; but, except one or two, they are not of great height. Some of them consist of volcanic matter or basalt, and the soil produces trees and fine grass, and is partly cultivated; but others are composed of sandstone or clay slate, and are nearly bare or only covered with low stunted bushes. Some of the plains extend several miles in every direction, are well watered, and in a state of high cultivation, whilst others suffer from want of water, and are not inhabited except in the rainy season. The valleys resemble the plains.

The southern part of Tigré, or that which is south of the Plain of Antálo, has a mountainous character. Our information respecting these countries however is scanty, as they have only been traversed by a few travellers in haste and under unfavourable circumstances. This part of Tigré comprehends the upper basin of the Takkazie and the whole basin of its affluent the Tzelari. Near the source of the Tzelari is the watershed between the rivers which flow north and south, and at some distance from it, probably on the watershed, are two large lakes, of which the larger is called Tzado Bahari, or the great lake of Ashangi, and is three days' journey in circuit; the smaller is called Guala Ashangi or Macbakh. The country surrounding these lakes and the source of the Tzelari must have a great elevation above the sea-level. Pearce saw here hoar-frost in the beginning of October, and Krapf found this tract destitute of trees and covered with a coarse grass, which also occurs in Shoa, but only at an elevation of from 8000 to 10,000 feet. Both travellers complain of the cold that they experienced. The country is a complete wilderness; there is neither village nor cultivation nor cattle, nor wild beast except the fox. It suffers extremely from want of water all the year round, and produces only, at a few places, kolqual (Euphorbia Canariensis) and thorny acacias. The numerous hills which are dispersed over it are composed of sand. To the east of this central table-land of Abyssinia extends a mountainous country, of which we have no information. It is inhabited by the Raia or Azabo Gallas, who are described as the most savage of all the tribes of Africa. It is certainly remarkable that their neighbours to the south-west, the Yejju, have not the least intercourse with them, and were unable to give the least information about them and their country to Krapf. To the east of the mountains inhabited by the Raia Gallas lies a country called Zobul; it is said to be a fine country, well wooded, and producing grapes, olives, limes, cedars, and other fruits and trees; but, in consequence of long wars, it is now uninhabited. It is said to have remained in this state since the time of Mohammed Gragne. In the middle of last century, when an Abyssinian army marched through Zobul to attack Adál, the soldiers dropped a quantity of durrah, which has since continued to grow without cultivation. Zobul is contiguous to Adál. [ADAL, P. C. S.]

The country surrounding the upper course of the Tzelari river and its affluents is represented as resembling a sea agitated by a gale, rising in numerous hills like waves, with large spaces of lower ground between them. The hills as well as the depressions are covered with sand and almost without vegetation, except some kolqual-trees and thorny acacia-bushes. For the greater part of the year it is almost destitute of water, which is only found in *wadies*, which are dry during the summer. In these wadies there are only a few pasture-grounds and cultivated spots. Dr. Beke is of opinion that this tract is not so high as the basin of the Takkazie, which is contiguous to it on the west. The upper basin of the Takkazie is a much better country. It is stated that near 12° N. lat. a plain of considerable extent stretches from east to west, but we are not informed of its productive powers. North of 12° N. lat. lies the mountain country of Lasta. It forms one mass of mountains intersected by numerous steep valleys. The ridges are all flat-topped and of the same elevation, so that when seen from an eminence, where the valleys are not visible, the country has the appearance of an uninterrupted plain. Dr. Beke thinks that the general level of this plain is between 6500 and 7000 feet above the sea; but as in the northern parts of Tigré, Lasta is considered a very cold country, it is probably higher than the Plain of Antálo. The tops of the mountains are sometimes, though rarely, covered with trees; most of them however are grassy and have excellent pastures; a few only are quite barren. The descent into the valleys is often so steep and rocky as to prevent vegetation from growing. Some of the valleys are fertile and well cultivated. This region is in general well watered, and the rivers have water all the year round. Between the basin of the Takkazie and of the Tzelari is a range of mountains, which rises above the ridges that fill up the interior of the two basins, and some of its summits are very high. That tract of country which lies between the river Tzelari and the southern border of the Plain of Antálo is barren; it is almost uninhabited, and constitutes the natural boundary between Northern and Southern Tigré.

The Takkazie is the second river in Abyssinia in size, the Abái, or Nile, being the first. It originates near 12° N. lat. and 39° E. long., and its upper course in Abyssinia is to the north, until having received the waters of the Tzelari from the east, and those of the Bellegas from the west, it turns by degrees westward, and continues in that direction to the boundary of Abyssinia. Before it leaves the country it is joined by the Angrab from the south. The two last-mentioned affluents drain the whole of the volcanic region, which extends from the banks of the Takkazie to the vicinity of Lake Zana, and all the volcanic matter brought down by their rapid currents is thus carried to the Nile. Rüppel, who has seen the greatest part of the course of the Nile, is decidedly of opinion that to this volcanic matter mainly, if not entirely, the great fertility of the soil is to be ascribed, which the Nile deposits in its lower course during the inundations. If we consider that the countries lower down on both sides of the river have either a sandy or rocky soil of very moderate fertility, and are frequently desert owing to their sterility, his opinion appears to be well founded. The bottom of the Takkazie is very narrow compared with the size of the river, and there is frequently no bottom at all, the rocks rising immediately from the water's edge to a considerable height, and attaining at a distance of a few miles an elevation of from 2000 to 4000 feet above the river.

The western and southern part of the table-land of Abyssinia is called *Amhara*, from a province of that name situated nearly in the middle of it. The south-eastern portion of this large country bears the name of *Shoa*. Under the name of Amhara we shall describe the country which is divided by the Takkazie from Tigré, and extends southward on both sides of Lake Tzana or Zana to the most southern bend of the Nile or Abái. It is divided from Shoa by the last-named river and a line beginning on its banks at a place called Broken Bridge and terminating at the source of the most southern affluent of the Takkazie.

2. *The Table-land of Amhara* contains the highest mountain-range in Abyssimia. This range in the most eastern portion of the country is close to the banks of the river Takkazie in the province of Samen or Semien, whence it is also called the Mountains of Samen or Semien. This range begins in the south with Mount Zozamba, a flat-topped summit which lies near 12° 30′ N. lat. and runs nearly due north to near 13° 30′, so that in length it extends about 70 miles. The most elevated summits are towards the northern extremity of the range, where the peak called Abba Yaret rises to 15,006 feet and that which bears the name of Buahat to 14,364 feet above the sea-level. The two high summits are only a few miles distant from one another, Abba Yaret to the east and Buahat to the west. Their northern declivities are united by a ridge, over which runs a mountain-pass called Selki. This pass is 12,696 feet above the sea-level. Between the two

summits is a deep depression, in which a river, the Mashada, which rises on the ridge of the Selki pass, runs southward. Another pass runs along the eastern declivity of the Buahat, and its highest point is only about 450 feet below the summit. Rüppel found, in July, the upper part of the summit, to a distance of 1500 feet below the summit, covered with snow. This portion of the range is composed of plutonic rocks, lava, and basalt columns of slender shape. The country between the highest portion of the range and the river Takkazie is about 30 miles in width, and is covered with mountains, which grow lower as they approach the river. The greater number of them consist of sandstone, but there are some which are composed of lava. Near the river the sandstone is nearly bare, and only here and there covered with thorn-bushes, but in ascending the steep valleys the sides of the hills are clothed with trees or fine grass, and the bottoms are either meadows or fields in which barley is cultivated and yields good crops. Agriculture is favoured by the climate, which all the year round resembles the spring in Europe, by abundance of rain in every month of the year, and by the absence of locusts, which frequently lay waste the corn-fields in other parts of Abyssinia. In the higher region the mountains, up to the parts which are covered with snow, are pasture-ground equal to the famous Alpine pastures in Switzerland, and the scenery is also very similar, except that in those regions which are above the line of trees a plant is found which resembles the palm: it is called gibarra (Rhynchopetalum montanum), and its peculiar shape makes a very pleasant impression on the observer, when it stands near tracts covered with snow. Here are also found, almost mingled with the leopard and hyæna, two inhabitants of the European Alps, the mountain-goat (Capra Ibex) and the lammergeier (Gypaëtus barbatus).

The western declivity of the mountains of Semien is less broken, and terminates about ten miles from Mount Buahat at the Plain of Entshetquab, which is about 10,000 feet above the level of the sea. This plain extends for seven miles westward, when it is interrupted by the valley of Shoada, which is at least 4000 feet below its surface, and is traversed by a river called Bellegas. The plain has an undulating surface, and is entirely destitute of wood, except those clumps of trees which surround every church in Abyssinia. The soil however is good, the pastures abundant, and the barley yields rich crops. The whole plain is available for some of these purposes. Rüppel passed the months of July, August, and September, 1832, in Entshetquab, and observed the thermometer four times every day. The results of his observations are—

	5 h. 50 m.	9 h. 4 m.	12 h. 25 m.	3 h. 0 m.	Mean temp.
July 8—31 .	46·44°	56·23°	59·00°	57·56°	54·81°
Aug. 1—31 .	45·59	56·52	59·56	58·05	54·93
Sept. 1 to Oct. 4	43·85	57·74	62·07	60·05	55·93

The temperature of Entshetquab was therefore in July and August eight degrees lower than in London, but in September only a little less than two degrees. The weather was very foggy and rainy. The wind blew in the evening and morning from east-north-east, or from the mountains, and during the day from west-south-west, or from the plains.

The small table-land of Entshetquab is separated from the large table-land of Wogghera by the Vale of Shoada, which is at least 4000 feet, as already observed, lower than Entshetquab. It is from three to four miles wide at the top, and more than a mile wide at the bottom. The bottom is partly swampy, and only used as pasture-ground, but on the gentle ascent much barley and some flax are cultivated. The table-land of Wogghera extends more than 40 miles from east to west, and nearly as much from north to south. The greater part of it is about 8500 feet above the sea-level. Near the vale of Shoada its surface presents low hills and depressions; but farther on it is almost a dead level, with a few isolated hills dispersed over it. They are all of volcanic origin and of conical shapes. The highest of them, called Waaken, has only an elevation of about 800 feet above its base. There are many watercourses, but they are deeply depressed below the general level, and in summer they are dry. As the rocks which constitute the body of the table-land are of volcanic origin, the soil is rather fertile, and produces good crops of barley, which however is only cultivated in a few places. The incessant civil wars from which this country has suffered for nearly a century have driven away the husbandman, and his place is supplied by wandering herdsmen, who go with their herds and flocks during the dry season to the low country on the lake Zana. The pasture-grounds are very good: the descent from the table-land to Gondar and the country surrounding Lake Zana is gradual, and passes through several valleys, whose declivities are generally wooded, and cultivated only to a small extent. Nearly all the waters that are collected on the plain of Wogghera run off eastward, and fall into the Bellegas, which carries its waters to the Takkazie and passes through the mountain-range of Semien near 12° 35′ N. lat.

The northern boundary of the plain of Wogghera is formed by a rocky ridge, which at one place is not more than 40 feet above its level, and has a flat top. This ridge is in some places hardly 200 feet wide and at one place only 40 feet. It runs eastward for more than 60 miles, increasing in width and in height until it joins the mountain-range at the Pass of Selki. It is remarkable that this ridge, which is so little elevated above the plain of Wogghera, descends northward with a very steep declivity of more than 3000 feet to the table-land of Adarga. The place where the caravan-road cuts the ridge is known as the Pass of Lamalmon, which is of very difficult ascent, and 8802 feet above the sea-level. The table land of Adarga is somewhat more than 3000 feet above the sea. The rivers which drain it rise partly along the north-western declivity of the mountains of Semien and partly at the foot of the ridge of the Lamalmon Pass, and run in a north-western direction to the Takkazie. Near the base of the ridge the Plain of Adarga is interspersed with numerous volcanic cones, most of which are low, but they increase in elevation and size as they approach the high mountains. They are covered with brushwood, and no cultivated fields are found near them. In advancing farther north, the plain becomes more level, and in the valleys are sycamores and other large trees. Though there are some tracts of rocky hills which in the dry season are destitute of vegetation, the greater part of the plain is covered with good grass, and at intervals with numerous bushes. There are many volcanic hills here also, but they are at greater distances from one another. Near the banks of the Takkazie the country is almost a dead level. Its soil is a thick layer of mould resting on sandstone rocks, and rather fertile, so that a considerable portion of it is under cultivation. The descent from the plain to the banks of the Takkazie is more than 2000 feet of perpendicular height, and the surface of the river at Haita is 2775 feet above the sea-level.

On the west of the table-land of Adarga are the provinces of Waldubba and Walkeit, which lie on the southern side of the Takkazie, which here constitutes the boundary between Abyssinia and the country inhabited by the Shangalla and other tribes. These provinces have never been visited by Europeans. The natives describe them as fine pasture countries, well watered, and they add that the valleys are wide, and rich in agricultural produce and fine trees. The surface is mostly a level plain.

South of these provinces and west of the table-land of Wogghera is an extensive hilly tract, which may be called the *Hilly Table-land of the Kulla*. In length from east to west it occupies about 50 miles, and not much less from north to south. Its highest level is on the ridge which separates it from the low lands surrounding Lake Zana, which lie south of it. This ridge, where it is passed by the road, nearly due north of Gondar, is 1200 feet above that town, or about 8600 feet above the sea-level. It forms in these parts the water-shed between the rivers which run to Lake Zana and those which flow northward to the Takkazie. All the waters that run in the last-named direction unite in the Angrab, which is one of the most considerable affluents of the Takkazie. On the north of this ridge the country descends considerably, and though the surface is a labyrinth of rugged mountains, isolated conical hills, and rocks rising perpendicularly to a considerable elevation, none of these heights attain the elevation of the pass. A few miles from the pass the surface of the country is less hilly, and the descent is more gradual. Cultivation is here in due proportion united to pasturage. The soil between the rocks, which are chiefly volcanic, is very fertile, and maize and other kinds of grain are extensively grown. On the uncultivated tracts are thick bushes and fine groves of trees, and in the deep valleys of the rivers numerous sycamores. Farther north the hills are still less numerous, and mostly covered with bushes, but the depressions are swampy and overgrown with high canes. The ground then ascends, and on the back of the ridge stands an isolated mountain-mass, which attains a great elevation and is called Mount Ankodib. From its base the country descends northward in an undulating plain into the Kulla. The Kulla is a depression, similar to a lake, between four and six miles wide, but of great extent from east to west. Though only about 600 feet lower than the ridges which lie north and south of it, it is 3600 feet lower than the above-mentioned pass north of Gondar, or only 5000 feet above the sea-level. Its soil is somewhat swampy, partly covered with canes more than ten feet high and partly with fine trees. Several rivulets pass through it in various directions, and form pools and small lakes. This low country is uninhabited on account of the bad air. Through want of ventilation the vapours rising from the surface, which is covered with water during the rainy season, accumulate to such a degree that it cannot be passed by any person without contracting a malignant fever. It is the haunt of numerous wild animals of the largest size. Buffaloes (Bos caffer) and elephants are met with in herds in and near the lakes. There are also rhinoceroses with two horns, and various species of antelopes and deer of very large size, especially Antilope defassa, Rüppel.

We come now to that depression of the table-land of Amhara, the lowest part of which is occupied by Lake Zana, called also the Lake of Dembea. The surface of the lake is 6110 feet above the sea-level; and from its shores a flat country extends on all sides to the high lands which surround it at different distances from the lake. From the mountains inclosing the basin of the Upper Takkazie on the west, two low ridges run off westward and approach the shores of the lake: the northern, on its north-eastern bay, opposite the island of Mazraka; and the southern, north and south of the efflux of the Abái from the lake. These two offsets separate from one another the three plains surrounding the northern, eastern, and southern sides of the lake. These plains derive their names from the provinces in which they are situated. The northern is called the Plain of Dembea, the eastern the Plain of Biegemider, and the southern the Plain of Miecha.

The Plain of Dembea, which is also called the Plain of Gondar, from the capital of Amhara, which is built on hilly ground at the north-eastern extremity of the plain, extends about 20 miles from north to south, and 40 from east to west. Its surface at Gondar is 7420 feet above the sea, so that its descent is rather rapid: for in 20 miles it sinks 1300 feet lower. Near the surrounding heights there are numerous low volcanic hills, mostly overgrown with bushes; and in their vicinity the soil is fertile, and part of the country is under cultivation. At a distance of three or four miles from the heights the hills disappear, and are replaced by an undulating surface, whose soil, being composed of disintegrated volcanic matter, is a black mould of great fertility, but very little of it is under cultivation. There are no trees, except round the churches. Bushes are frequent, but occur only in patches. In the dry season, from October to April, the country is almost covered with herds of cattle, which, when the rains begin, are driven to the table-land of Wogghera, because the plain is then nearly converted into a swamp. Even in the dry season those tracts which are near the lake are marshy, and only inhabited by fishermen. The plain is drained by many small rivers, which at the close of the dry season are dry, with the exception of the largest, named the Angrab. Rüppel passed six months and a half at Gondar, and made meteorological observations four times every day. The result of these observations follows:—

1832.	5h. 40m.	9h. 6m	12h. 30m.	3h. 33m.	Mean temp.
Oct. 15-31 .	56·43°	66·89	72·99°	72·88°	67·30°.
Nov. 1-30 .	56·52	66·31	72·81	70·96	66·60
Dec. 1-4 & 12-30	58·09	64·85	72·05	71·24	65·31
1833.					
Jan. 1-31 .	57·26	66·62	74·27	73·40	67·88
Feb. 1-28 .	57·24	68·58	77·81	76·18	69·94
March 1-31 .	59·94	73·58	80·66	79·90	73·52
April 1-30 .	61·79	75·17	79·88	75·60	73·11

It would be very interesting to compare these observations with those made at Mexico, especially as the difference of elevation is small, Mexico being 7470 feet and Gondar 7420 feet above the sea-level. The difference in latitude is less than seven degrees, Mexico being situated in 19° 26′ and Gondar in 12° 36′ N. lat. The meteorological observations however respecting Mexico, which have been published in Humboldt's work, do not contain the months of January, February, and March, because their mean temperature had not been ascertained. For October it was 61·52°, for November 59·92°, for December 56·66°, and for April 65·48°. From these data we may conclude that the temperature of Gondar is from six to nine degrees higher than that of Mexico, which appears to be more than could be expected from the difference in latitude. The annual quantity of rain at Gondar is very great, which is not generally the case on elevated table-lands, and perhaps is to be ascribed to the circumstance of the town being built in a wide depression of the table-land, and partly surrounded by heights which rise a thousand feet above its level. The annual quantity in 1770 was 35·5 inches, and in 1771 it was 41·3 inches. In January hardly a shower falls, but the rain becomes more frequent in February and March. In April and May there is more rain, but the rainy season properly commences in June and lasts to October. In July and August the rains are very heavy, so that nearly two-thirds of the whole annual quantity fall in these two months. In September the rains become moderate, and in October they cease, with the exception of a few short showers which fall in November and December. During the rains the wind blows in the morning from north-east, but it turns before nine o'clock to south-east, and at noon it blows from the south-west. In the afternoon it turns to north-west, where it remains until it becomes calm after sunset.

The narrow strip of low country which lies west of Lake Zana is a part of the Plain of Dembea, and is included in the province of that name. The adjacent heights do not rise to a great elevation above the level of the lake. Their declivities are overgrown with bushes and stunted acacia-trees, from which a considerable quantity of gum-arabic might be collected. At the base of these heights the country is fruitful, and a considerable portion of it is under cultivation; much durrha is grown. This tract is considered one of the granaries of Gondar. In the vicinity of the lake no cultivation is carried on, the whole being used as pasture-ground and meadows. The deep black soil is very favourable to vegetation, and usually covered with high grass. Cattle are very numerous. Though there are many rivers, they all originate in the heights, which are seldom more than ten miles from the shores of the lake, and accordingly the courses of the rivers are short. They are dry in January and February; but, as they receive their waters from a much more elevated country, their course, as long as they have water, is rather rapid, and different from those of the great plain of Dembea, which have a sluggish current. The village of Dingelber stands on a rock which forms the extremity of a ridge that projects from the heights on the west, and which approaches so near to the lake that there remains only a narrow place on its shores, through which the great road passes which leads from Gondar to Miecha and Gojam. The table-land which is west of the tract just now noticed is that of Kuara and Ras-el-Feel, of which the first-named province forms the southern and Ras-el-Feel the northern part. Kuara has never been visited by a European, but Bruce passed through Ras-el-Feel, which he describes as a fertile and level country with a rich black soil. The surface is mostly covered with bushes, and occasionally there is a grove of trees. Cattle and horses are numerous; butter, honey, horses, and gold, which is here found in larger quantities than in any other part of Abyssinia, are the principal articles which are sent from Ras-el-Feel to the other provinces and to Sennaar.

The Plain of Biegemider, which lies on the eastern side of Lake Zana, extends from near Emfras on the north to the banks of the Abái or Nile, nearly forty miles in length. Its width, from the low shores of the lake to the high mountain-masses which inclose the upper basin of the Takkazie on the west, is nearly thirty miles. The mountain-masses rise from the plain with a steep ascent, except where their edges are broken down by the torrents and rivers, which originate on the higher land and tumble in cataracts into the lower plain. The elevation of these mountains of Biegemider is estimated by Dr. Beke at between 7000 and 8000 feet above the sea, the last-mentioned elevation being assigned to the Pass of Chámma Marágfia. As the level of Lake Zana is 6110 feet above the sea, the mountains of Biegemider rise only from 1500 to 2000 feet above their bases, or rather less, as the plain has a gradual rise from the shores of the lake to the foot of the mountain masses. North of the river Reb, where the plain is not so wide, it consists of two tracts of different characters, a lower one skirting the shores of the lake for several miles, which in the rainy season is inundated and in the dry season covered with aquatic plants or grass, and a more elevated part which has an undulating surface, and is covered with low bushes. No part of this district is under cultivation, but both supply pasture. On the declivity of the mountains there are extensive orchards which produce fine grapes. From the river Reb to that of Fogara, and even farther to the south, the country is a dead level, and the soil consists of a fine black mould of great fertility, which is the deposit of the earthy matter brought down by the rivers Reb and Gomára. There are no springs, but good water may be found by digging to the depth of a few feet. There are no bushes or trees, except near the churches. Only a small portion of this fine tract is at present cultivated; but the numerous traces of the canals for irrigation show that formerly it was a corn country, which has been reduced to its present low state by the internal wars of a century. Numerous herds of cattle find pasture during the dry season, but when the rains have converted the whole into a swamp, the cattle are taken to the high land on the east. Near the banks of the rivers are extensive fields, in which lupines and vetches are cultivated. The beds of the rivers in the dry season are not more than five feet below the level of the plain. This country is better peopled than the adjacent provinces of Abyssinia. The most southern district of the plain of Biegemider, or that which lies between the river Fogara and the Abái (Nile), at its efflux from Lake Zána, has a very broken surface, being traversed by several ridges of rocky hills which detach themselves from Mount Chámma Marágfia, and run westward to the lake and south-westward to the Abái. These ridges are covered with fine forest-trees, and as the depressions are extensive and well watered and have a fertile soil, cultivation is carried on to a great extent. As in approaching the banks of the Abái the country becomes more broken and rugged and rises higher, the village of Dómbasa, though only five miles from the river, is at least a thousand feet above its level at the bridge which is here thrown over the Abái. The hills which skirt the banks of the river are composed of volcanic rocks, and show great fertility in the vigorous growth of the trees and bushes with which they are covered. From the efflux of the Abái from Lake Zana to the vicinity of the cataract of Alata, the river runs through a wide bottom which is covered with the finest grass.

3. The Plain of Miécha is a part of the *Peninsula of the Abái*. This peninsula forms a part of Amhara, but as it is naturally separated from the other divisions of the country, and constitutes by itself a well defined system, it ought to be noticed separately. The river Abái and Lake Zana surround it on the north, west, and south, and its western limits may be tolerably well defined by a line drawn from the banks of the Abái where it is joined by the Jamma to the village of Dingelber on the shores of Lake Zana. Thus limited, the peninsula extends in length from east-south-east to west-north-west 150 miles, with an average width of about 100 miles, so that it covers an area of 15,000 square miles, or more than half of Ireland.

The *Abái*, as this great branch of the Nile is uniformly called by the inhabitants of Abyssinia, rises near 11° N. lat. and 37° E. long. at the foot of Mount Giesh, in a swampy tract. The source of the river is 8700 feet above the sea-level, and the summit of Mount Giesh about 9700 feet. After running northward for about 60 miles in a straight line, the Abái descends from 8700 feet to the level of Lake Zana (6111 feet), or about 2600 feet, or more than 43 feet a mile: the current is of course extremely swift, and forms a kind of continuous rapid, interrupted by some cataracts. One of these was visited by Bruce, who found its perpendicular height 16 feet, and he heard of another. The Abái enters Lake Zana on the south-west side and leaves it on the south-east side. According to Bruce this lake is 35 miles broad in the widest part, from east to west, but it decreases in width towards the extremities, where it is sometimes not above 10 miles wide. Its greatest length, according to the same authority, is 49 miles. Bruce and Rüppel, the two travellers who have had an opportunity of examining this lake, have given it quite a different shape on their maps. That on the map of Rüppel is much more regular. The number of rivers which the lake receives from all sides is very great; those which join it from the north and west are dry during a great part of the year, but most of those which fall into it from the east and south contain water all the year round. The immense supply of water which the lake receives during the rains, raises its level sufficiently to lay under water the low country on its banks to the distance of two miles. There are many islands in this lake; Rüppel has laid down eighteen in his map. The greater number of them are inhabited. The largest, called Deck, is low, but of considerable size. To the east of it is the island of Daka, which is elevated and terminates in a cone. Fish is abundant and of various kinds, most of which are of the family of the Cyprinidæ, and are taken in great quantity. The hippopotamus is common in the lake, but the crocodile is not found there. The Abái river leaves Lake Zana north of its south-eastern corner, and after running south-east for about 15 miles it forms the cataract of Alata or Tis Eset, where the river descends about 100 feet perpendicularly. Below the cataract it runs with great violence through a deep fissure in the rock, which at one place is hardly more than two yards wide. We may form a notion of the rapidity of this part of the Abái, from the fact that at the Broken Bridge, which is about 40 miles from the efflux of the river, its level is not more than 3852 feet above the sea. In 40 miles therefore the river has fallen 2259 feet, or about 56 feet per mile. From the Broken Bridge the current abates. North of the Mietta Ford, which is north of the place where the Abái is joined by the Jamma, after a course of about 100 miles, its level is still 2936 feet above the sea. In this space therefore the Abái has fallen not much more than nine feet per mile. At the Mietta Ford the river begins to turn westward, and by degrees to the north of west. At the Melka Kuki, or Ford of Kuki, 60 miles lower down, the elevation of the Abái above the sea-level is 2815 feet. In 60 miles therefore it has fallen 111 feet, or not quite two feet per mile. Where the Abái leaves Abyssinia it is joined by the river Durra.

The interior of the peninsula of the Abái is traversed by a mountain-range whose general direction is from west-north-west to east-south-east. It may be called the Talba Waha mountains, though that name is properly applied only to the most elevated portion of it, which extends between 37° 20′ and 37° 50′ E. long. This range begins on the western border of Abyssinia with Mount Eshiti, and runs eastward to Mount Barf, Mount Atzab, and Mount Giesh, where the sources of the Abái are. Mount Giesh, as already observed, rises to 9700 feet above the sea, and a lower ridge connects it with Mount Lichema, which is still higher. East of Mount Lichema there is a depression in the range of a considerable extent, but then the range attains its greatest elevation, as it is supposed, for the elevation of no part has been ascertained by actual measurement or in any other way. This portion is called Talba Waha. Where it begins to decrease in elevation east of 37° 50′ it is crossed by the great commercial road leading from Northern Abyssinia to Gójam. The summit of the mountain pass through which the road runs is at least 11,000 feet above the sea-level; and Mount Goéba, which is near and on the northern side of the range, is 8751 feet high. East of the mountain-pass just mentioned, the range subsides and has only a moderate elevation above the general level of the country; at the same time it changes its direction, and runs to the north-east. As it approaches the banks of the Abái it rises again to a considerable elevation in the mountain mass of Mount Yékandach. This mountain may be considered as the termination of the Talba Waha mountains. It does not appear that any summit of this range is always covered with snow, but the higher portion is cold from November to March. This range is in general covered with forests of large trees, but there are many tracts under cultivation, which produce nearly all the grains that are cultivated in Europe. The higher region is dotted with heaths and ferns, and the most elevated is an extensive level producing stunted grass, interspersed with numerous gibárra plants (Rhynchopetalum montanum). At the base of the Talba Waha mountains lie the Plains of Miécha and Gojam. The first extends northwards from their base to the shores of Lake Zana and the Plain of Gójam from their southern foot to the banks of the Abái. The descent towards the lake terminates at 6111 feet above the sea-level, but that towards the Abái at 2815 feet, this being the elevation of the river at Melka Kuki.

The country which extends from the northern base of the Talba Waha mountains to the Lake Zana is called the Plain of Miécha (Maisha, Matcha), from a province of that name, but this name properly applies only to the low country which extends from the Pass of Dingelber along the south-western shore of the lake to its most south-eastern corner. Between the south-eastern corner of the lake and the Abái, after its efflux from the lake, there is a hilly tract consisting of rocks partially overgrown with stunted bushes. The low plain along the shores of the lake, which is narrow near the Pass of Dingelber, widens as it proceeds southward, and where it reaches the Abái river it is 20 miles wide, extending from the lake to the confluence of the Abái and of the Kelti. A line drawn from this point to the village of Kariagna, on the river of that name, and thence to the Tis Eset cataract, would separate the low plain of Miécha from the hilly tract that lies south of it and extends to the base of the Talba Waha range. This plain is very fruitful, the soil being an alluvium composed of the detritus brought by the rivers from the higher country, but as it is entirely flat, it is not well drained; the currents of the rivers are stagnant at the close of the dry season, especially in January and February, and many pools are left by the inundations. This renders the country unhealthy; as however the soil is very fertile, a large portion of the country is well cultivated, and produces abundant crops of every kind of grain. A narrow tract near the lake is too swampy for cultivation, and is partly used as pasture-ground, but the greater portion of it is overgrown with aquatic plants, especially a large kind of rushes, which for want of wood are used for the construction of the small boats by which the lake is navigated. There are no trees or bushes on the plain, except near the base of the more elevated tract south of it, where there are groves of acacias. The hilly tract occupies about 20 miles in width along the banks of the Abái to its confluence with the river Jamma. Its surface is diversified with several low and rocky ridges, between which are small plains. The courses of the rivers, which are rather rapid, show that the descent of this tract is considerable, and this prevents stagnation, and renders the country healthy. The soil is chiefly composed of decomposed volcanic matter, and is fertile. Those tracts which are not cultivated are generally covered with woods of acacias, which attain a considerable size, and those tracts which are destitute of trees and bushes are overgrown with wild oats and wild lupines. This tract contains abundance of water, and is very healthy. Between it and the mountain range lies a mountain region. Several summits, as Mount Lijambera and Amidamit, rise to a great elevation, but between these and other ridges are many tracts of more level ground, which are partly cultivated notwithstanding the gullies and beds of torrents which intersect them and sink deep below the general level of the country. The lower parts of the mountains are covered with herbage and acacias, and higher up are forests of different kinds of trees. The pastures on these mountains are excellent. Even in the vicinity of the sources of the Abái large quantities of barley are raised. Along the eastern bank of the Abái is a marshy plain, several miles in length and bounded by high hills, which is partly used as pasture-ground. The eastern part of the Plain of Miécha, or that which borders on the banks of the Abái below its efflux from Lake Zana, and which terminates at Mount Yékandach, has a somewhat different character. Its general level is much higher than the low part of the plain before mentioned, but it is tolerably even, except that it is furrowed by numerous deep valleys, in which the watercourses lie; towards the Abái its descent is generally steep and difficult. The soil of the level grounds is of moderate fertility, and partly cultivated and party used as pasture-ground.

The Plain of Gojam is surrounded by the Abái in the form of a semicircle, which on the east begins at Mount Yékandach, and terminates on the west at the mouth of the river Zingini. The middle region is a table-land from 2000 to 3000 feet above the level of the river. This table-land is about 20 miles wide. About the same space is occupied by the broken country which lies between the plain and the river. Between the plain and the highest part of the Talba Waha Mountains is a mountainous tract somewhat less than 20 miles in width. Thus the average width of the whole region is about 60 miles. The ascent from the river from the Ford of Mictta (some miles north of the mouth of the Jamma) is formed by a succession of bluffs which rise in terraces. Near the river the whole is thickly clothed with jungle, and no part of it is cultivated; but higher up the jungle is less dense, and occasionally intermixed with cultivation. Towards the level country the ascent is more regular, the country rising with a slight and continual slope. Here the jungle alternates with grassy tracts, but even here cultivation is rare. The watercourses run in beds deeply depressed below the surface, and with great rapidity. The ascent from the south from the fords called Melka Kuki and Melka Furi is much more irregular and steep. About seven or eight miles from the banks of the river there runs a steep and almost perpendicular wall, which in the lowest parts is from 500 to 600 feet high, but in some places crowned with peaks that rise several hundred feet higher. Between this wall and the river, but nearer the river, is another terrace, whose descent is not so steep, and it is not so high. Offsets from the higher terrace occasionally advance nearer to the river, where they appear like hills. The banks of the river are rocky and precipitous. Above the highest of the terraces is a level tract several miles in extent, which rises regularly but slowly to the north. This tract contains the large towns of Yejúbbi and Yaush, and the market-town of Báso; and the country is almost entirely under tillage, except towards the north, where it approaches the last steppe or terrace, and is there used as pasture-grounds. The last steppe, which is more than 20 miles from the river, is formed by a slope of moderate declivity, and rises only about 200 feet. Near the western extremity of this region is the ford called Melka Abro, and here the ascent occupies only about 12 miles in width, and is much more regular, as it rises gradually from the rocky banks of the river, and is only occasionally interrupted by solitary hills. On this slope the country is cultivated, but only to a small extent. All the watercourses that traverse these ascents run in very deep beds, and the sides of the heights which border them are clothed with jungle or trees.

The table-land itself differs considerably in its eastern and western districts. The eastern district is the plain of Gojam and the western that of Damot. The Plain of Gojam extends westward to the banks of the river Godieb, an affluent of the Bir, and comprehends somewhat more than one-half of the table-land. Towards the mountains of Talba Waha it is almost a perfect level, through which the rivers run with a sluggish current; but where it approaches the descent to the Abái the rivers sink much deeper below the general level of the country, the current is quick, and at some places interrupted by rapids and cataracts. In these parts also there are a few hills on the high grounds between the watercourses. No trees are found in this plain, except the plantations round the churches. Those districts which are quite level are covered with grass, and are very little cultivated and inhabited; but where the ground is somewhat broken, cultivation is carried on to a greater extent. The Plain of Damot, between the river Godieb and the Zingini, rises and sinks alternately with gentle slopes. The current of the rivers which traverse it is rapid. Hills are more numerous than in Gojam, and rise to a greater elevation. Where the country is not cultivated, it is covered with forests: grassy plains are comparatively rare. A great part of the plain is well cultivated, and studded with villages. The gradual fall of the country from the mountains to the Abai often allows the fields to be irrigated by merely diverting to them a portion of the waters of the numerous streams. The south-western portion of the plain, or that which lies contiguous to the descent to the Melka Abro (Ford of Abro) is a perfect level, overgrown with gigantic grass: as we approach the descent to the Abái, it exhibits some signs of cultivation. In some places the grassy plain is interspersed with swamps. It is stated that this part of the plain could be cultivated with advantage, but for the frequent inroads of the Galla tribes which inhabit the southern banks of the Abái.

The country which extends from the bank of the Zingini to the western boundary of Abyssinia, may be called the *Volcanic Region of Agaumider*. The name of this province is derived from a nation, the Agows, who differ from the other inhabitants of the country. The river Zingini runs in a bed of volcanic rocks, and the adjacent country exhibits unequivocal signs of volcanic origin. The soil is very fertile, being formed by the disintegration of volcanic rocks, which in some places protrude through it. The surface is much broken. Such is the country between the river Zingini and a continuous ridge of high hills which, on the north, is connected with the western and lower continuation of the Talba Waha Mountains at Mount Barf, and thence runs in a south-west direction towards the banks of the Abái. This ridge consists of a mass of volcanic cones or high-pointed domes; the Peak of Fudi, which stands nearly in the middle of them, rises to a considerable elevation above its base. From the west of this elevated mass several lower ridges run off to the westward to the distance of several miles, when they terminate with bluffs in the adjacent plain. This tract has a heavy argillaceous soil, which is cultivated, and by means of irrigation yields abundant crops. In some places the volcanic rocks peep through the soil. The plain, which extends farther westward, is of indifferent quality, and chiefly covered with brushwood, with occasional patches of cultivation. The rivers which originate at the foot of the volcanic ridge run westward and fall into the Durra, an affluent of the Abái, which constitutes the boundary-line between Abyssinia and the country of the Shangallas, a tribe of negroes. Where this volcanic region approaches the Talba Waha Mountains, it is less fertile, though there are some fine plains between the high hills and mountains, which are largely cultivated, and covered with numerous villages: there are other tracts which are only used as pasture-ground, but they are covered with excellent grass, and filled with herds of cattle.

Dr. Beke, who in 1841 and 1842 passed a whole year in these regions, has given an account of the seasons. The rains are more heavy and continual in the peninsula of the Abái than in the Plain of Gondar. It was only during the month of January that no rain fell. In February slight rains only were experienced on ten days, and in March on nine days. In April they were much heavier, and very frequent from the middle of that month. In May rain fell only in the night or in the evening on four days, except the last three days, when every evening a heavy storm with thunder and lightning was experienced. The regular rainy season commenced in June. Rain fell more or less every day, with the exception of five days, and continued through July and August. On the 11th of July the Abái had risen so much as to be no longer passable. The rains continued to be heavy till the 16th of September, and till the end of this month it rained every night and sometimes in the day. Heavy rains were experienced up to the 7th of October, when for the first time none fell. It was stated that the rainy season had commenced sooner and continued longer than usual. Still, notwithstanding this duration of the rain, the rivers had fallen considerably, and in the middle of September the Abái was crossed by the Gallas, who brought cloth and cotton to Baso market. The rain kept falling for several days in October, but in November it rained only on six days, and slightly. In the beginning of December only showers were experienced, but after the middle of that month heavy rains fell on several days.

4. *Shoa*, as a political division, extends only over the south-eastern portion of Abyssinia, from the northern banks of the Hawash, which divides it from the independent Galla tribes, to the Berkona, which falls into the Hawash (near 12° N. lat.), and the Wanchit, an affluent of the Jamma, which joins the Abái; but we shall notice under this head also the countries that lie farther north, and extend to the upper basin of the Takkazie and the central table-land of Woffla, though they are in possession of independent tribes.

The Jamma is the largest tributary which the Abái receives on the table-land of Abyssinia. It drains a great extent of country, which extends to the eastern edge of the table-land, and brings a great volume of water to the Abái. Where it falls into that river its surface is less than 3000 feet above the sea-level. From this place the country rises to the south and to the east until it attains an elevation of between 9000 and 10,000 feet above the sea. On the south the table-land slopes gradually down to the wide plain, which is drained by the Hawásh river. But on the east, at the upper branches of the Jamma, it descends with a steep declivity, similar to that with which the table-land of Tigré terminates towards the Red Sea at the back of the harbour of Massówa and Annesley Bay.

The valley of the Jamma appears to be enclosed on the north as well as on the south by high mountains, which rise from 4000 to 5000 feet above its level. These heights however are only the bluffs with which the table-land of Shoa terminates on both sides. The ascent is steep, but there is usually a wide terrace between two steep acclivities. This terrace on the southern side of the river has a slight slope towards the river, and is generally fertile, and studded with numerous villages which contain a considerable population. The number of rivers which join the Jamma from the south is very great. Though their course towards the interior of the table-land is not rapid, they run with great velocity as they approach its northern edge, and most of them fall precipitously several hundred feet into a ravine, in which they continue to flow to their receptacle. Thus the edge of the table-land is cut by narrow valleys into a great number of comparatively narrow ridges, which give it the appearance of a very mountainous country. This is particularly the case in the western district, towards the junction of the Jamma with the Abái, where the affluents join the principal river at right angles. Towards the eastern edge of the table-land they run nearly parallel to one another, and here the ridges between the valleys are more extensive, at least when compared with the still narrower ravines in which the rivers run. These ridges are generally level at the top, except towards their termination between the two rivers, where they approach their junction, and in these parts they gradually grow lower. Though the soil is chiefly rocky, it is of good quality, and produces pulse, tobacco, cotton, maize, and other grains. There are trees about the numerous villages. There are other tracts which are without villages or trees, but they supply pasture to numerous herds of cattle, except towards the west, where the country is overgrown with jungle; some tracts produce only aloes and stunted acacias. The steep sides of the valleys also are usually clad with jungle. About 15 miles from the banks of the Jamma the table-land takes that form which is expressed by this term. There are a few hills dispersed over it, but in general it stretches away to the water-bed between the Hawash and the Jamma either in a level plain or with an undulating surface. Near the watershed itself or upon it isolated high hills and short ridges again make their appearance, but they do not rise to a great elevation, except the Garra Gorpha ridge and Mount Finfinni. But towards the source of the Hawásh and between it and the mouth of the Jamma the country is more broken. The greater part of the eastern district of the table-land is destitute of trees and bushes. Some tracts are partly cultivated and partly used as pasture-ground, but others are entirely left to the herds and flocks, cultivation being limited to the hills and the higher tracts surrounding their bases. In these parts also many of the rivers are dry for two or three months in the year. The western districts of the table-land, which have a more uneven surface, are well watered, as the rivers flow all the year round. These districts are covered alternately with forests of high trees and by grassy plains without bushes. In approaching the sources of the Hawásh the whole country is almost one forest, the haunt of elephants and buffaloes.

Our information respecting the southern declivity of the table-land of Southern Shoa is very scanty. But it is known that near the watershed between the Jamma and the Hawásh rivers it descends with a gentle slope resembling a slightly inclined plain. It is however not improbable that near the banks of the Hawásh a steep descent may exist, when it is considered that the river at Melka Kuya, where it is traversed by the caravan road from the harbour of Tajurra to Ankóbar is less than 2200 feet above the sea-level, and certainly from 5000 to 6000 feet below the watershed on the table-land. There are a few high hills or mountains dispersed over the slope, among which the most elevated are Mount Enloto, Mount Sekuála, and Mount Ferrer. Considerable tracts are well cultivated and studded with villages, but more detailed information is still wanting, as this part of the table-land has hardly been seen by Europeans. We do not even know if the mountains which extend southward from Ankóbar into the province of Bulga constitute only the edge of the table-land, or are a ridge which on both sides, on the west and east, is bounded by a low country along its base. The course of the rivers favour the first supposition.

The eastern edge of the table-land of Shoa, from the town of Ankóbar northward to a distance of about 50 miles, is well known; it rises with a steep ascent from the low country west of the Hawash river, which is only about 2000 feet above the sea-level, to an elevation of from 8000 to 9000 feet. The whole ascent does not appear to occupy more than eight or ten miles in width; to the west of it the country continues for a considerable distance at the same elevation. The town of Angolalla, which is several miles from the edge, is 8564 feet above the sea-level, and surrounded by a plain intersected by hills and rivulets. The ascent is best known between the Melka Kuya and Ankóbar; the distance in a straight line is about 30 miles. In the first ten miles from the river the country contains several plains of moderate extent, divided from one another by low hills; the level tracts are generally destitute of grass and water, and the higher parts clothed with jungle, in which sheep and goats find pasture. At Atkonti the country begins to rise, but in the next ten miles it hardly attains an elevation of more than 3000 feet above the sea. This tract is thickly wooded, and between the trees the socotrine aloe completely covers the ground. The lower tracts between the hills are cultivated to a small extent. In the last ten miles the country rises to more than 8000 feet above the sea, the town of Ankóbar being 8198 feet above it, or about 700 feet higher than the city of Mexico, which is 7468 feet above the sea; but Ankóbar is on the declivity, and the table-land is 400 feet above it. This steeper part of the ascent is very broken and hilly, consisting of a succession of valleys and steep hills, which are partly wooded and partly cultivated; the soil must be rich considering the vigorous vegetation which it shows. The villages are small, but numerous; they consist of a few houses, which have a circular form, with a conical roof, and are perched on the sides or summits of the hills.

In proceeding northward along the ascent, it preserves the same features, except that from time to time a valley is met with of moderate width, and of superior fertility to the adjacent tracts. There are also extensive tracts which are mere wastes; they are generally more level than the other parts of the ascent, and covered with bushes and herbaceous plants or woods of acacia; in some places there are forests of acacias, kolquols, and euphorbias. Where these level tracts are at a considerable elevation above the country at the base of the descent, they suffer from want of water; and where they are much lower, they are intersected by numerous watercourses and interspersed with swamps. The edge of the table-land is hilly, rising and descending alternately. In the depressions the ground is swampy or springy, and here are the sources of the rivers which descend to the east and west. In many places this edge is much higher than the town of Ankóbar, which is proved by the difference in the degree of cold, and by the vegetation, which near the highest part of the rocky masses consists only of fir, heath, and fern. Some high mountains rise above the ascent, among which Mount Emmamret, a few miles north-north-east of Ankóbar, rises to a considerable elevation, but probably not above the line of trees, which is about 11,000 feet above the sea-level.

It is not known how far this steep ascent of the table-land continues to the north. It certainly extends from Ankóbar to Kok Fara, a distance of about 50 miles, and probably to Antziokia, 35 miles farther, but in the parallel of Lake Haik (10° 25′ N. lat.) it appears that the country lowers on both sides of the watershed with a long and gentle slope. Krapf, who passed over this country, does not speak of any difficulties. It cannot be urged against this supposition, that the watershed lies on the table-land, and that the descent from it is at a considerable distance from it farther to the east; for Krapf expressly states that the climate grew much warmer as he descended from the watershed eastward; but he also says that several lofty isolated mountains were observed on or near the watershed, among which Mount Sako rises above the rest.

The country which lies contiguous to the steep ascent of the table-land (from 9° 30′ to 11° N. lat.) on the west continues for a short distance to preserve the elevation of the edge, and then slopes gently to the west. The surface is generally level, forming plains interspersed with small hills or short low ridges; these plains however rise in elevation as they proceed northward, and as they approach Antziokia their surface is rather hilly than undulating. The most remarkable feature of this *Northern table-land of Shoa* is the deep depressions in which the rivers run; for a distance of several miles from the watershed they run in deepish valleys, but farther on they fall down in cataracts several hundred feet high into deep basins, and below these basins they continue to flow between steep and lofty banks; the descent to them is frequently 500 or even 1000 feet. The valley through which the Kachena, an affluent of the Wanchit, runs, is 3000 feet below the upper edge of its banks and the general level of the country, according to the estimate of Krapf. How far this peculiarity of the river-valleys continues westward is not known, as the whole country to the banks of the Abái river, which is about 80 miles distant from the region just described, has never been visited by any European; but as the country near the banks of the Abái is also several thousand feet above its bed, it is probable that these deep valleys continue through the whole width of the region. These valleys are generally well wooded; but the table-lands between them are destitute of trees and bushes, and are only used as pasture-ground, though they have a deep black soil of great fertility, which is proved by the abundant crops which are obtained from the fields at the base and on the declivities of the small hills, which occur everywhere, and in some places in considerable numbers. The grains and pulse which are principally cultivated are wheat, barley, peas, and hogs' beans. Cotton, maize, and many other plants do not succeed on account of the cold, which proves the great elevation of this part of the table-land. No domestic animals are so well suited to this country as a kind of black sheep, of which there are numerous flocks.

North of 11° N. lat. the table-land, as already observed, slopes down to the east and west. The scanty information which we possess about this country is not sufficient to give us a general idea of its character. It was traversed by Krapf under very unfavourable circumstances. This bold missionary informs us that several high mountains rise on the watershed, but where he crossed it there were two valleys separated at their upper extremities by a ridge of no great elevation. The western valley, called Totola, from a celebrated market-place there, is intersected by the river Gherádo, an affluent of the Bashilo, and on both sides enclosed by a range of hills partly covered with juniper-trees. On these hills there are many hamlets and villages. The valley is wide and well cultivated; the surface is irrigated artificially from the river, and as the elevation above the sea is considerable, the air is cool even in summer. The eastern valley is watered by the Berkona, an affluent of the Hawash; as several hills are dispersed over the adjacent country, it does not form a regular valley; the soil is black, of great fertility, rich in wood and grass for cattle; in many parts it is well cultivated, and as maize and cotton are grown, it is evident that it must be much lower than the country on the other side of the watershed, a fact which is expressly stated by Krapf.

The country west of the watershed on both sides of the river Bashilo, an affluent of the Abái, and extending to the high ranges that surround the sources of the Takkazie, is probably the most elevated portion of the table-land of Abyssinia. It comprehends the ancient province of Amhara, and is now in possession of the independent tribes of the Wollo Gallas. Though there are, according to Krapf, very mountainous regions among the Wollo tribes, the country is in general level; there are some plains of considerable extent on which only a few single hills are found, whilst in other places ridges of hills traverse the country, and some summits rise to a considerable elevation above the base. The rivers run through bottoms which are bounded by steep rocky masses, but it does not appear that their beds are so much depressed below the general level of the country as they are farther south. Some of the plains are complete wildernesses, whilst others make good pastures, and in some places are well cultivated; but only barley is grown. Sheep are most numerous, and especially that kind whose skin is called *lovisa*, which seems to be peculiar to this region. The wool is of a black colour, and about eighteen inches in length. The people take great care of these animals, lest they should get too fat, for then the wool falls off. They are placed on bedsteads and cleaned every day with water, and fed with roasted barley and other food. A skin of good quality is sold for a dollar and upwards, which is a very large sum in that country. These skins are worn by the warriors, and give them a very martial appearance.

The country which lies east of the watershed is in possession of a tribe called Yejjoo or Yechoo, whom Bruce considered to be a tribe of the Galla; but Krapf, who traversed the whole of their country from south to north, says expressly that the Yejjoo are not Gallas nor pagans. They speak the Amharic language, and all of them are either Christians or Mohammedans: their features differ from those of the Gallas, and resemble those of the Abyssinians. Near the southern extremity of their country is Lake Haik, whose circumference may be about 45 miles. Its greatest extent is from east to west. On the south and east it is surrounded by high and steep hills, but on the north and west by a low level country. In the lake is an elevated island, on which a famous monastery is built. Krapf estimated its elevation at 5000 feet above the sea-level, and found the climate very agreeable. The country of the Yejjoo is an immense plain, which inclines towards the east, as the courses of the rivers evidently show; but it becomes higher as it proceeds northward to the central table-land of Woffla. Several offsets from the higher country west of it advance some distance into the plain, and render it hilly in some places. In the southern district the climate is very temperate, and cotton and maize are grown to a great extent; but as we approach the table-land of Woffla a great degree of cold is experienced. Though the soil is in general fertile, with the exception of a few tracts which are covered with sand and have a scanty vegetation, a very large portion is a wilderness overgrown with acacia-trees and bushes, and the cultivated districts are few and far from one another. Water is very abundant, except in the most northern district, which lies contiguous to the table-land of Woffla.

The table-land of Shoa has two rainy seasons. January appears to be the only month in which the weather is always fine and no rain falls. The shorter rainy season commences in the middle of February and lasts till the end of April. In the beginning the rains are slight, but they increase in March and April, when showers occur nearly every day, and heavy rains with thunder and lightning are frequent. In May and the early part of June only a few showers fall, but towards the end of June the longer rainy season sets in, which lasts till the middle of September. In this season it rains every night, and often during the day, and the rains are generally heavy. After the middle of September only occasional showers occur, and a heavy fall of rain is a rare occurrence.

The table-land of Abyssinia is distinguished from all other elevated table-lands by the great depression of the valleys in which the watercourses are. Some of the rivers run for the greater part of their course in valleys many hundred and even thousand feet below the general level of the country: others are not much depressed in the interior of the high plains, but many miles before they reach the lower country they begin to sink deeper; and where they leave it, their level is many hundred feet below the contiguous plains. It is probable, from the formation of the valleys, that the waters themselves have scooped out these deep and narrow depressions. As such a phenomenon is not observed in other table-lands of the globe, we must suppose that the rocks of which the elevated masses are composed are of a softer nature than elsewhere, and that they more easily yield to the force of running waters. These rivers exhibit another remarkable phenomenon in their quick rise and fall. After a heavy fall of rain the Takkazie rises five feet in one hour; and when the rains continue, it rises to 20 feet above its common level. But in one or two days the water has run off, and the river fallen to its common level. A similar phenomenon has been observed in other rivers. Dr. Beke states that after a shower of rain he saw the waters of a small river, the Gáua, come down from the mountains in one large wave, which raised the level of the river at least one foot as it descended. In June, 1842, the Abái suddenly rose three feet, in consequence of a violent storm which had happened the previous night; but the following day it fell again to its level. When travellers come to a large river, and find that it has risen so as to be unfordable, they are not embarrassed by this circumstance: they have only to wait twenty-four hours, or a little longer, when it becomes again fordable. The Abái is passed at two places by bridges, but there are no other bridges in the country.

Productions.—Though Abyssinia is situated between the tropics, its productions rather resemble those of the temperate zone, to which its climate, with the exception of the rainy season, bears a great resemblance, on account of the elevation above the sea-level. This is especially the case with the vegetable products. None of the grains of India are found here, with the exception of the *neug* (Sesamum orientale), a small grain which resembles the *raggy* of the table-land of Dekkan; but it is scarce. The other grains are wheat and barley, the latter grown most extensively, as it is the only corn given to horses and mules: oats are not cultivated, though large tracts in the Plain of Miécha are covered with wild oats. Indian-corn is grown in many places, especially on the lower parts of the table-land, as in the Plain of Gondar and in the country of the Yejjoos; and in some places *durrha* (Holcus sorghum) and *tokussa*, a kind of Eleusine. From this grain two crops are annually obtained as a general rule, especially where the fields can be irrigated. The leguminous vegetables which are most extensively grown are teff (Poa Abyssynica), beans, lupines, lentils, and a kind of vetch, which is eaten. A plant, *nuck* (Polymnia frondosa), is much cultivated for the seed, from which a bad oil is extracted. Garlick, onions, and capsicums are extensively used. Our flax-plant is cultivated in a few places, but another species is grown exclusively for the seed, which, when parched, is eaten by the lower classes. There are some small plantations of coffee, but the produce is not valued, because it is much inferior to that which is imported from Kaffa. Cotton is grown in the lower parts of the country, as in the provinces of Shiri, Waldubba, and Walkkeit, and in the country of the Yejjoos. Excellent grapes grow at the foot of the rocky masses to the east of Lake Zana.

The most useful wild plants are the sycamore; the Rhamnus nabia, whose nuts are edible; and Phytolacca abyssinica, the seed-pods of which are used as soap.

The domestic animals consist of horses, cattle, sheep, goats, mules, and asses. The Sanga oxen are found in the countries south of Antálo, and are remarkable for the great size of their horns, which sometimes are nearly four feet long. There is also the black sheep, from which the skin called lovisa is obtained, and which has been mentioned before. The Abyssinians keep a strong and swift kind of dogs, which are employed in the chace.

Wild animals are very numerous: there are lions, elephants, and buffaloes. Tigers are not found, but several species of leopard, as the common leopard and the black leopard, the skin of which fetches a high price in the country, and is worn by the governors of provinces. There are also lynxes, lion-cats, leopard-cats, and the wild cats. There are also hyenas (Hyæna crocuta), a small species of wolf, a small species of fox on the table-land of Woffla, and the jackal.

The larger quadrupeds are only found in the wildernesses which lie along the northern and southern boundary of the country. Elephants and buffaloes are very numerous; the two-horned rhinoceros is not so common; and giraffes appear only along the northern border. Shields and whips are made of their skin, and the long brush of wiry hair at the end of their tail is used as a fan. In the low country at the base of the table-land of Shoa a wild animal of the ox kind is found, which is called béeza, and has erect horns. It has not yet been described. In the same country there are zebras, quaggas, wild asses, and elephants. There are several species of antelopes, among which the madoqua (Antilope saltana), the smallest of the horned animals, not larger than an English hare, and the Antilope Sömmeringii. Two kinds of boars, the Phascochoerus Aeliani and another species, are common in some of the woods. There are various kinds of quadrumana, as Cynocephalus babuinus, the Cynocephalus hamadryas, and the Colobus guereza, Rüppel. Of smaller animals there are porcupines, rock-rabbits, ground-squirrels, ferrets, polecats, and otters.

Fowls are generally kept. There are several species of eagles, the Gypaëtus barbatus, and also several kinds of vultures. On the high mountains of Semien are Alpine ravens (Pyrrhocorax graculus). Rüppel notices three kinds of parrots, Psittacus Levaillantii, P. Taranta, and P. Meyeri. In Tigré there are herons and hornbills. The Egyptian goose and a species of duck, with several other kinds of water-fowl, frequent the swamps and lakes. Guinea-fowls, red-legged partridges, quails, snipes, larks, and pigeons abound all through the country: among the latter is the Columba Abyssinica, whose beautiful yellow colour shades off into purple. There is also a beautiful species of muscicapa.

Hippopotami are abundant in Lake Zana and the larger rivers, where many are killed annually for their flesh and hides. Crocodiles are probably not found in the waters of Abyssinia. Bees are so common that honey is very abundant, and this prevents the importation of sugar. Locusts frequently lay waste the fields: they are most numerous on the table-land of Tigré: other parts of the country do not seem to suffer much from them.

Abyssinia is poor in minerals. Gold has occasionally been found. The mountains of Lasta are rich in iron-ore, which is worked, and appears to be of good quality. The great salt-plain which lies between the Red Sea and the table-land of Tigré belongs partly to the sovereign of Tigré, and immense quantities of rock-salt are annually taken from it and imported to all parts of the country, as it is not only used for culinary purposes, but also as currency. [Adal, P. C. S.] Large quantities of salt, taken from the salt lake Assal, are annually imported into Shoa, as salt is not found on the table-land. Sulphur is found at several places.

Population and Inhabitants.—Rüppel estimates the area of Abyssinia, exclusive of the countries which form the kingdom of Shoa, at about 270,000 square miles, or more than double the area of the British Islands, and assigns to Tigré half a million, and to Amhára, including the countries belonging to the Wollo Gallas and the Yejjoos, a million of inhabitants. But this estimate is certainly underrated. He had not an opportunity of seeing the best cultivated and most populous part of Tigré, the Plain of Antálo, nor the most densely peopled portion of Amhára, namely, the peninsula which is surrounded by the Abái. Looking at the accounts of Dr. Beke, who traversed the last-named country repeatedly and in almost every direction, one would suppose that this part of Amhára alone must contain at least a million of inhabitants. The countries which at present constitute the kingdom of Shoa have an area of about 12,000 square miles. They are tolerably well peopled, owing to the peaceful state in which they have lived for a century, and may contain a population of about half a million. We think therefore that the whole population of Abyssinia may amount to about three millions, but that it certainly falls short of four millions. The first estimate gives less than ten individuals to a square mile.

Rüppel distinguishes three different races among the inhabitants of Abyssinia. The bulk of the population belong to the Caucasian race, and in features do not differ from the Beduins of Arabia. They have an oval face, a pointed nose, and a well-formed mouth. Their lips are not thicker than those of Europeans, their eyes are lively, their teeth well set, and their black hair is either smooth or slightly curled. They are of a middling stature. They inhabit almost exclusively the northern parts of Amhára, and are also numerous in Tigré and in most of the southern districts of Amhára. The Falashas, or Jews, the Gamant, and Agows belong to this race, notwithstanding the different dialects which they speak. Another race is found mingled with them: it is more closely allied to the inhabitants of the interior of Africa, and is distinguished by a somewhat curved but not pointed nose, thick lips, and lengthened eyes, which are not lively, and by black but curly, almost woolly hair, which is very thick set. They are most numerous in the northern districts of Tigré, especially in Hamazien and the adjacent countries. The third race are the Gallas. Their face is round, their nose straight and short, but not pointed, and divided from the forehead by a depression. Their lips are rather thick, but do not resemble those of the negroes. They have small eyes, which are very lively, but deeply set in the sockets, and their body is rather stout and large. These Gallas constitute the majority of the inhabitants in the southern provinces of Shoa, and the countries west of the Lake Zana and the river Abái; they are also numerous in the armies of the other divisions of the country. There are no negroes in Abyssinia, except the slaves which are brought from the countries of the Shangallas, who inhabit the border countries to the west of the peninsula of the Abái. These negroes are the only blacks in the country. The colour of the other inhabitants varies from the darkest black-brown to the clearest light brown, and does not appear to be peculiar to any of the races.

The Abyssinians have a dead language, the Geez or Ethiopian language. [ETHIOPIAN LANGUAGES, P.C.] The spoken languages are derived from it, and constitute, as it appears, four dialects, namely, the languages of Amhára, Tigré, Shoa, and of the Yejjoos. They are comprehended under the name of Amharic languages, and differ considerably from one another; but the people understand one another and do not need an interpreter. The language of Gondar is considered to be the purest Amharic. The language of the Gallas is radically different, and is spoken by the northern Gallas, who inhabit the elevated region which extends from the river Wanshit, an affluent of the Jamma, on the south, to the Bashilo river and farther on the north, and by the southern Gallas, who live on the highest part of the southern table-land of Shoa and the plains contiguous to the Hawásh river. There are also three other languages spoken in Abyssinia, which however are limited to a small number of people. There are two tribes called Agows. One of them lives near the western border in the province of Agaumider, which has obtained its name from them; and the other at a great distance on the western banks of the Tacazzie, and extends from the mountains of Lasta to the Plain of Tembien. We do not know if there is much difference between the languages spoken by these two tribes, but they differ materially from the Amharic. The languages spoken by the Falasha and by the Gamants, two tribes inhabiting the Semien mountains and the hilly country west of the table-land of Wogghera, are nearly identical; but they differ from the Amharic and Galla languages, according to the statement of Rüppel. He adds to these languages that of the Shangalla Takkazie, who inhabit the wilderness north of Shiré and Waldubba, and who according to his statement are not negroes, but resemble the inhabitants of Hamazien, or the second race noticed above. But the Shangallas, who live along the western border of Agaumider, are true negroes, and speak a different language.

The Abyssinians are Christians, but their tenets differ materially from those of the Roman and Greek churches, so that their religion must be set down as the fourth great section of the Christian community. They are called Coptic Christians, and the head of their church, named Abúna, is ordained and sent out by the archbishop of Alexandria. Respecting their rites and manners see P.C. vol. i. p. 57 and 58. A great number of the Gallas, as well among the Wollo as among the southern tribes as far as they are subject to the king of Shoa, have also embraced Christianity. In every part of Abyssinia there are many Mohammedans. They are numerous among the Yejjoos and Wollo Gallas, and their number is on the increase. The Falashas in the Semien Mountains and the Gamants in the hilly region west of the table-land of Wogghera are a set of Hebrews, who have adopted a few ceremonies of the Christian community. Many Falashas are settled at Gondar, where they inhabit a separate quarter of the town called Falashabad. The Gallas who inhabit the banks of the Hawásh are still heathens, and so are the Shangallas. On the shores of Lake Zana live the Waitos, who are considered heathens, but they conform to most of the rites of the Abyssinian Church, except that they do not observe the frequent fastings, which amount to 192 days in the year, and some other observances of that community.

Political State and Towns.—For more than a century Abyssinia has been in a state bordering on anarchy. An emperor, or as he is called a Negus, is the sovereign of the whole country, but his authority is only nominal, and his revenues consist of an annual pension of three hundred dollars, and of a share of the excise levied on the butter sold in the market of Gondar. The governors of the provinces have usurped his authority in their respective districts and transmitted it to their children. They are almost continually in a state of war with one another, and the stronger expels his neighbour from his possessions and gives them to his relations who are most in favour with him. The governor in possession of the town of Gondar creates the emperor. How rapid the political changes are, appears from the fact, that a few years ago eight persons were alive, each of whom had been emperor, and some for only a few weeks or months. The country and population suffer greatly by these wars, to which is owing the destitute state of the greatest part of the country, but especially those parts of Amhara which lie north of Lake Zana, and are usually the theatre of protracted wars.

Under such circumstances it would be useless to attempt to give any account of the political divisions of the country. What was true three or four years ago, is probably not true now. It will also be conceived, that there is hardly a place which deserves to be called a town in our signification of the word. The manufacturing industry is too small to collect a number of individuals in one place, and each usurper chooses a new place for his residence, according to his political views or his caprice. When a place has for some years been the residence of a chief, it acquires importance, but its ruin begins with his death. Thus the town of Antálo in Tigré, under the wise and energetic government of Ras Welled Selassé, had so much improved, that when Salt was in the country (1810) it had a population of 8000 inhabitants, but since his death (1816) it has fallen to decay; even Adowa, though a commercial place, is going to ruin. The town of Gondar alone still retains some importance, though it has greatly declined from its condition when the emperors had not yet lost their authority. The most important town in the Peninsula of the Abái is Burie, the capital of Damot, but as the governor of the province has lately transferred his residence to Gúdera, it will probably soon share the fate of the other towns. The towns of Yaush and Yejubbi, also in the Peninsula of the Abái, appear to be considerable places. They are inhabited by merchants, who have acquired some wealth by their business in the neighbouring market-place of Báso.

The kingdom of Shoa forms an exception. Though this state is of modern date, its internal organization appears to have acquired a considerable degree of stability. It has also acquired a power which renders it superior to all the neighbouring chiefs, and enables it to keep them in check. The authority of the king of Shoa extends over the country north of the Hawásh from its source to its junction with the river Kassam (40° E. long.). From the last-mentioned place the eastern boundary of Shoa appears to run northward from 10 to 15 miles from the ascent of the table-land, until it reaches the river Berkona, an affluent of the Hawásh. The Berkona runs along the northern boundary on the east of the table-land. On the table-land itself the boundary is formed by the river Waiat, an affluent of the Wanshit, by the last-mentioned river and its recipient the Jamma. The western border runs along a line drawn from the point where the Jamma falls into the Abái to the source of the Hawásh. Among the Galla tribes who inhabit the plains along the banks of the Hawásh, and those who reside along the western boundary-line, the authority of the king of Shoa has not yet been firmly established, but the other parts of the country are completely subjected to his sway.

The capital of Shoa is Ankóbar. It is situated on the ascent of the table-land, not far from its upper edge, and 8198 feet above the sea-level. This town is built on two wooded hills, of which the higher and northern one is hedged in with long poles connected by branches of trees, like palisadoes, and on the summit is the king's residence, built of stone, with a thatched roof and numerous outbuildings. The southern hill is clustered with houses, chiefly of wood with thatched roofs, and they are generally surrounded by a garden, and disposed round the cone in a spiral form. The population may amount to between 8000 and 10,000, exclusive of the king's household, which consists of more than 1000 persons. The climate of this place is compared with a fine spring or autumn in England; the thermometer during August and September never rises above 63° nor falls below 46°.

Manufactures.—When it is considered that the elevated table-land of Abyssinia is very difficult of access from the sea-side, and that therefore the intercourse between its inhabitants and foreigners cannot be very great, we must admit that they have made considerable progress in manufactures. They do not indeed excel in the fabrication of any article, as they have had no instruction from other nations, to which circumstance the manufactures of Europe in a great part owe their perfection. The best article is tanned skins, which are used for bedding or for tents, an important article on account of the numerous caravans. Shields made of the hides of elephants or rhinoceroses are also good. The iron articles come next. Axes and ploughshares as well as spear-heads are made at several places, but knives, sword-blades, scissors, and razors are only made at Gondar and at Kiratza, a town situated on the eastern shore of Lake Zana, which contains 5000 inhabitants, and is under the authority of the clergy, which circumstance protects it effectually against the evils of war. At Gondar there are guns made, but only by some Greeks, not by the natives. Large quantities of coarse cotton-cloth are made in several parts of the country by women, especially by the Falashas, and a finer kind with a red or blue border for the more wealthy classes of society. The silk manufactures are limited to some embroidery, made by Mohammedans and worn by their women, and to blue strings, which are worn on the neck by all Christians, as a mark of distinction from Mohammedans or heathens. Only a coarse stuff is made from the wool and hair of the black sheep and goats, which is also employed in making a kind of counterpanes. Coarse black pottery is made in every part of the country. Printing has not yet been introduced into Abyssinia, and the copying of manuscripts forms a distinct branch of manufacturing industry. Rüppel states that they have brought it to considerable perfection. Their handwriting is very fine. They use a kind of cane as a pen, and always copy on parchment. These manuscripts are embellished with pictures, which at present are indifferent; but Rüppel saw some which were made eighty years ago, which were much superior. He praises also the tasteful manner in which the binding of these manuscripts is executed.

Commerce.—As Abyssinia does not border on the sea, but is separated from it by the countries of the Danakil or Adál, it has no immediate intercourse with sea-faring nations, but its products are carried either to Massówa (15° 40′ N. lat.) on the Red Sea or to Tajurrah (11° 50′ N. lat.) built on an inlet of the Gulf of Aden. Massówa is about forty miles from the eastern boundary of Abyssinia, and through this place the maritime commerce between Tigré and Amhára and other nations is carried on. It is accordingly the harbour of these two great divisions of the country. Tajurrah is more than 200 miles from the nearest boundary-line of Shoa, and 372 miles from Ankóbar, by the caravan road. The kingdom of Shoa exports its productions through this harbour.

Lord Valentia and Rüppel have given some account of the trade of Massówa. Rüppel stayed there nearly eight months, and got the following information about the exports :—

Articles.	Value Aust. dol.		£
2000 slaves of both sexes . .	120,000	or	24,000
150 horns of musk or civet, at 30 ounces, at 2 dollars per ounce	9,000	or	1,800
300 pieces elephants' teeth of different sizes, at 20 dollars each	6,000	or	1,200
700 hundredweight of wax, at 20 dol.	8,000	or	1,600
100 hundredweights of coffee from Enarea and Kaffa, at 10 dol.	1,000	or	200
Tanned leather and skins, amounting to . . .	1,600	or	300
2000 hundredweight of butter, at 8 dol.	16,000	or	3,200
Honey, wheat and other kinds of grain	6,000	or	1,200
Gold, about 2000 ounces, at 20 dol.	40,000	or	8,000
Khéle, a spice which grows only in Enarea, and which goes in considerable quantities to India	1,000	or	200
	dol. 208,500	or	£41,700

All articles imported into Massówa go to Abyssinia, with the exception of a large quantity of rice from India, dhurra (Holcus sorghum) from Yemen, and dates from Basra, which are consumed in the town. The articles sent to Abyssinia are raw cotton and pepper, blue and red cotton-cloth, the threads of which are unravelled and woven into the borders of the cloths of native manufacture, raw silk dyed blue, white cambrics, and a small quantity of glazed silks and some common velvet. These articles are imported from India by the way of Mocha. Articles from Egypt are imported by way of Jedda. These are glass pearls, linen shirts, common red cloth, some articles of glass, common razors, sword-blades, spica celtica, small parcels of red or green marocco leather, zinc, and common Turkish carpets. From Basra are imported bottles of a peculiar shape, of which large numbers are used in Abyssinia, and a large quantity of Persian tobacco.

The bulk of the goods imported into Abyssinia is probably consumed there, but some of them find their way into the interior of Africa to supply countries and nations with whose names we are hardly acquainted. They are exchanged for the produce of these countries at Báso, a market-place (not a town) situated in Gojam, 15 or 18 miles from the most southern bend of the Abái river and a few miles from the towns of Yejubbi and Yaush, where many merchants reside. Dr. Beke has given some account of this trade. The market is held weekly during the season, which lasts about eight months, for during the other four months the river cannot be forded. The merchants bring from the southern countries slaves, ivory, coffee, civet, gold, cloth, iron, and cattle. While Dr. Beke was there the number of slaves imported amounted to 160 individuals of both sexes, and he estimates the weekly average at 200, which gives 7000 slaves as the yearly import. They are mostly children, male and female, from the Galla countries, and other countries south of them, as Kaffa, Enárea, and Jánjero. Many of them are Christians, others are Mohammedans, but the greater portion are pagan Gallas. Their colour is generally lighter than that of the Abyssinians and some are not darker than the natives of Southern Europe. A smaller portion consists of Shangallas, or negroes from the low country to the south-west. The number of loads of ivory which was imported when Dr. Beke was there amounted to 75: a load consisted in some cases of one, most frequently of two, and sometimes of three, four, and even more tusks. The quantity however was stated to exceed the weekly average, whilst the number of slaves was universally admitted to fall much below it. The ivory comes principally from Enárea, and the gold, civet, and coffee, from Enárea and Kaffa; the other articles come from the Galla countries. Dr. Beke does not mention the spice called *khéle*, which Rüppel enumerates among the articles of export from Massówa: Rüppel states that it is imported from Enárea.

On comparing the imports from these southern countries with the export trade of Massówa, it is evident that most of the exported articles and also most of the imported are not of Abyssinian growth, and that this country produces very few articles for foreign commerce. Nearly all the merchants of the country are engaged in this transit trade. The unsettled state of the country obliges them to travel in cafilahs, and they always keep to the same routes. Gondar may be considered as the centre of this commerce, and with the exception of the clergy and slaves almost all its inhabitants are engaged in this trade. Two caravan-roads lead from Gondar to Massówa. One traverses the table-land of Wogghera, and the pass of Lamalmon crosses the Takkazie in Shiré, and continues through Axum and Adowa to the descent of the table-land. The other, having traversed Wogghera, turns eastward and passes over the Semien mountains by the Selki pass. It crosses the Takkazie at Ber Ágow, and continues to Adowa, where it falls into the road before mentioned. Two caravan-roads lead from Gondar to Báso. The most western runs along the eastern shores of Lake Zana, crosses the Abái at the bridge which is below the cataract of Aláta, traverses the plain of Miecha and the western portion of the Talba Waha range, passes through Dembecha in Damot, and thence continues to Báso. The other lies more to the east, goes through the commercial town of Dérita, which has not yet been visited by Europeans, and the market-place of Bada, whence it continues over the Broken Bridge on the Abái to Móta and thence to Báso. There are several other caravan roads by which the interior commerce is carried on. There are a certain number of Austrian dollars circulating in Abyssinia. Rüppel thinks that they do not amount to a hundred thousand. The common currency consists of pieces of rock-salt in the shape of a whetstone, and weighing between 19 and 20 ounces. They are taken from the great salt plain, which properly lies in Adál, but partly belongs to Tigré [ADAL, P. C. S.], and are carried by the merchants of Antálo to Sócota in Waag, whence they find their way to the southern provinces of Abyssinia. These pieces of rock-salt are called *amole*.

History.—There is a tradition in Abyssinia, generally credited, that the original inhabitants of that country, many centuries before the Christian æra, were converted to the Jewish faith, and that the founder of the first dynasty of their kings was Menilek, a son of Solomon and a queen of Saba. The Abyssinians were converted to Christianity in the time of the Emperor Constantine by some missionaries sent from Alexandria. At that time the town of Axum was the seat of the empire, and most of the antiquities which still exist at that place must be ascribed to that period. The power of the emperors seems then to have been well established, and they got possession of the low country which divides the table-land from the Red Sea, and at present forms the country of Adál. In the sixth century they had so increased their power that they were able to send an army to Arabia and to conquer a part of Yemen. This was the period of the greatest political power of Abyssinia. Seventy years afterwards the Abyssinians were deprived of Yemen, probably by the Arabs, whom Mohammed had inspired with the zeal of propagating his doctrines, and with the spirit of conquering all neighbouring nations. The Arabs soon attacked Abyssinia itself, and though they did not succeed in conquering it, they took possession of Adál, and converted its inhabitants to the Islam. It appears that after this time great disorder crept into the internal affairs of the empire, for in the year 925 a Jewess, called Sague, overthrew the reigning dynasty and destroyed Axum. The descendants of the royal family fled to Shoa. For more than three hundred years the country appears to have remained in a distracted state, until the Emperor Iqon Amlaq recovered the whole kingdom, about 1255, aided by the abilities of an ecclesiastic named Tecla Haimanot. In the following three centuries the country appears to have remained in an improving state, and even to have acquired a part of its former power, as in the thirteenth century it is said to have again got possession of the southern part of Adál, which however it lost soon afterwards. Towards the end of the fifteenth century Pedro Covilhão, an agent of the court of Lisbon, visited the country, and this circumstance saved the empire from destruction; for in the beginning of the fifteenth century Granie, or Gragne, a sultan of Hurrur, or Adál, had, like Gengis Khan, succeeded in gathering under his banners the nomadic tribes of Danákil and the Gallas, and made frequent incursions into Abyssinia. The emperor sent an ambassador to Lisbon to get aid from the king of Portugal, at the same time promising unqualified submission to the pope. Four hundred soldiers, a considerable supply of arms, and some ecclesiastics were sent off, and they arrived in time. In 1540 Granie was defeated, by the assistance of the Portuguese soldiers, in the Plain of Dembea, and lost his life. The empire was saved, but the southern provinces were lost. By these events the seat of the emperor was transferred from Shoa to Gondar. The mission of the Portuguese ecclesiastics however appears to have laid the foundation of that unsettled state of the country into which Abyssinia fell soon afterwards, and in which it has continued to the present time. The Roman Catholic priests were men of education, of knowledge, and character, and soon got into favour with the emperor and his family, who were inclined to renounce the tenets and rites of the Coptic Church, and to adopt those of Rome; but the people and the ecclesiastics opposed this innovation. For some time the matter was managed with prudence, but the ill-timed zeal of some Roman Catholic missionaries brought about a crisis: the people rose in rebellion against the emperor, and continued to resist for many years. After a long struggle between the sovereign and his subjects, the emperor was obliged to give way, and the Roman Catholic priests were expelled in 1632. During this period of anarchy the governors of the provinces made themselves independent, and thus arose the unsettled state of the country which we have already noticed.

It has been stated that after the defeat and the death of Granie, the southern provinces were not recovered; but it appears that the Abyssinian Christians maintained a footing in the elevated regions that border on the steep ascent from the table-land, and that these chiefs considered themselves dependent on the emperors. One of them however, called Nágasi, claimed an independent authority, and became the founder of the kingdom of Shoa. Travellers who have lately visited that country have not yet had time to acquaint us with the history of its dynasty. Krapf however states that the present sovereign is the seventh king from Nagási. It would therefore appear that Nagási lived at the end of the seventeenth or the beginning of the eighteenth century. His successors began to enlarge their territories; and the second of them, Abiye, took Ankóbar from the Gallas. In one century or a little more they have extended their authority over a country covering at least 12,000 square miles; and the order which they have introduced into the administration and the army seems to promise them a rapid and certain success in their wars with the neighbouring Galla tribes.

(Bruce, *Travels to discover the Source of the Nile*; Lord Valentia, *Voyages and Travels to India, Ceylon, the Red Sea, Abyssinia, and Egypt*; Salt, *Voyage to Abyssinia and Travels into the interior of that country*; Pearce, *Life and Adventures*, by Hall; Gobat, *Journal of a Three Years' Residence in Abyssinia*; Rüppel, *Reise in Abyssinien*; Isenberg and Krapf, *Journals*, detailing their proceedings in the kingdom of Shoa, &c.; Kirk, *Report on the Route from Tajurra to Ankóbar*, in the 'London Geographical Journal,' vol. xii.; Beke, *Communications respecting the Geography of Southern Abyssinia*, and his *Route from Ankóbar to Dérná*, in 'London Geographical Journal,' vol. xii.; Beke, *Continuation of Routes in Abyssinia*, in 'London Geographical Journal,' vol. xiv.)

ACANTHODE'RMA, a fossil genus of fishes from Glaris. (Agassiz.)

ACANTHO'DES, a genus of fossil Ganoid fishes, established by M. Agassiz. The species occur in the carboniferous strata near Edinburgh. (Agassiz.)

A'CANUS, a fossil genus of fishes, from Glaris. (Agassiz.)

ACCELERATION AND RETARDATION OF TIDES are certain deviations of the times of consecutive high-water at any place from those which would be observed if the tides occurred after the lapse of a mean interval. The interval between the culmination of the moon, or the occurrence of her principal phases, and the nearest time of high-water, is also called the retardation of the tide.

The tides are caused by the attractions exercised both by the sun and moon on the waters of the earth; but the effect produced by the moon exceeds that which is produced by the sun, and the difference is such, that the phenomena of the tides depend principally on the former. The mean interval between two consecutive returns of the moon, above and below the pole, to the meridian of any place, is 24h. 50m. 28·32s.; and since, neglecting all causes of irregularity, two lunar high-tides occur in that time, the mean interval between two consecutive lunar tides should be 12h. 25m. 14·16s.; while the mean interval between two consecutive solar tides should be 12h. Hence, if at the time of a conjunction or opposition of the sun and moon, the high tides which are produced by the actions of the luminaries separately were coincident, the next lunar tide would be retarded with respect to the next solar tide, by 25m. 14·16s., that is, by the excess of half a lunar day above half a solar day. These retardations continuing daily, the lunar high-water would coincide, at the time of quadrature, with the solar low-water, and thus produce the neap or diminished tides; after which, the like retardation continuing, the solar and lunar high-waters would again become coincident at the times of syzygy, and so on. The observed daily retardation of the lunar high-tides varies however according to the position of the moon with respect to the sun, to the moon's declination, and to the distance of that luminary from the earth. At Brest, when the sun and moon are in conjunction or in opposition, at the summer or winter solstice, the retardation is equal to 40m. 51·69s., and at the time of the equinoxes 37m. 38·15s. Again, when the sun and moon are in quadrature at either solstice, the retardation is 1h. 7m. 27·49s., and at the time of the equinoxes 1h. 23m. 16·34s.

If the earth were a solid of revolution, and were covered by the sea, the high-tides produced by the sun and moon separately would, at any place, occur at the instants when those celestial bodies are on the meridian of the place; but such is not the fact in the actual condition of the earth; and local circumstances produce, at different ports, great differences in the intervals between the culmination of the sun or moon and the time of high-water, even on the days when the luminaries are in conjunction or opposition. The interval between the instant that the sun passes the meridian of a place and the occurrence of the solar high-tide, is found to be greater than the interval between the transit of the moon and the occurrence of the lunar high-tide; and this acceleration, as it is called, of the lunar tide, is with much probability ascribed by Dr. Young to a difference in the resistances experienced by the waters on account of the different velocities which are communicated to them by the separate actions of the sun and moon.

It should be observed however that at Ipswich the time of high-water is nearly coincident with the time at which the moon passes the meridian of that port; and both at Glasgow and Greenock the high-tide generally precedes the transit (Mr. Mackie's *Report*, at the seventh meeting of the British Association); but such phenomena are of rare occurrence, and at almost every place the high-tide occurs some time after the moon has culminated.

From a series of observations continued during sixteen years, at Brest, La Place, taking the excesses of the height of the evening tide above that of the morning for the day of syzygy, for the day preceding it, and for four days following it, has ascertained that at the syzygies which occur about the vernal and autumnal equinox the highest tides at that port take place 1·48013 days after the instant of the conjunction or opposition; and at the syzygies which occur about the summer and winter solstices they take place 1·54684 days after conjunction or opposition. Again, taking the excesses of the height of the morning tide above that of the evening for six days, as above, he ascertained that at the quadratures which occur about the equinoxes the highest tides take place 1·50964 days after the instant of quadrature, and at the solsticial quadratures 1·51269 days after such instant.

Mr. Airy ('Tides and Waves,' *Encycl. Metrop.*) observes that these retardations cannot be accounted for by delays in the transmission of the tide-waves, since no cause for such delay can be imagined to exist in the Southern Ocean, where the waves are formed; and it is known that the time of high-water at Brest is only fifteen hours later than at the Cape of Good Hope: he conceives therefore that the retardation must be ascribed to friction. By taking the means of the daily retardations of the morning and evening tides at Brest, La Place found that at the equinoctial syzygies such mean retardation was equal to 37m. 38s.; at the solsticial syzygies, 40m. 52s.; at the equinoctial quadratures, 83m. 16s.; and at the solsticial quadratures, 67m. 27s.

From a series of observed heights of the tides, Sir John Lubbock has determined that the highest tides occur at London 2·018 days after the conjunction or opposition of the sun and moon; and at Liverpool, 1·68 days. (*Phil. Trans.* 1831, 1835.) Also, from the observed heights, Dr. Whewell has found that the highest tides occur at Bristol 1·667 days after the syzygies; and at Dundee 1·639 days. (*Phil. Trans.* 1838, 1839.) On the supposition that the mean retardation of the tide at London at the times of syzygy is 2·459 days, Mr. Airy has computed the moon's true hour angle west of the meridian, at the time of high-water, for every half hour's difference in the time of her transit; and from the table it appears, that when the moon passes the meridian of London at noon (that is, at the time of conjunction), that angle, in time, is 1h. 57m. 17s.; when it passes at 3 P.M., the angle is 1h. 10m. 45s.; at 6 P.M., or at quadrature, 0h. 41m. 17s.; and at 9 P.M., 1h. 55m. 29s. The hour angle is the greatest at 10½ P.M., when it is equal to 2h. 9m. 55s.; and at 11½ P.M., or nearly at the time of opposition, it is 2h. 3m. 9s.: all these times are found to agree very nearly with the results of observation. From such results it is ascertained that, on the days following the times of syzygy and quadrature, the intervals between the time of the moon's transit and the instant of high-water are nearly equal; but from conjunction to the first quarter, and from opposition to the third quarter, the intervals are less than on the days of syzygy and quadrature, or the time of high-water is accelerated; while from the time of the first quarter to that of full moon, and from the third quarter to the new moon, the interval is greater, or the time of high-water is retarded. The time first mentioned (1h. 57m. 17s.) is that which is called the Establishment, at London; but Dr. Whewell recommends that the mean of the times (1h. 25m. 35s.), which he calls the mean, or correct, establishment, should be used in preference, because it differs less, on any day, from the vulgar establishment.

From Dr. Whewell's paper in the 'Philosophical Transactions' for 1836, we find that at Liverpool, when the moon passes the meridian at 30m. P.M., her hour angle at the time of high-water is 11h. 18m. 16s.; when the hour of transit is 6½ P.M., the hour angle is 10h. 40m. 52s.; and when it is 11½ P.M., the angle is 11h. 33m. 36s. The mean, or correct establishment, at that port, is 11h. 6m.

The acceleration and retardation of the times of high-water must evidently depend on the distance of the moon from the earth, and they are presumed to be proportional to the difference between the actual and the mean horizontal parallax of the luminary: this is called the parallax inequality of the tides; and La Place has determined, for the lunar tides, that the ratio of the daily variations, when the moon is in apogeum and in perigeum, is nearly as 2227 to 2899. He estimates the variation at 9m. 26·4s. for a change equal to one minute in the moon's apparent semidiameter at the times of conjunction and opposition, and at one-third of that quantity at the times of quadrature. Corresponding variations, but less in amount, take place with respect to the solar tides.

ACCIDENTAL COLOUR is a name given to that which an object appears to have when seen by an eye which, at the time, is strongly affected by some particular colour.

The colour observed in a natural body, when the eye is in the ordinary state, depending on the figure or disposition of the particles of the body, by which they transmit to the eye in the greatest abundance those rays which give rise to the perception of that colour; it follows that such colour is the most vivid when the object is beheld by rays of that one only of the three, or seven, primary or homogeneous colours: and since the rays which actually arrive at the eye from any object are blended with those which proceed from surrounding objects, it follows that almost every tint observed in ordinary circumstances is, in a certain degree, an accidental colour.

Particular cases in which remarkable accidental colours were formed appear to have been long since observed; and there is a passage in one of the chapters of the 'Tratato della Pittura' by Da Vinci, in which, as a reason why, on a white wall, the shadows produced by the setting sun appear to be blue, it is stated that the reflexion of the azure tint of the sky becomes sensible in the shadow because the part of the wall on which it falls does not receive the red light of the luminary. The variations produced by causing the colours observed in the shadows of small objects to fall upon one another were noticed by Maraldi; and Dr. Jurin (Treatise on distinct and indistinct vision, in Smith's *Optics*) described the apparent images produced by looking intently, for a time, at a black object on a white ground and at a white object on a black ground. But Buffon was the first who made a series of observations to ascertain the colour of the image of which the mind acquires a perception when the eye has been for some time directed to an object of some particular colour; and it is he who gave the name of accidental colours to those which are so perceived.

In a 'Mémoire' presented to the Académie des Sciences in 1743 he gives an account of his observations, the substance of which is, that when the eye had been, for a certain time, directed steadily to a square spot of one of the following colours, red, yellow, green, blue, and black, the object being placed on a white ground, there was seen about the spot a fringe or border of one of the colours in the following series: green, blue, pale purple, pale red, and white, each of which, in order, is the accidental colour of the corresponding colour in the former series. Immediately afterwards, on directing the eye to a different part of the white ground, there appeared upon it a square spot of the same accidental colour, the white spot being considerably brighter than the ground.

The subject of accidental colours was pursued by the Jesuit Scherffer ('Institutionum Opticarum partes quatuor,' 1775), and he recommended that, except when the object viewed was black, that object should be placed on a black ground: in order that, with less fatigue to the eye, the accidental colours might be more vivid when the eye was directed to the white ground on which they were to be perceived. Scherffer made observations with coloured spots on grounds of different colours, from which he ascertained, at the same time, the accidental colours of the spot and of the ground; for example, on contemplating a red square placed on yellow paper, and then turning the eye to white paper, he found that the latter was of a blue colour, and that on it appeared a square coloured green.

Buffon, continuing to look at one of the coloured spots during a longer time than was necessary to produce the border above mentioned, observed that the colour of the spot itself became less vivid, that the spot subsequently took the form of a cross, and, finally, that of a narrow rectangle: these appearances, which have been ascribed to the unsteadiness of the eye, have not since been observed. A border of accidental colour is constantly observed about an object when it has been for a time viewed intently; and in order that, by rendering it insensible, a coloured object may be seen as distinctly as possible, it has been recommended that it be painted or formed on a ground whose natural colour is similar to that of the accidental colour peculiar to the object.

In the 'Novi Commentarii Petrop.' tom. x., M. Æpinus has described the perceptions which resulted from looking at the sun when behind thin clouds near the horizon; from which it appears that the impressions directly excited by the rays of the sun change, after a short time, into those which give rise to the perception of yellow, and afterwards, successively, into such as produce green and blue. On ceasing to look at the sun, and shutting his eyes, there appeared a spot irregularly round, with a red margin, and the interior of which was a pale yellow. Afterwards, on opening his eyes and looking at a white wall, a spot of the like form appeared on the latter, but the interior was red or brown, and the border a sky-blue. On again closing his eyes, the appearances were the same as those first observed; and on opening them a second time, the form of the spot was still the same, but its colour was green. Continuing thus to shut and open his eyes, alternately, the colour of the spot was found to change successively to reddish-green, bluish-green, and blue. It is remarked that these changes in the accidental colours are similar to those which take place in natural colours, when blue, in increasing quantities, is mixed with yellow; the result being first green and at length blue; and the same may be inferred from a curious experiment of Scherffer. That philosopher placed close together, on black paper, two square spots, of which that on the left hand was yellow, and the other a bright red: having turned his eyes, without moving his head, from one to the other alternately several times, he looked directly at a white wall; when there appeared upon it three squares close together, of which that on the left was of a violet colour, that in the centre was a mixture of green and blue, and that on the right a bright green. The apparent colour of the middle square is accounted for by the union, on the same part of the retina, of the accidental colours of the yellow and red, of which the former is violet and the latter green.

There is a paper on accidental colours, by Dr. Darwin, in the 'Philosophical Transactions' for 1786.

The explanation given by Hassenfratz of accidental colours, in general, is that the eye being directed to a coloured spot, the part of the retina on which the image of the spot is formed becomes thereby weakened, so as to be in a great measure insensible to the action of rays of that particular colour; and thus, on the eye being afterwards directed to a white ground, it receives sensible impressions only from the rays of the remaining colours in the pencils of white light. There is consequently apprehended an image similar in form to the spot on which the eye was first directed, but of a magnitude depending on the distance of the eye from the ground on which it appears, and of a colour which is complementary to that of the spot itself. [COLOURS, COMPLEMENTARY, P. C. S.]

ACCOMPLICE. [APPROVER, P. C.]

ACCORDION, a musical instrument of the pneumatic class, which came into England, from Germany, about the year 1828.

The Accordion is in the form of a small box, varying from eight to fifteen inches in length, four in width, and, when closed, five in depth. The interior exhibits a row of very small elastic metallic laminæ, or springs, fixed at one end in a plate of metal, so that they may vibrate freely. The upper and lower parts of the box, or machine, are united by a folding apparatus, or bellows, which supplies the air required to put the springs into vibration, and to these the air is admitted by means of valves acted on by keys, in the manner of an organ. There is also a very simple contrivance by which a base note, or drone, may be added, at the discretion of the performer. These beautiful instruments vary in size and in capabilities: the compass of the most complete is from G the fourth space in the base staff, to E the seventh additional space above the treble, including all the semitones. Hence the Accordion is not limited to melody, but can produce the most agreeable harmonic effects.

The principle on which the Accordion, and all other instruments of the kind, is founded, is fully explained by Dr. Gottfried Weber, in his *Leges Oscillationis*, &c. published in 1827, who refers as his source of information to an article by Strohmann, in the *Allgemeine Musicalische Zeitung* of 1813. This principle however had been fully set forth many years before by Professor Robison, in the 'Encyclopædia Britannica,' under the term 'Musical Trumpet.' But Europe undoubtedly is indebted for the instrument to a people with whom originated—so far at least as we can trace—some of the most important inventions enjoyed by mankind. The distinguished French missionary to China, the Père Amiot, describes the *Cheng*, a small instrument consisting of laminæ, or springs, fixed in tubes, and acted on by the breath of the performer, which is in common use with the people of that extraordinary country. An engraving of it is given in the *Essai sur la Musique* of M. De Laborde, tome i. p. 129, and is a faithful representation of this curious sweet-toned instrument.

ACCOUNT STATED. This is the title of the common count in an action at law for the amount due upon a balanced account between the parties, the form of which is that the defendant was indebted to the plaintiff in a certain sum of money found to be due from the defendant to the plaintiff upon an account then stated between them, and in consideration thereof promised payment. This form should always be introduced in an action upon a simple contract for the recovery of a pecuniary demand.

It is not essential in support of this count that there should be reciprocal demands between the parties, or that the account should relate to more than a single debt or transaction. The original demand need not have been one recoverable at law. It may have been equitable, as in the case of a claim against an executor to recover a legacy to which he has assented, or in that of a member of a copartnership, who, though he cannot in general sue his copartner at law for his share of the profits, may do so after an account has been stated between them and a balance struck in his favour. It is necessary however that there should have existed some claim against the defendant, or some previous transactions in respect of which the account is stated, for an action cannot be brought in this form upon a mere agreement to pay a sum of money. It is usual in support of this count to give evidence of an original demand or a prior transaction, and of a balance struck and agreed upon, but it is sufficient in the first instance to prove an admission by the defendant to the plaintiff or his agent, that a certain sum was then due, without showing the origin or nature of the claim, or proving the specific items constituting the account. The account must have been stated before the action is brought. The admission, in order to charge a defendant upon an account stated, must be positive, unqualified, and unconditional, and must not be merely the admission of a debt, but either expressly or by reference the admission of a specific sum being due. If the plaintiff sues in a representative character, as in that of executor or assignee, he must show that the admission was made to him in that character. The statement of an account is it seems only presumptive evidence against the party who admits the balance to be against him, and does not preclude him from showing by clear evidence the existence of error in the account; unless in the case of an account actually settled by payment, which cannot be opened except upon proof of fraud. (Chitty *On Contracts*, 648, et seq., 3rd ed.)

In order to support this plea the statement of the account must be shown to have been final, and to have been in writing; but it is not essential that it should have been signed by the parties, and it will be sufficient if the account has been delivered and acquiesced in for such a length of time as to afford legal presumption of a settlement. A general release not under seal may be pleaded as a stated account. A plea of this kind must aver that the account is just and fair, whether error or fraud is charged by the bill or not.

In answer to a plea of a stated account the plaintiff may show either the existence of fraud, which will be a sufficient ground for opening the whole account, or that the account contains specific errors, which will enable him to surcharge, *i. e.* to show omissions for which there ought to be credit, and falsify, *i. e.* to show that there are wrong charges which ought to be deducted. (Daniel's *Practice in Chancery*, vol. ii. p. 186 et seq.)

ACCOUNTANT, a person who professes skill in mercantile accounts. In a commercial community occasions are constantly arising for the employment of accountants. They are generally appointed to examine the books of traders who have been compelled by embarrassment in their affairs to summon a meeting of their creditors; or they may be called in by a trader to investigate his accounts and to ascertain the state of his affairs. The collection of debts or rents, and the winding-up of affairs of persons deceased, or who have given up business, are matters often put into their hands. Appraisers and auctioneers frequently act as accountants. An accountant has no legal status, like a notary or an auctioneer or appraiser, who perform certain duties which none but they are allowed to discharge; but in the Bankrupt Act (5 & 6 Vict. c. 122) official assignees must be selected from persons in trade, or who are or have been 'merchants, brokers, or accountants.' The number of persons returned as accountants in the Occupation Census of 1841 was 4974 for Great Britain; of whom 4260 were returned in England, the number in London being 1108.

ACCOUNTANT-GENERAL, an officer of the Court of Chancery, first appointed under an act (12 Geo. I. c. 32) 'for securing the moneys and effects of the suitors.' The act recites that ill consequence and great prejudice already had and might again ensue to the suitors by having their moneys left in the sole power of the Masters of the Court. The bonds, tallies, orders and effects of suitors were, it appears, until the passing of this act, locked up in several chests in the Bank of England, under the direction of the Masters and two of the Six Clerks. The act confirms a previous order of the Court of Chancery for adopting a different system; and § 3 enacts that 'to the end the account between the suitors of the High Court of Chancery and the Bank of England may be the more regularly and plainly kept, and the state of such account may be at all times seen and known,' there shall be 'one person appointed by the High Court of Chancery to act, perform, and do all such matters and things relating to the delivering of the suitors' money and effects into the Bank, and taking them out of the Bank, &c., which was formerly done by the Masters and Usher of the Court.' The Accountant-General is 'not to meddle with the suitors' money, but only to keep an account with the Bank.' He attends several times a-week at the Bank and other places for the purpose of making sales, transfers, and acceptances of stock, according to the orders of the Court. The Bank receives moneys under a power of attorney from the Accountant-General. No one has yet been appointed to the office without being a Master in Chancery. The Accountant-General attends the public office in his turn as Master in Ordinary. The present Accountant-General, who was appointed in April, 1839, is the thirteenth who has filled the situation since the first appointment in 1726. The salary is 900*l.* a-year (650*l.* under 12 Geo. II. c. 24, and 250*l.* under 9 Geo. III. c. 19), and there is an allowance for stationery and other articles of 250*l.* under 46 Geo. III. c. 129, and 55 Geo. III. c. 64. His income is further increased by his salary as one of the Masters in Ordinary, which is 200*l.* under 5 Geo. III. c. 28, to which 400*l.* was added by 46 Geo. III. c. 129. He receives fees besides when attending the Public Office as Master; and has some other trifling emoluments. In addition to the above, the Accountant-General receives from the broker employed by him part of the broker's usual commission. In 1843 this amounted to a sum of 2314*l.* after deducting a sum of 150*l.* paid into the Suitors' Fund under 5 Vict. c. 5. The total emoluments of the Accountant-General in the above year were 3814*l.*

The total sum standing in the name of the Accountant-General on the 30th of April, 1841, was 40,957,839*l.*, of which above 39,000,000*l.* was invested in stock, and 1,759,629*l.* was in cash. (*App. to Report on Courts of Law and Equity*, No. 476, Sess. 1842.) The act 5 Vict. c. 5, § 63, directs the Accountant-General to cause to be laid before parliament every year an account showing the state of the Suitors' Fund and the Suitors' Fee Fund, which stand in his name. The Suitors' Fund consists of money and stock unclaimed, but which are open to claim at any time. On the 1st of October, 1842, this fund amounted to 26,299*l.* cash, and 2,869,213*l.* stock. The Fee Fund accrues from fees formerly payable to the different officers of the court for their own advantage. These fees amounted to 62,808*l.* in the year ending November, 1842. The salaries of the lord chancellor, the vice-chancellors, and other officers of the Court of Chancery are paid out of these two funds.

Before the passing of the act 5 Vict. c. 5, which suppressed the equity jurisdiction of the Court of Exchequer, there was an Accountant-General of that court; and in April, 1841, a sum of 2,730,862*l.* was standing in his name in the Bank of England. The account is now transferred to the Accountant-General of the Court of Chancery. The duties of the Accountant-General and Masters of the Exchequer are now performed by the Queen's Remembrancer.

There is an Accountant-General of the Irish Court of Chancery.

ACCUMULATION. [THELLUSSON, PETER, P. C., p. 305.]

ACCUMULATION OF POWER is a term applied to that quantity of motion which exists in some machines at the end of intervals of time, during which the velocity of the moving body has been constantly accelerated.

The simplest case in which there is such an accumulation of power is that of a heavy body, like the rammer of a pile-driving machine, which descends by the action of gravity during a certain time and impinges upon some object. At the moment of impact, supposing that the object struck does not move, the velocities of all the particles, which had gone on continually increasing during the descent, are destroyed, and thus a shock is produced immensely greater than that which would result from the mere pressure of the body. The battering ram of the antients, when, being suspended from some fixed point, it was allowed to swing by the action of gravity till one of its extremities struck the face of a wall, produced its effect in like manner by the power accumulated in it during its motion. In all such cases, the effect, if measured by the magnitude of an impression or indentation produced in the object struck, is, by mechanics, directly proportional to the mass in motion and to the square of the velocity at the instant of impact.

The accumulation produced by the continuous action of gravity, when a body has not far to fall, is commonly increased by that of a quantity of motion obtained by an exertion of muscular power. Thus a smith, when he would strike on an anvil with the greatest force, adds to the power of gravity on the hammer the accumulation of velocity arising from a whirling motion, in a vertical plane, which he gives above his head to the hammer before he allows it to descend.

In the old coining-machines, which, like those at present used, produced the impression on the metal by the power of a screw, a great accumulation of force was obtained by causing a number of men to turn the horizontal bars attached to the vertical shaft which carried the screw: by the pressure of the men against the bars, while several revolutions were made about the axis of the screw, an acceleration of motion during that time took place; and the accumulation was instantaneously spent upon the metal, in aid of the pressure arising from the power of the screw alone. The like accumulation of force is obtained, but far more efficiently, in the coining-press of the present day by means of its fly-wheel: the reciprocating motion of a piston connected with a steam-engine communicates, by means of a crank, a continuous circular movement to the fly, and at the same time a reciprocating rectilinear motion vertically to the cylindrical shaft (the stamper) on which the screw is formed. With half a revolution of the fly-wheel the stamper is lifted up, and with the other half it is forced down upon the metal.

When a fly-wheel is acted on by any prime mover, as wind, water, or steam, its motion continually accelerates, and a corresponding acceleration is induced in the wheel-work, in rollers, or in the stampers with which it is connected: the resistance to be overcome at what is called the working point destroys however this acceleration, and would allow the movement to be uniform, if it were not for the temporary accelerations or retardations which are caused by variations in the intensity of the moving power, or in the amount of the resistance; and these are almost wholly counteracted by the accumulated power which constantly exists in the fly.

If the effect of impact at the circumference of a revolving wheel be considered as proportional to the diameter, or radius, of the wheel and to its mass (supposed to be collected in its circumference), it may be represented by rW, r being the radius and W the weight of the wheel; the effect at a working point, when the latter is connected with the axis of revolution at a distance from it represented by r', being, to the effect at the circumference of the wheel, as r to r', we should have $\frac{r^2W}{r'}$ to represent the effect at such working point. Consequently, the place of the working point being given, it should follow that it is more advantageous to increase the diameter of the wheel, or its velocity, than its weight: but, in practice, there are certain limits both to the magnitude and the velocity of the wheel, which must not be exceeded, lest the centrifugal force arising from the revolution should destroy the cohesion of its parts.

ACERATHE'RIUM. Some fossil Rhinocerata have been thus named by Kaup.

ACERVULA'RIA, a genus of fossil Madrephylliœa.

ACHILLE'UM, a genus of fossil Spongiadæ, of which two species occur in the cretaceous strata of England. (Goldfuss.)

ACIDA'SPIS, a genus of fossil Crustacea, of the group of Trilobites; found in the Wenlock limestone. (Murchison.)

ACONI'TUM (*Monkshood* or *Wolfsbane*), *Medical Properties of.*—The botanical characters of this genus of Ranunculaceous plants have been already given. [P. C. vol. i. p. 88.]

Which species merits the preference as a medicinal agent, is a greatly controverted point. The London and Dublin Pharmacopœias, following the notions of Decandolle as to the identity of his A. paniculatum, var. γ Störkianum, with the A. Napellus officinalis, figured by Störk in his 'Libellus de Stramonio, Hyoscyamio, Aconito,' Vindobon. 1762, have given that as the officinal one, while the Edinburgh College has retained the common A. Napellus. The preponderance of evidence and good sense is in favour of the latter, as, besides the almost impossibility of procuring the plant indicated by the two former, since it is only a rare inmate of botanic gardens, it is substituting a confessedly less potent for a more potent plant. The Aconite of Störk, whatever species he used, was a plant possessed of great acrimony, while A. paniculatum has scarcely a perceptibly acrid taste. The officinal parts are the root and leaves, but the seeds might be added with propriety. Every part of the plant has a narcotico-acrid property. The live plant has little of the virose repulsive odour common in poisonous vegetables; nevertheless very sensitive individuals, by merely smelling the flowers, have fainted, and had dimness of vision for some days, and handling the fresh plant has occasioned tremblings and faintness. Honey collected from these flowers has caused severe suffering and even death. In making the essential extract, and in procuring the alcaloid *Aconitina*, the vapours have powerfully affected the operators; hence much care is required on their part. A small piece of the leaf, root, or a single seed, if chewed, causes a feeling of tingling, followed by numbness of the lips and tongue, which lasts for hours. A greater portion causes these sensations in the palate and throat, where in larger or poisonous doses a choking sensation is felt. The resemblance of many aconites, especially before flowering, to several umbelliferous plants in common use, such as celery, lovage, masterwort, &c., proves a frequent source of poisoning by them; a calamity further augmented by the inconsiderate practice of giving ignorant persons portions of the leaves to chew, or as a kind of parsley. (See a melancholy case of poisoning by Aconitum neomontanum, in Johnson's 'Medico-Chirurg. Review,' vol. lxi. p. 264.) Such unprincipled practices cannot be too severely reprobated. No complete analysis of the root or leaves of the A. Napellus has hitherto been published, though Pallas analyzed the root of A. Lycoctonum, and Bucholz the leaves of A. Medium, Schrad. It is probable that all the species contain similar constituents, differing only in degree, the most powerful being the A. ferox (Wallich, *Pl. Asiat. Rariores*, i. t. 41) or Bisk of Northern India. The most important are the alcaloid aconitina, aconitic acid, a fatty oil, and perhaps a volatile acrid principle. The latter probably results from the decomposition of aconitina by the action of heat. Almost all ranunculaceous plants have an acrid principle, which is very easily driven off by heat. Much care is therefore requisite in drying the root or leaves of aconite not to apply too high a temperature. The same precaution is required in forming the extract or inspissating the juice. A knowledge of this fact leads to the most convenient and effectual antidote in cases of poisoning by these plants, viz. causing the patient to drink very warm water till vomiting is excited. Linnæus saw aconite disarmed of its virulence, so that it could be used as a pot-herb, by merely boiling it, and adding a little fat or butter. (Linnæus, *Flora Lapponica*, p. 187, ed. Lond. 1792.)

The fatty oil is destructive of the sensibility of any part to which it is applied, but whether from inherent powers or from having aconitina dissolved in it is yet unknown. The alcaloid is regarded as the efficient principle when aconite is used medicinally. The forms of administration are various. Powder is objectionable from the variable degree of power. This further varies with the period when the leaves are collected. The best time to gather them is immediately before the flowers wither, as when the seeds advance to maturity the acrimony of the leaves rapidly diminishes. (Christison.) When the seeds are intended to be collected, this should be done just before they are perfectly ripe. The root should be taken up before the flowers expand; it must be carefully, yet speedily dried, at a very low temperature, otherwise it soon becomes mouldy and its activity is impaired, while a high temperature quite dissipates its valuable properties. The watery extract is a worthless preparation; and the inspissated juice of the London Pharmacopœia, improperly termed an extract, is also objectionable. The best forms are either an alcoholic extract of the leaves, or an alcoholic tincture of the root made by displacement. The inactivity of the watery extract and inspissated juice has led to statements in some popular treatises that it may be given in the dose of twenty grains, a quantity which would prove fatal when the extract is prepared with alcohol. Of this latter it is rare that two grains can be given with safety: a quarter of a grain is sufficient to begin with. Possessing narcotico-acrid properties, the action of aconite on the human frame is different according to the quantity used. In small medicinal doses its most obvious action is purely local; in larger, its action is both local and remote. Thus a small portion chewed produces an immediate action, tingling, followed by numbness of the lips and tongue; increased secretion of saliva also occurs. Minute doses taken into the stomach cause augmented secretion both of the mucous membrane and of the glands in the vicinity; the secretion of the liver is often markedly increased; while tingling of the extremities, with heat, is often felt, and either perspiration or increased action of the kidneys. The effect on the pupil is variously stated. Geiger affirms that aconitina produces dilatation of the pupil. Dr. Pereira most positively asserts, in his Materia Medica, that the external application of it produces contraction; while in his experiments with the extract of the Aconitum ferox (recorded in 'Edinb. Journ. of Natural and Geograph. Science,' July 1830, p. 235) he distinctly affirms that while the animal continued alive the pupils were 'much dilated,' contraction taking place only after the animal was apparently dead. Large doses cause redness and inflammation of the parts brought in contact with it; but the intellectual powers do not seem impaired by it, even when a fatal result occurs. Sir B. Brodie thinks that it occasions death by destroying the functions of the brain. ('Phil. Trans.' 1818, p. 186.) For this effect he does not consider absorption necessary; while Dr. Pereira concludes from his experiments, that the intensity of its remote action on the nervous system is in proportion to the absorbing powers of the part to which it is applied (*loc. cit.* p. 242). The susceptibility of the heart to galvanic agents is greatly impaired by it.

When first introduced into medical practice it was recommended in many diseases; but it is now almost entirely restricted to painful affections of the nerves, and to rheumatic complaints, particularly when they are complicated with syphilis. For nervous affections it is more used externally than internally, but this last mode is to be commended at the same time. An ointment is formed with one or two grains of the aconitina to one drachm of axunge. A small portion of this is to be applied frequently to the part affected. An eruption sometimes appears, especially if the ointment be strong. The internal use of aconitina is scarcely to be advised, one-fiftieth of a grain having endangered the life of an adult. The very high price of this article is an obstacle to its extensive employment; but ingenious chemists are endeavouring to simplify the process of extracting it. To obtain it perfectly pure it is almost essential to use sulphuric æther in the preparation of it, which necessarily increases the expense. The alcoholic tincture or extract is of great service in chronic rheumatism, and even in some cases of acute rheumatism.

Should poisoning occur, attempts must immediately be made to empty the stomach by emetics or the stomach-pump. No brandy or other form of alcohol should be given, nor vinegar, till all the herb is removed from the stomach, after which coffee with vinegar is very useful: venesection may sometimes be required.

ACORI'NÆ, ACORI'DEÆ, or **ACORA'CEÆ**, a small natural order of spadicose Endogens, with the following essential character:—The flowers are hermaphrodite, surrounded with scales. The spathe is leaf-like, but not rolled up. The stamens are complete, placed opposite the scales, and have 2-celled anthers which are turned inwards. The ovaries are distinct; the fruit is baccate, juicy at first, but finally juiceless. The seeds have the embryo seated in the axis of a copious albumen. The rootstock is jointed, the leaves sword-shaped and embracing each other in the bud. Such is the character given this order, which was first separated from Aroideæ by Agardh, and the separation was afterwards adopted by Schott, Link, and Lindley. The diagnostic characters of this order from Araceæ are—1, The different arrangement of the leaves in the bud, which are convolute in Araceæ, and hence a difference of habit is produced; and 2, the scaly rudiments of the perianth, which are never present in Araceæ. The genera assigned to this order by Lindley are Acorus, Gymnostachys, Tupistra, and Aspidistra. The two last genera however are assigned this position because the author did not know what else to do with them on account of their anomalous structure. This small group of plants in its geographical distribution is confined to the Eastern hemisphere. None of them have the acrid properties of some of the Araceæ. The Acorus calamus is a British plant, and has slightly aromatic properties. (Lindley, *Natural System.*) [Acorus, P .C.]

ACQUI, *the Province of*, an administrative division of the Sardinian States, situated on the northern side of the Ligurian Apennines, the ramifications of which run northwards until they slope down into the great valley of the Po. The Bormida, the Bolbo, the Erro, and other minor rivers, or rather torrents, which rise in the main ridge of the Apennines, flow between these offsets until they all join the Tanaro, which is the great affluent of the Po on this side. The province of Acqui was formerly called the High or Upper Monferrato, being part of the Marquisate of that name before it was annexed to the dominions of the House of Savoy. The country produces some corn and much fruit. The lower hills are planted with vineyards, from which good wine is made, known at Turin and Genoa by the name of Monferrato wine. The mountains are partly covered with chestnut-trees, which supply an article of common food for the peasantry. The rearing of silkworms is an important branch of industry. A considerable quantity of cattle, especially horned cattle, is bred in the province.

The province of Acqui is bounded on the north by Alessandria, east by Novi, south by Savona, and west by Alba. Its length is about 40 miles north to south, and its greatest breadth is about 25 miles. The population is 92,000 inhabitants, distributed among 73 communes. The head town of the province is called Acqui, and is a bishop's see. It is built partly at the foot and partly on the slope of a hill on the left or western bank of the river Bormida; it has a fine old cathedral with a handsome façade, several other churches and convents, a royal college, a clerical seminary, and a town-hall, some other remarkable buildings, and about 7800 inhabitants. The old walls of the town have been pulled down since the last peace of 1815. The old castle stands on a hill outside of the town, and is used as a prison. The town has some manufactories of linen and some tanyards. Acqui is much frequented by invalids from Lombardy and from Genoa for its hot sulphur springs; the establishment for bathing is about a quarter of a mile out of the town, on the opposite or right bank of the Bormida. The buildings have been restored and enlarged by the late king, Charles Felix. The 'fango,' or mud formed by the sediment of the water, is applied in many cases of local complaints or old wounds, and is considered very efficacious. The town derives its name from its springs, which were known to the Romans by the nâme of Aquæ Statiellæ, Statielli being the name of a tribe of Ligurians who inhabited this region, and who being joined by other tribes were defeated in a great battle near Caristum by the consul M. Popilius Lænas, 173 B.C. The consul razed Caristum to the ground, devastated the whole country, and sold many of the inhabitants. His severity was considered excessive even at Rome, especially as the Statielli had not born arms against the Romans until the other Ligurian tribes made a gathering in their territory, where they were attacked by the consul. The senate ordered the captives to be restored to liberty, and the purchase-money to be returned to the purchasers: gracing its resolution by the well-sounding moral, 'that the splendour of victory consists in subduing an enemy in arms, and not in oppressing those who have submitted.' The decree however was eluded for a time, and Popilius in the face of it again attacked the Statielli in the following year, and killed ten thousand of them. At last the senate and the people joined in reproving the conduct of Popilius, who was summoned to Rome to answer for his conduct, and his brother C. Popilius, the consul for the year, was commissioned to execute the former decree and liberate the surviving Statielli, several thousands of whom were released from slavery, and settled on some grounds which were assigned to them north of the Po. M. Popilius Lænas appeared before the prætor, C. Licinius, who being tampered with by the friends of the accused, put off the matter to the Ides of March, when the new magistrates came into office, and Licinius retired into private life, by which means Popilius came off unpunished. 'Thus,' tamely observes Livy (42, c. 22), 'by an artful trick the rogation concerning the Ligurians was eluded.' Afterwards the mineral springs above mentioned having attracted the attention of the Romans, the place became known by the name of Aquæ Statiellæ, and there are inscriptions remaining which relate to the care taken of the thermæ, or warm baths, by the local officers.

In the early part of the middle ages Acqui was a countship, one of the early counts of which was a certain Aleramus, whose history has been interspersed with wonderful fables by the chroniclers: he fought valiantly against the Moors or Saracens who had invaded part of Liguria. He married a daughter of Berengarius II., some say of Otho I., was made a marquis, and died A.D. 993. He was the progenitor of the Marquises of Monferrato and of the Marquises of Saluzzo, who figured for centuries afterwards in the vicissitudes of North Italy.

The other towns of the province of Acqui are—1. Nizza della Paglia, called also Nizza di Monferrato, situated in a pleasant district on the banks of the Belbo, with about 3500 inhabitants. It is the native place of the Jesuit Giulio Cesare Cordara, a distinguished writer both in Italian and Latin, who flourished in the eighteenth century. 2. Ovada, a town of 6000 inhabitants, situated among the Ligurian Apennines. 3. Strevi, a small town, known for its good wine. A number of smaller towns and villages, of from 1000 to 2000 inhabitants, are scattered throughout the province.

(Casalis, *Dizionario Geografico, Statistico, Commerciale, degli Stati di S. M. il Rè di Sardegna;* Denina, *Quadro dell' Alta Italia; Calendario Sardo.*)

ACRE, SAINT JEAN D', the celebrated fortress on the coast of Syria, was taken by the united English and Austrian squadrons in 1840, after a bombardment which was short, but so effective as to form one of the most memorable events in modern warfare. Great Britain and her allies, Austria, Prussia, Russia, and Turkey, having concluded a treaty at London on the 15th of July, 1840, for the purpose of driving the Egyptian troops out of Syria, and restoring this country to its former master, the Sultan, a combined English and Austrian fleet attacked and took the Syrian seaports. On the 2nd of November, 1840, this fleet arrived off Acre: it consisted of seven English line-of-battle ships, four war-steamers for throwing shells, and some smaller vessels, commanded by Admiral Sir Robert Stopford, who was commander-in-chief of the united fleet, and under whom Sir Charles Napier acted as commodore of the English squadron; and two Austrian frigates, the Medea, on board of which the Austrian admiral, the Marquis de Bandeira, had hoisted his flag, and the Guerriera, commanded by Captain the Archduke Frederick of Austria. The attack began on the following day, the 3rd of November. The ships had some difficulty in taking their positions, as the officers had no good chart of the coast nor plan of the fortress, which, through the care of the pasha of Egypt, Mehemet Ali, had been made almost impregnable, except to troops and officers who combined the most consummate skill with the utmost bravery. After a heavy firing of two hours, which was well answered by the Egyptians, the grand magazine blew up with a tremendous explosion, probably ignited by a shell from one of the steamers. Two entire regiments of infantry, which were standing in battle array near it, were annihilated, as well as every living creature within an area of 60,000 square feet. The Egyptian commandant nevertheless continued to defend the town, but the fire of the ships was so effective that it was discontinued at sunset, and the admiral prepared for a storm on the following day. This however the commandant did not await, but evacuated the fortress during the night of the 3rd of November with the feeble remnant of his garrison, the force of which was from 4500 to 5000 men before the action. On the 4th the Anglo-Austrian force took possession of Acre: they lost some men by a second explosion, the blowing up of a magazine of loaded shells which had been covered by the rubbish of the grand magazine, under which fire was smouldering. The allies lost eighteen killed and forty-one wounded. Lieutenant G. B. Le Mesurier, of the Talbot, was the only officer killed. After the fall of this bulwark of Syria, Ibrahim Pasha evacuated that country and retired to Egypt. Acre has since been restored to the Turks, and some care has been taken by them in rebuilding the fortifications, but the whole is still little more than an indefensible heap of ruins. (Sir Charles Napier, *The War in Syria.*)

ACROCU'LIA, a fossil genus of Gasteropoda, allied to the Neritadæ. It occurs in Palæozoic strata. (Phillips.)

A'CRODUS, a genus of fossil Placoid fishes, established by M. Agassiz. The species occur almost exclusively in the lias and oolite. One British species (A. minimus) is referred to the keüper series by M. Agassiz. It occurs at Aust Cliff in the bone-bed. The others abound at Lyme Regis, Bath, and Stonesfield.

ACRO'GASTER, a fossil genus of fishes. (Agassiz.)

ACRO'GNATHUS, a genus of fossil Cycloid fishes, found in the chalk of Sussex. (Agassiz.)

ACRO'LEPIS, a genus of fossil Ganoid fishes, found in the magnesian limestone of Durham. (Agassiz.)

ACROSALE'NIA, a genus of fossil Echinodermata. (Agassiz.) It occurs in the Isle of Sheppy. (Bowerbank.)

ACROTE'MNUS, a genus of fossil Ganoid fishes. A. faba is found in the chalk of Sussex. (Agassiz.)

ACTA SANCTO'RUM. [Bollandus, P. C.]

ACTI'NOCAMAX, a division of Belemnites, proposed by the late Mr. Miller of Bristol, upon the supposition that the species which he ranked in it had no true alveolar cavity or phragmacone. The correctness of this view is doubtful. The species belong to the cretaceous strata. [Belemnite, P. C.]

ACTINO'CERAS, a genus of fossil Cephalopoda, separated from Orthoceras by Mr. Stokes. The species belong to Palæozoic strata. A. Simmsii occurs in Ireland.

ACTINOCRINI'TES, a genus of Cinoidea [Encrinites, P. C.], containing many species. It occurs in Silurian and carboniferous strata. (Miller.)

ACTINO'METER (from ἀκτίν, a sunbeam; and μέτρον, a measure) is an instrument employed for the purpose of ascertaining the intensity of heat in the direct rays of the sun. It is a highly delicate thermometer, having a large cylindrical bulb filled with ammonio-sulphate of copper (a deep blue fluid), and a capillary tube, to which a graduated scale is applied. It was invented by Sir John Herschel, who gave a description of it in the 'Edinburgh Journal of Science' for 1825 (vol. iii.). The construction of the instrument and the manner of using it are noticed under the word Thermometer, P. C., p. 350.

The indications of heat afforded by the actinometer depend evidently upon the magnitude of the beam of light which falls on the bulb and upon the bore of the tube, within which the fluid rises from the effect of the heat. The area of a longitudinal section through the axis of the cylindrical bulb, which is also the area of a transverse section of the beam of light incident on the bulb, is taken for the former; such sections, in different instruments, being proportional to the hemi-cylindrical surfaces which receive the beams; and the volume in the interior of the capillary tube, of one of the spaces corresponding to the length of a degree on its scale, measures the expansion of the fluid produced by a portion of the heat. This volume is found by measuring the volume of mercury which would fill a given length of the tube, and it should be determined by the maker of the instrument before its parts are put together.

The length of a degree on the thermometric scale is at present arbitrary, and the relative values of the degrees on the scales of different instruments are determined by comparing together the indications made in like circumstances. For this purpose, different persons may make observations simultaneously with the instruments, or the same person may make several observations with two instruments, exposing them alternately to the sun's rays. Such comparisons must necessarily be made when it is required to determine the corrections which should be applied to the indications of different instruments, on account of the unequal absorption of light in the plates of glass which cover them: the observations for this correction are made by exposing the instrument with the glass alternately on and off.

Sir John Herschel proposed to establish, as a unit for the intensity of solar heat, that value which would, in one minute of mean solar time, dissolve a thickness equal to one-millionth part of a metre (0·00039 English inch) of a horizontal sheet of ice when the sun's light falls vertically upon it. This he calls an *actine;* and, from experiments made by him at the Cape of Good Hope, he determined the value of a degree, on the scale of one of his actinometers (H, No. 8), to be equivalent to 6·093 actines. ('Phil. Trans.' 1842, part ii. p. 272.) Apparently however it has been hitherto preferred to determine the intensities of solar heat by comparisons of the indications given by different instruments.

It has been stated [Thermometer, P.C.] that the observations with an actinometer should be made at intervals of time equal to one minute: when the intervals are not one minute, the observations may be reduced to such by simple proportions, provided the deviations from one minute do not exceed a few seconds. On observations at half-minute intervals being made, Professor Forbes ('Phil. Trans.' 1842, p. 246) employed the factor 2·224, in order to obtain the equivalents for intervals of one minute.

The actinometer is highly useful in determining the quantity of solar heat which is absorbed in passing through different strata of the atmosphere, for which purpose the observations must be made at stations differently elevated above the general surface of the earth or sea. It may also be employed to determine the diminution of heat which takes place during eclipses of the sun.

ACTION (at Law). [See P. C. vol. i. p. 105, for Action, definition of; general object of; general principle respecting; three kinds of; general outline of proceedings in.]

On this head the following remarks may be added:—

1. When the object sought to be obtained by an action is a pecuniary compensation in damages, as in a case of an assault, breach of contract, &c., the party injured has an incomplete or inchoate right to such compensation as soon as he receives the injury, though such right be not fully ascertained till the amount of the damages are assessed through the intervention of law, that is, by the verdict of the jury by whom the action is tried. 2. Personal actions are founded either on contracts or torts, a term used to signify such wrongs as are in their nature distinguishable from breaches of contract, and these torts are usually considered as of three kinds, viz. nonfeazance, or the omission of some act which a man is bound to do; misfeazance, or the improper performance of some act which he may lawfully do; malfeazance, or the commission of some act which is unlawful. Actions founded on contract are sometimes described as actions ex contractu, and those on tort as actions ex delicto, a division which, as well as the terms used to express it, is derived from the Roman law (obligationes ex contractu, obligationes ex delicto: Gaius, iii. 182). 3. Actions are either local or transitory: local actions are founded on such causes of action as necessarily refer to some particular locality, as in the case of trespasses to land; transitory actions, on such causes of action as may be supposed to take place anywhere, as in the case of trespasses to goods, batteries, and the like. Real actions are always in their nature local, personal actions are for the most part transitory. Between local and transitory actions there is this distinction, that local actions must be tried in the proper county where the cause of action arose, and by a jury of that county: transitory actions may be tried in any county, at the discretion (in general) of the plaintiff. It follows from this that when an injury is committed out of England, and its nature is such as to make the action local, no action at all will lie for its redress in any English court. On the other hand, where the nature of the injury is such that the action is transitory, such action will lie in the English courts, whether the injury was committed in England or elsewhere. When the cause of action arose abroad, in a transitory action it was formerly necessary to have recourse to a legal fiction, and to allege that it arose in an English county. This fiction is now abolished, though the plaintiff in his declaration is still required to specify in the margin some English county as that in which he proposes that the cause should be tried. By the stat. 3 & 4 Wm. IV. c. 27, s. 36, all real and mixed actions are abolished, except 4, Writ of right of Dower, Dower, Quare Impedit, Ejectment. 4. Though an action will lie for a wrong unattended with actual loss or damage (as for instance where one commoner sues another for surcharging a common, that is, turning on more cattle than he was entitled to do, although the plaintiff may not himself have turned on any cattle of his own during the same year, and cannot therefore have sustained any actual loss), yet none can be maintained even for loss or damage actually inflicted, unless it result from a wrong, it being a maxim that a mere loss without a wrong is not actionable. Thus if I have a mill, and my neighbour builds another mill upon his own ground, by which the profit of my mill is diminished, yet no action lies against him, for every one may lawfully erect a mill on his own ground; but if I have a mill by prescription on my own land, and another erects a new mill which draws away some portion of the stream from mine, so as to diminish its former power, an action will lie against him of trespass on the case. 5. A plaintiff is not entitled to recover in respect of any damage that is too remote, or in other words, flows not naturally and directly from the alleged wrong. Thus, where the plaintiff, being a director of certain musical performances, brought an action on the case against the defendant for publishing a libel on a public singer engaged by the plaintiff, alleging that she was thereby deterred from performing in public, through the apprehension of being ill received, so that the plaintiff lost the profits which would otherwise have accrued to him as such director, it was held that the damage was too remote, and the action not maintainable. 6. As to suits of every class, it is generally true that the right of action is not assignable, so as to enable the assignee to sue at law in his own name; but in certain cases it is transferred by the

operation of law. Thus the rights of action of a bankrupt or insolvent pass (with certain exceptions) to their assignees; and upon the death of either of the parties between whom a cause of action has arisen, the right of maintaining such action survives in general to or against his executors or administrators. But in respect to suits which are founded on the violation of personal rights, as in the case of an action for slander, the maxim is that they die with the person, and by the common law this extended to every case of tort; but it is now no longer the rule as regards torts committed in respect of property. (4 Edward III. c. 7; and 3 & 4 William IV. c. 42, s. 2.) 7. The regular parts of an action at law are:—1, the process, or those proceedings which have for their object the compelling the defendant to appear, that is, to admit that he has a general intimation of the suit, and is ready to receive more particular notice of its ground and object; 2, the pleadings; 3, the trial and evidence; 4, the judgment; 5, the writ of error (where the judgment is supposed to be erroneous); 6, the execution. 8. By the stat. 2 Will. IV. c. 39, and the rules of court founded upon it, and by statutes 3 & 4 Will. IV. c. 67, and 1 & 2 Vict. c. 110, it is now provided that all personal actions shall be commenced by writ of summons, which is a writ issued out of the court in which the action is brought, directed to the intended defendant himself, and which, without setting forth the particular cause of action, but merely describing the action as one of debt, trespass, or the like, commands him to cause an appearance to be entered therein within eight days after the writ shall have been served upon him. Previously to the passing of the last-mentioned statute a plaintiff might commence an action of debt by arresting the defendant where the alleged subject of dispute was a debt to the amount of 20*l.* at the least. Arrest on mesne process, that is, this first stage of the action, is now abolished. [Arrest, P. C. S.]

(For further particulars see references in P. C. vol. i. Action; and Blackstone, *Comm.*; Stephen, *Comm.*; Stephen, *On Pleading*; Chitty, *On Pleading*.)

ACTION UPON THE CASE. [Case, Action upon, P. C.]

ACTION AND REACTION. [Motion, Laws of, P. C.]

ACTION, LEAST, PRINCIPLE OF, is a name given by Lagrange to a law of motion which he has thus enunciated:—In a system of moving bodies, the sum of the products of the masses of the bodies by the integral of the products of the velocities and the elements of the spaces passed over, is constantly a maximum or a minimum.

The principle, in a limited sense, originated with Maupertuis, who, in the 'Mémoires de l'Académie des Sciences de Paris,' for 1740, designating it the 'Law of Rest,' states that when bodies in motion act upon one another, the sum of the products of the masses by the velocities, and by the spaces described, is a minimum; and from this principle he deduced the laws of the reflexion and refraction of light, and of the collision of bodies. Euler also, in his 'Traité des Isopérimètres' (Lausanne, 1744), showed that when isolated bodies describe curvilineal paths by means of central forces, the integral of the product arising from the multiplication of the element of the curve by the velocity is always a maximum or a minimum. But the generality of the principle was established by Lagrange, who has extended it to the motion of a system of bodies acting upon one another in any manner whatever; and his first applications of it to the solution of dynamical propositions are contained in the second volume of the 'Mémoires de l'Académie, &c. de Turin.'

The analytical expression of the principle is, that $\Sigma m\int vds$, or $\int\Sigma mvds$, is a maximum or a minimum, or that the infinitely small variation of that quantity is zero. (Here m is the mass of a body, v its velocity, and ds the element of the space passed over.) But $ds=vdt$ (dt being the element of time); therefore, $\int\Sigma mvds$ is equivalent to $\int\Sigma mv^2dt$. Now, Σmv^2 is the expression for the active or living force of a finite number of bodies or molecules [Vis Viva, P. C.]; and it follows that the principle of 'least action' is the equivalent of the expression that the integral of the product of the living force of a system by the element of time, is in general a minimum.

The truth of the 'Principle of least action' may be readily proved from the general dynamical equation [Virtual Velocities, P. C., p. 380, col. 1], the sum of the terms containing X, Y, and Z, being made equivalent to $\delta\frac{1}{2}\Sigma mv^2$, or to $\Sigma mv\delta v$, conformably to what is shown in the article just quoted; and the whole being transformed agreeably to the process used in the 'Mécanique Analytique' (sect. iii. No. 39). It will be needless however to give the details, since, as is observed by Poisson, the use of the principle is only to serve as a rule for forming the differential equations of motion, and these may be obtained at once from the 'General Equation' to which reference has been made above.

ACTIVE OR LIVING FORCES. [Vis Viva, P. C.]

ACTON BURNEL, STATUTE OF. This statute was passed at Acton Burnel, in Shropshire, at a parliament held by Edward I. in the eleventh year of his reign, on his return from Wales. Acton Burnel was never even a market-town, and Leland says (*Itin.* vii. 19) that the parliament was held in a great barn. The date of the statute is October 12, 1283. It is remarkable as a proof of the importance which the mercantile class had acquired, and its object was to recover more quickly debts due to merchants and traders. Hence it is called the Statute of Merchants (Statutum Mercatorum).

The preamble recites, that, 'Forasmuch as merchants which heretofore have lent their goods to divers persons be greatly impoverished because there is no speedy law provided for them to have recovery of their debts at the day of payment assigned; and by reason hereof many merchants have withdrawn to come into this realm with their merchandises, to the damage as well of the merchants as of the whole realm;' and therefore 'the king by himself and his council ordain and establish' certain remedies for the evils complained of. (*Stat. of Realm*, i. 53.)

The merchant was to bring his debtor before the mayor of London, York, or Bristol, or before the mayor and a clerk who was appointed by the king, acknowledge the debt, and fix a time for payment. The clerk entered the recognizance, and also made a writing obligatory, to which the debtor affixed his seal. The king's seal, provided for the purpose, and kept by the mayor, was likewise appended to the instrument. If the debtor neglected to pay his debt at the time appointed, the mayor ordered his chattels and devisable burgages to be sold, to the amount of the debt, by the appraisement of honest men. The moveables were to be delivered to the creditor if no buyer came forward. In case the debtor's moveables were out of the mayor's jurisdiction, the chancellor was to direct a writ to the sheriff of the county, who was to act with the same authority as the mayor. The statute contains several provisions relating to the sale. To guard against the appraisers favouring the debtor by fixing too high a price on his goods, they might themselves be forced to take them at their own unfair valuation; and in that case they became answerable to the creditor for the debt. The statute inferred, on the other hand, that if the goods sold below their value, it was the debtor's fault. If the debtor had no effects, he was to be imprisoned until he or his friends had come to some agreement with the creditor; and the creditor was bound to provide him with bread and water, if he were so poor as to be unable to support himself: but the cost of his maintenance added to the original debt, and was required to be repaid before the debtor could obtain his release. The creditor might accept sureties or mainpernors, who by this act placed themselves precisely in the same situation as the debtor; but they were not liable till the goods of the principal had been sold and found insufficient.

The statute of Acton Burnel was further explained and new provisions added by 13 Edw. I. stat. 3, passed in 1285. The first statute appears to have been misinterpreted by the sheriffs, and its execution delayed on malicious and false pretences. The king therefore, in a parliament held in his thirteenth year, caused the statute of Acton Burnel to be rehearsed, and another Statutum Mercatorum (13 Edw. I. stat. 3) was passed, which extended and gave additional facilities for enforcing the statute of Acton Burnel. Recognizances might be taken before the mayor of London, or before some chief warden of a city or of another good town which the king should appoint, or before the mayor and chief warden or other sufficient men chosen or sworn thereto, when the mayor or chief warden could not attend, and before one of the clerks appointed by the king. If the debtor failed to make good his payment at the time promised in his recognizance, he was, if a layman, to be placed at once in prison. If he could not be found, the merchant might have writs to all the sheriffs in whose jurisdiction the debtor had lands; and as a last resource the merchant might have a writ directed to any sheriff that he pleased to take the debtor's body The keeper of the prison became answerable for the debt if he refused to take custody of the debtor. Within a quarter of a year the chattels and lands were to be delivered to the creditor for sale in payment of his debt. If within the second quarter he did not make terms, all his goods and lands were to be delivered, the latter as if a gift of freehold, to the creditor, to hold until the debt was paid; the debtor being maintained on bread and water by the merchant. Precautions were taken against the debtor fraudulently making over his property. Lands given away by feoffment subsequently to the recognizance were to return to the feoffor. The death of the debtor did not bar the debt; for though the body of the heir could not be taken, his lands were answerable as much as during the lifetime of the debtor. The Jews were excluded from the benefits of the statute. (*Stat. of Realm*, i. 98.)

Reeves (*Hist. of the English Law*, ii. 162) observes that the above statute may be 'considered as contributing to extend the power of alienating land.' Any common creditor by judgment was empowered in the same session to take half the debtor's land in execution, 'but a merchant who had resorted to this security might have the whole.' He adds that 'a recognizance acknowledged with the formalities [here] described was in after times called a statute merchant;' and 'a person who held lands in execution for payment of his debt, as hereby directed, was called tenant by statute merchant.' Barrington (*Obs. on the more Ancient Statutes*, p. 119) states that in 1536 an ordinance of Francis I. was issued, which very much resembled the statutes merchant, and shows, he says, 'the more early attention paid to commerce in this country.'

ADA'L is the Arabic name of a part of the eastern coast of Africa, and has been adopted by European geographers. Until lately it was applied to the country that surrounds the Bay of Tajurrah, which constitutes the most western corner of the Gulf of Aden, and to that tract of coast which extends from the Bay of Tajurrah to the Strait of Bab-el-mandeb, but of late years it has been ascertained that it is applied to all the countries inhabited by a nation called by the Arabs Danákil: they call themselves Affar. The name Adal, or rather Adaiel, is derived from Ad Alli, which is the name of one of the most famous tribes of the Danákil.

The Danákil tribes inhabit the coast from the Bay of Tajurrah to Cape Bab-el-mandeb, and from Bab-el-mandeb along the shores of the Red Sea to the harbour and town of Massowah, from 11° 30′ to 15° 40′ N. lat. It is not yet known how far inland the countries extend which are occupied by this nation, except at the most northern and the most southern extremity. Opposite Annesley Bay, south of Massowah, the Danákil occupy only the narrow flat which lies along the Red Sea and the acclivity by which the table-land of Abyssinia is ascended: both taken together do not exceed 40 miles in width. At the back of the Bay of Tajurrah their territories extend to some distance west of the river Hawash, or at least 120 miles from the sea. As the highlands of Abyssinia gradually approach nearer to the shores of the Red Sea as they run farther north, the territories possessed by the Danákil grow narrower in that direction.

Coast and Islands.—The length of the coast along the Red Sea is above 300 miles. In several places it is studded with rocky islands. With some few exceptions they belong to the coral formation. Their surface consists of small fragments of coralline rocks mixed with sand, shells, and the indurated parts of mollusca. These islands do not in general rise more than 12 feet above the sea. In the dry season they appear to be quite bare of vegetation, but in the wet season, which lasts from December to April, the shrubs are covered with leaves, and a scanty grass springs up in some tracts: a few mimosas preserve the moisture longer. No agriculture is carried on. Only a few of these islands are inhabited the whole year by some families who live by their fisheries: many of them are used as pasture for goats, and some antelopes are met with. The largest of these islands is Dhalak. Between these islands and the mainland are several anchorages, but few of them are good: it is however remarkable that the wind never blows a gale along this coast, however boisterous the weather may be in the middle of the sea or along the coast of Arabia; thus the harbours generally afford shelter, especially to small vessels.

The adjacent coast resembles the islands in its formation. It consists of coral rocks rising abruptly 10 or 12 feet above the sea, but on the top it extends in a dead level. Opposite Massowah Bay this level is about two miles wide, but farther south somewhat wider. It is furrowed by numerous watercourses, in which during the rains an immense volume of water rushes down from the adjacent mountains; but when the rains have ceased the beds become dry, and in that state they remain for eight months. There are no springs, and the rain-water is preserved in tanks; but water may also be obtained by digging in the dry beds of the watercourses, where it is generally met with at a depth of 12 feet. The soil consists of sand, mixed with coral rocks and the shells of shell-fish, and is so sterile that the whole is left in its natural state, cultivation being limited to a few gardens in which hennéh (Lusonia inermis) is grown. Full-grown trees are only found in the beds of the rivers: in other parts there are only a few isolated mimosas and acacias, a coarse kind of grass, saline plants, and asclepias. Along the sea are isolated bushes of avicennia (Avicennia alba, Blum.) and tamarisks. Between the Bay of Massowah and Annesley Bay is Mount Gedem, which has a tolerably regular form, and rises about 5000 feet above the sea. It is isolated, and its upper part is covered with large trees, but there are no springs at its base.

South of this mountain the level plain grows wider, being three miles across. There are dispersed over it a considerable number of conical hills, which rise from 200 to 300 feet above their base. In their vicinity the soil chiefly consists of decomposed lava, and is much more fertile than the other parts of the plain: trees however are wanting, and low bushes appear only occasionally. In winter this tract is covered with excellent grass, and makes fine pasture. Camels, goats, and sheep are comparatively numerous. Cattle are not so common. Antelopes are numerous. Water is generally got by digging a few feet below the surface.

It is a general opinion that the low tracts along both sides of the Red Sea are the hottest countries on the globe. This is also confirmed by the meteorological observations which were made by Rüppel at Massowah during eight months (from Sept. 1831, to April, 1832). During the wet season (from December to April) the temperature ranged between 72·5° and 80° before sunrise, and between 82° and 88·5° at three o'clock in the afternoon. In the hot and dry season (from July to September) the temperature before sunrise ranged between 86° and 92°, and in the afternoon it was generally five degrees higher. In this season the sky is rarely overcast; but in the beginning of October, when the rainy season on the table-land of Abyssinia is near its termination, thunder-storms are frequent. This region has regular land and sea breezes, but the land-breezes are slight. The mean annual temperature of Massowah is 88°.

Though this low tract produces hardly anything fit for use except fire-wood, the sea supplies subsistence and articles of commerce to many families. Pearls are found in some places, especially in the vicinity of Dhalak, and also turtle. Among the fishes are whales, probably the Physeter; three kinds of dolphins, of which the largest is a Phocaena; and the dugong, of which last three hundred are annually taken by the fishermen of Dhalak.

Physical Geography.—The interior of Adal is only known along the routes which European travellers have followed in ascending from the sea to the table-lands of Tigré and Shoa. Those who have visited Tigré traversed the country south of the harbour of Massowah, and those who visited Shoa departed from Tajurrah, and reached Ankóbar by a south-western road.

The acclivity by which the table-land of Tigré is ascended occupies a space varying between 30 and 40 miles in width. Its direction is nearly parallel to the sea-coast. The depressions, valleys, or ravines by which it is furrowed generally traverse it at right angles to the edge of the mountain-mass, but at others they cut that edge obliquely, running from north to south. Near the low tract along the coast the rise is gradual, and the country at a distance of from 25 to 35 miles attains only an elevation of about 2000 feet above the sea-level; but as it approaches the edge of the table-land the ascent is very steep, for within six or eight miles the rise of the rocky mass generally amounts to between 6000 and 7000 feet.

At the back of the low tract along the sea the rise of the country is very gentle, presenting an inclined plain cut by depressions, in which the watercourses lie. The surface of this tract is sandy, and nearly without grass, but sprinkled with acacias and low bushes: it occupies about three miles in width, and is not inhabited. Adjacent to it is a much better tract: its surface consists of low hills composed of black rock, and supplies tolerably good pasture in the rainy season. The depressions between them may be called valleys. In winter they are traversed by large torrents, and in summer there is always excellent water a few feet below the surface in the beds of the streams. These valleys are covered with bushes and a few trees, of which the acacia is most common. There are many small villages, which are inhabited by herdsmen. In approaching the base of the steeper declivity the rocky masses that enclose the valleys become much more elevated, but at the same time the valleys themselves are wider. The more elevated part of this tract is an inclined plain with a strongly undulating surface. In general the eminences are composed of volcanic matter: in some places lava is found, and at others the surface is covered with a salt efflorescence. The valleys are full of bushes, and in many parts there are groves of trees, and the upper country is covered with low and stunted thorn-trees. In the valleys there are sycamores of considerable size and nabac bushes (Rhamnus nabca), which produce an edible and pleasant fruit. Near the base of the steep ascent some of the valleys are contracted to ravines, but others widen into plains: such is the Valley of Modat, about 25 miles due west of Massowah, which is nearly three miles wide, and extends to a considerable distance from south-east to north-west along the base of the mountain-masses. In this valley, as in other parts of this region, a few spots are cultivated with durra (Holcus sorghum). Cattle are kept; and large quantities of butter are made and sent to Massowah, and thence to Arabia. At the end of the dry season (from June to November), when the grass in the valleys is dried up, the cattle ascend the higher acclivity of the mountains, and even to the table-land of Tigré. Camels, mules, asses, goats, and sheep are abundant. This tract is the haunt of numerous wild animals: elephants are sometimes met with, which have descended from the table-land. Lions also sometimes make their appearance. There are numerous wolves, hyænas, lynxes, leopards, foxes, wild hogs, several kinds of antelopes, among which are the Antilope strepsiceros and the gazelle, and hares. Among the birds are several kinds of parrots (Fringilla paradisea) and pearl-fowls (Numidia ptilonorhyncha.)

The upper declivity of these rocky masses presents a succession of long and steep ascents and sloping terraces of moderate extent. The ravines by which they are intersected contain large trees. On some of the terraces a little cultivation is carried on, and durra and barley are grown. In this region the Euphorbia Canariensis is found, and this plant increases in abundance and size with the elevation of the mountains. Camels, cattle, and goats find abundant pasture. This region is inhabited by nomadic tribes.

This description applies to the caravan-road from Massowah to the village of Halaï, situated on the top of the ascent on the table-land of Tigré, and this road has been followed until lately by all travellers to Abyssinia. It is called the road by the Pass of Taranta, which name is applied to the higher and steeper portion of the acclivity. The village of Halaï is 8628 feet above the sea-level; and a resting-place at the base of the steeper ascent, called Mahio, is only about 2130 feet; but of late years it has been ascertained that there are in the vicinity of this pass two other passes, which are preferable, because the ascent is less steep. One lies north of the Taranta Pass, and connects the village of Gara on the table-land with Massowah; and the other is south of the Taranta Pass, and leads from the village of Tekunda (Degonta) down the declivity to Arkiko and Massowah.

We pass to the southern extremity of Adal, to the caravan road which leads from Tajurrah to Ankóbar, the capital of Shoa. The country through which this road runs is a table-land of moderate elevation, and it may be considered as an intermediate terrace by which the highlands of Shoa are ascended. The surface exhibits a considerable variety. No portion of it is under cultivation; but, with the exception of a few tracts of no great extent, it supplies pasture all the year round; at the end of the dry season however, in May and June, it suffers from want of water.

A short distance from the shore on which the town of Tajurrah is built, there is a cluster of hills of trachyte formation, the highest point of which, called Mount Gudah, is 2000 feet above the sea. This group of hills is traversed by glens, through which a considerable volume of water runs during the rains, but very little is found at the end of the dry season. Between these hills and the sea-shore is a narrow tract formed by sandy deposits covering a stony substratum. Water is obtained from wells: it is pure, but has an unpleasant taste. Grass is scarce, and only goats are kept. There are only shrubs and dwarfish mimosas, with a few date-trees, near the villages. Of wild animals, antelopes, hares, jackals, lynxes, and leopards are numerous, and various kinds of birds.

The Bay of Tajurrah terminates in a shallow lagoon called Gubbat-el-Kharab. This lagoon approaches the base of a table-land covered with lava, which extends westward to the vicinity of Lake Assal. The road lies north of this table-land. It passes through low undulating hills covered with basaltic boulders and a hilly table-land to the Plain of Wardilissan, which is covered with pebbles, and has neither grass nor water. This plain is 1697 feet above the sea-level. The descent from this plain to the Bahr Assal (Salt Lake) lies through an exceedingly broken country between high and steep hills. The whole of this tract between the Bay of Tajurrah and Bahr Assal is a waste, without water or vegetation. The Bahr Assal is 570 feet below the level of the sea. It is of an oval form, about seven miles across in its longest diameter, which runs from south-west to north-east, and about three miles wide. About one-third of its surface is covered with a sheet of salt, about half a foot thick, which resembles ice. The lake is shut in on the northern, western, and southern shores by ranges of high hills, among which is Mount Sivaro on the northern side, which is probably 1500 feet above the sea. On the eastern side is a bed of lava, which, as before mentioned, extends to the Gubbat-el-Kharab, and which contains several deep craters. It is supposed that at this point the lake was, at some remote period, connected with the Bay of Tajurrah.

On the south-west of Bahr Assal is a hilly tract. The hills near the lake are precipitous and high, but farther on they are low and rounded. The country rises slowly, for the Plain of Gagade, more than 20 miles distant from the lake, is only 270 feet above the sea. The water in this tract is plentiful, but has a brackish taste. Grass is only found at a few spots at the end of the dry season. A few groves of doom palm-trees are met with. The Plain of Gagade is eight miles in breadth, and lies between high hills running from south-east to north-west. The surface is partly composed of a hardened and cracked alluvial deposit, which is quite bare, and is partly covered with a thin soil overgrown with a jungle of acacia and a species of spartum.

After leaving this plain the country rises more rapidly. A few miles farther to the south-east it is 1200 feet above the sea-level. Farther on the country preserves in general the same level. The surface is a plain, occasionally diversified by elevated ridges, some of which are composed of lava, and sometimes by depressions in the form of valleys Some parts of the plain have a stony soil, and are covered with basaltic fragments and lava. Scarcely a trace of vegetation is found on them. Other parts have a sandy and sometimes a stony soil; but they are covered with coarse grass even in the dry season. Some tracts bear a rich grass, and resemble the plains of the Deccan. Water is generally got by digging in the beds of dry rivers and by wells. These plains terminate on the west at the Mari range, which rises about 1000 feet above the adjacent country, and runs for several miles across the plains from south-east to north-west. It is basaltic, and the base is strewn with huge blocks, which have been detached from its face. Its width does not appear to be much more than a mile.

The plains continue nearly on the same general level west of the Mari range. In fertility they resemble those east of the ridge, except that the grass is generally more abundant. The Plain of Killelu, which is from 20 to 30 miles wide, is always covered with grass. It terminates at the Wady Killelu, a large ravine bounded by basaltic cliffs from 800 to 900 feet high. At the end of the dry season water is only found in pools, but during the rains it is a large river, which receives the drainage of an extensive tract, and carries it to the Hawash river. The ravine is covered with bushes which are not found in other parts of the table-land, where the soil is very dry.

West of the Wady Killelu the table-land rises gradually till it attains an elevation of 2000 feet above the sea. The soil is here more volcanic, and improves in fertility; but the surface is more broken, and level plains are rarer and of less extent. Extensive tracts rest on basaltic rocks, and are only covered with a thin layer of soil, which however is covered with a thick turf. But this region is almost destitute of water. On the west of this tract two lofty peaks rise from the plain. Mount Abida and Mount Aiyalu or Azolo. Mount Abida rises about 4000 feet above its base and Azolo still higher. They appear to stand in the centre of a volcanic tract, from which sheets of lava have descended on all sides to the plain, forming a field of volcanic matter about 30 miles in diameter, studded with small cones, each showing a distinct crater. Mr. Kirk counted 21 of such cones. The surface of the lava appeared fresh and glossy. The vast plain adjacent to this tract is covered with low shrubs, and during the greater part of the year it is a sheet of water; but at the end of the dry season not a drop is found on it. As this region contains more wood than those nearer the sea, wild animals and game are more numerous, such as wild asses, wild hogs, zebras, guinea-fowls, quails, and spur-fowls.

South-west of this region the general level of the country is about 2500 feet above the sea. This is the most fertile portion of the table-land. The surface is not much diversified: it generally extends in large level plains, which are separated from one another by narrow hilly tracts or by wadys. All of them are clothed with perpetual verdure, as the soil is alluvial and good. No portion of them, except that bordering on the volcanic region before mentioned, is destitute of grass. Bushes are found nearly everywhere: in some places they form a close jungle, in others they are sprinkled over the plain. There are also trees here, but they do not appear farther east. A large part of this tract would probably admit of cultivation, but the inhabitants are accustomed to a nomadic life, and keep great numbers of camels, cattle, mules, asses, goats, and sheep. Wild animals are very common, especially the beeza, which is as large as a cow and formed like a deer, with horns not branching, but upright: the flesh is excellent. There are also antelopes, zebras, wild asses, and hares, as well as leopards, jackals, and hyænas. Guinea-fowls, spur-fowls, quails, and bustards are very numerous. The greater part of this fine country is without water towards the close of the dry season.

The country descends by several short terraces to the banks of the Hawash river. The wide alluvial bottom through which the river flows is covered with thick jungle sprinkled with small trees. Among them are mimosas, from which gum-arabic is collected. This jungle is the haunt of elephants and rhinoceroses. The river Hawash, where it is crossed by the caravan road, is 2200 feet above the sea. This river here constitutes the boundary between the Danákil tribes and the kingdom of Shoa, but the lower part of its course lies through Adal. The Hawash is said to originate in an extensive marsh near 9° N. lat. and about 37° 30′ E. long. Its upper course, which has not yet been visited by Europeans, is to the east, but it gradually turns to the north-east, and where it is crossed by the caravan road it runs north in a valley about six miles wide. At the close of the season its breadth is still from 40 to 50 yards, and it is from 10 to 12 feet deep; it runs at the rate of three miles an hour. The banks are from 15 to 20 feet above the stream, but after heavy rains it overflows the valley for miles. This part of the river contains hippopotami. Farther on, the Hawash is said to decline gradually to the north-north-east, and to continue in that direction until it nearly reaches the parallel of the Bay of Tajurrah, when it turns to the east, and soon afterwards is lost in an extensive lake called Abhebbad. This lake is supposed to be not more than thirty miles from the caravan road leading from Tajurrah to Ankóbar. It does not appear that the Hawash is interrupted by cataracts or rapids, and it is supposed that it could be navigated through nearly all its course, which probably exceeds 300 miles in length.

According to the old Portuguese travellers, there is another large river, called Anazo, in this part of Africa, which is likewise said to terminate in a lake or swamp, but modern travellers have not obtained any information about it.

With the exception of the country contiguous to the two caravan roads which have been noticed, the interior of Adal is almost unknown. Vessels passing through the Strait of Bab-el-mandeb observe two high peaks, which appear to rise at some distance from the shore, but whether they are part of a continuous range or are isolated mountains has not been ascertained. Adal however has been traversed by Coffin, but only by him at one place, namely, between the Bay of Hánfila (Amphila) 14° 40′ N. lat. and Chelicut. The road beginning at the bay passes for two days over barren and rugged hills, of no great height, in which a few hamlets occur, inhabited by herdsmen; then follows a large and level plain, which is called Hárho, and is covered with a thick layer of salt. This plain is said to be four days' journey in length, and it took five hours to cross it from north-east to south-west. The bed of salt is about three feet thick. In some places it continues tolerably pure to that depth, but in general not lower than two feet, below which it becomes mixed with the soil. As this salt is not only used for culinary purposes, but also in Abyssinia as a currency, it is cut into pieces of the shape of a whetstone: they are about nine inches long, one inch and three-quarters thick, in the middle two inches wide; they weigh between 19 and 20 ounces. The value differs greatly according to the distance from the place where it is obtained. In Tigré, which is situated not far from the Hárho, 50 amule, as these salt pieces are called, are equal in value to an Austrian dollar, but at Gondar 25 only are paid for it. We do not know how much the Hárho is elevated above the level of the sea; on the south-west of it, the country rises in high and rugged mountains with narrow and steep passes, and after two days' journey the table-land of Tigré is ascended by the Pass of Senafé.

Inhabitants.—Adal is inhabited by many tribes, which are comprehended under the name of Danákil or Dankali, and they all appear to belong to the same stock. The missionaries Isenberg and Krapf, who had an opportunity of conversing with the Shohos, who inhabit some tracts near the Taranta Pass, and with those tribes who live near the southern caravan road, state that these tribes are of the same race, and differ little from one another either in language or physiognomy. Rüppel describes the Shohos as having a strongly set and bulky body; their face is round rather than oblong; their hair is black, thick, and very crisp, almost woolly; their eyes are very lively, but small and set deep in the sockets; the nose is short and straight, and divided from the forehead by a depression; their lips are thick, but not so thick as those of the negroes; their colour is dark brown: their language appears to differ entirely from that spoken in Tigré and Shoa.

All the Danákil tribes are said to lead a nomadic life. This is certainly true of those with whom we are acquainted; but this fact can only be established generally when European travellers shall have reached Aussa, which is considered the capital of the nation, and appears to be a considerable place. In its vicinity there may be some cultivation. They keep a large number of camels, cattle, mules, asses, and sheep, and a few horses of a small breed, and they change their place of abode according to the seasons, to which they are principally compelled by the want of water at the close of the dry season. Like all other nomadic tribes they are inclined to plundering, and are of bad repute among their neighbours.

The Danákil are Mohammedans, but though in some respects they are bigoted, they have dispensed with many rules of their faith. They have a kind of literary institution at Aussa, which is constituted, as it appears, like those of the Ulemas of the Mohammedan countries, and is called by that name.

The most powerful tribes inhabit the countries on both sides of the caravan road between Tajurrah and Ankóbar. The road lies mostly through the territories possessed by the Debenik; but between the road and the course of the Hawash river there is the more powerful tribe of the Mudaïto. These tribes are frequently at war with one another. How far this tribe is dependent on the Sultan of Tajurrah, or what relation exists between him and the Agil or chief of the Mudaïto, is not known, but it is stated that the sultan has an agent at Aussa, the capital of the Mudaïto.

Adal does not supply any article for foreign commerce, except the salt which is collected on the Bahr Assal, which is carried along the caravan road to Shoa. But the inhabitants of the country between the sea and the nations which cultivate the soil have attained a higher degree of civilization, and consume some articles of Indian growth and manufacture; and these articles are carried through their territories by caravans. Two of these roads have been described, but there are others of which we have only obtained some information from the native traders. Two of the most frequented caravan roads run from Tajurrah to Aussa. The southern follows the caravan road to Ankóbar, as far as the Plain of Gagade, and then branches off to the west and passes round the southern extremity of the Lake Abhebbad to Aussa. It takes thirty-one days to reach Aussa. The northern road runs from Tajurrah west-north-west, passes through Rahaita, leaves Lake Abhebbad to the south and reaches Aussa after having passed over the river Hawash near its influx into the lake. The caravans are eighteen days on this road. Another caravan road leads from Aussa westward to the countries inhabited by the Wollo and Yejju Gallas, which reside in the high lands between Shoa and Tigré. The Hawash river is crossed near Aussa, and afterwards the caravan travels west to the market of Dowe, which lies on the edge of the high land, and near the boundary between the Danákil and Gallas. At Dowe the merchandise is exchanged between the two nations.

There is a tradition that Adal once formed a powerful empire, which is hardly to be credited when the present condition of the nation is considered. It was almost entirely unknown in Europe previous to the year 1839. The Portuguese indeed in the sixteenth century got some information respecting it, but they knew little of any part, except the tract through which the caravan road from Massowah to Tigré lies. This road was also described by Bruce and Salt. In 1839 the English took possession of Aden in Arabia, to facilitate the passage of steam-vessels between Bombay and Suez, and this event soon led to a closer connection with the surrounding countries. In the same year the missionaries Isenberg and Krapf, having been obliged to leave Tigré, where they had resided for several years, went from Tajurrah to Ankóbar, and they were soon followed by other English and French travellers. In 1841 Major Harris was sent by the British government to Shoa and succeeded in concluding a treaty of amity.

(Bruce, *Travels to discover the Source of the Nile;* Lord Valentia, *Voyages and Travels to India, Ceylon, the Red Sea, Abyssinia, and Egypt;* Salt, *Voyage to Abyssinia and Travels into the Interior of that Country;* Rüppel, *Reise in Abyssinien;* Isenberg and Krapf, *Journals detailing their Proceedings in the Kingdom of Shoa;* Kirk, 'Report on the Route from Tajurra to Ankóbar,' in *London Geogr. Journal*, vol. xii.; Dr. Beke, 'Routes in Abyssinia,' in *London Geogr. Journal*, vol. xii.)

ADDINGTON. [SIDMOUTH, LORD.]

ADELAIDE. [SOUTH AUSTRALIA, P. C. S.]

ADELO'CRINUS, a fossil genus of Crinoidea, from North Devon. (Phillips.)

ADELSBERG, a town not far from Laibach, in the duchy of Krain, in the Austrian part of Germany, is celebrated for the great caverns which are in its environs. There are two principal caverns, the cavern of Adelsberg, which is 1250 Vienna klafter, or about 7500 feet long, and the Magdalena cavern, which has been explored for a length of 200 klafter, or about 1200 feet. Both of them are in a calcareous rock, the layers of which are broken into huge square fragments, which in some places are heaped up by nature so as to resemble a Roman bridge. The most remarkable is the cavern of Adelsberg, the entrance of which, near the ruined castle of Adelsberg, is very narrow, but the cavern soon becomes wider, and forms several spacious grottoes which are from 60 to 80 feet high. Splendid stalactites hang down from the roofs and cover the walls, and present a beautiful appearance when seen by the light of torches. The Pink or Pinka, a little river, throws itself into the cavern, and as it forms several cascades the interior resounds with the uninterrupted noise of the waters. In the innermost corner of the cavern this river disappears through a narrow fissure in the rock, but continues its subterranean course for nearly eight miles, till it appears again near Malingradu-Kleinhäusel, where it is called Unze. After having flowed through the valley of Planina it disappears once more in the caverns of Laase, and comes again to the surface near Ober-Laibach, as a navigable river, called the Laibach. In those parts of this river which are subterranean, and especially in the cavern of Adelsberg, the Proteus is found. The Slavonian inhabitants of the country call it 'Bela Riba,' the Germans 'Weissfisch,' both of which means the same, the White Fish. It was first made known by Laurenti in 1768, in his 'Synopsis Reptilium,' and was called the Proteus Anguinus; but we owe the first and best scientific description of it to the learned Scopoli, a naturalist who paid particular attention to the various animal, botanical, and mineral phenomena of his native country Krain. Sometimes the Proteus is found in the open parts of the river, though only when the water is high in consequence of heavy rains. [PROTEUS, P. C.] Engravings on steel of the most picturesque of the caverns near Adelsberg have been drawn and published by A. Schaffenrath, Laibach, 1839, fol.

(Count F. von Hohenwart, *Wegweiser für die Wanderer in der berühmten Adelsberger Grotte*, Laibach, 1832; *Neuestes Conversations-Lexicon;* Hamilton, *Researches in Asia Minor*, vol. i. ch. 1.)

ADEN, a town and harbour on the southern shores of Arabia, in 12° 46′ 15″ N. lat. and 45° 10′ 20″ E. long. Before the British took possession of it, Aden was a miserable place, consisting of a small number of mud huts covered with mats, and containing about 600 inhabitants. Good water could be procured, but fire-wood, fruit, and vegetables were scarce and dear; bullocks and sheep were plentiful, and occasionally poultry was to be got. At present it is a flourishing place of trade, containing 22,000 inhabitants, surrounded with gardens and orchards, in which all the necessaries of life may be had at a moderate price.

The town is built at the eastern base of a mountain-mass called Jebel Shamshan, which rises to 1776 feet above the sea-level. This mountain-mass forms a peninsula, which is united to the mainland of Arabia by a narrow, low, and sandy isthmus, like Gibraltar, and it is thought that it could easily be rendered as impregnable as that famous fortress. But the rocks are much more elevated and more peaked. The isthmus is about three miles long. The harbours of Aden are considered the best on the southern as well as on the western coast of Arabia, and accordingly the British took possession of Aden in 1840, when a steam-boat navigation had been established between Bombay and Suez. It has two harbours. The smaller one near the town is divided into two small bays by a rocky and fortified island called Sirah, which is about 430 feet high, and commands the harbours and town. Of late years the small creek which used to separate the island from the mainland has been filled up, so that at low water it is now joined to the coast. The anchorage in the bays is very regular, and a vessel may choose her own position in from five to ten fathoms water. But it is only safe for three months, from June to August, when the wind blows from the westward, during which time there is always smooth water close to the island. At other seasons the anchorage is exposed to the prevailing winds and to the swell of the sea. The other harbour, which is called by seamen the Back Bay, and by the Arabs Bander Tuwayyi, lies west of the peninsula, and has on the eastern side of its entrance another mass of rocks called Jebel Hasan, which rises 1237 feet above the sea. The entrance between these two masses is nearly four miles wide. The bay stretches northward about the same distance, but at its eastern extremity is a smaller bay, which extends eastward to the isthmus which unites the Jebel Shamshan to the mainland. A ship may anchor in any part of this bay; the soundings gradually decrease from five fathoms towards the shore with a clear sandy bottom. The Jebel Shamshan protects the anchorage against the prevailing winds and the swell. The tides are strong and irregular, owing to the influence of the outside currents. At full and change they rise eight feet and a half.

Aden appears in remote times to have been a place of importance. It occurs in the 'Periplus' under the name of Eudaimon, or the Prosperous. When the Portuguese carried on their conquests in India, they wished to appropriate to themselves the commerce of the Gulf of Persia and of the Red Sea by taking possession of Ormuz and Aden. They succeeded in taking Ormuz, but the two attempts made by Alfonso Albuquerque to take Aden were abortive. When however the Turks had got possession of Egypt and extended their views to India, and prepared for a war with the Portuguese, they got possession of Aden in 1538 by treachery. They increased the fortifications greatly, and built an aqueduct more than eight miles long through the length of the isthmus, by which the town received an ample supply of water. The ruins of this substantial work, built of red brick and stone, still exist. As the power of the Turks gradually declined, the Arabians threw off their yoke, but the time when Aden became free is not precisely known. In 1708 Aden was governed by its own prince. Meanwhile the trade of this place had also gradually declined and had been transferred to Mocha, which is much better situated for the depôt of coffee, the principal production of Yemen. The trade of Aden was limited to its intercourse with Berberah and Zeila, in the country of the Somaulis, whence it received several kinds of gum, myrrh, aloes, libanum, and mastic, as also cattle and sheep, to which it added its own exports, coffee and jowary in small quantities; it imported cotton-cloth, iron, lead, rice, and dates. Since the occupation by the British its trade with Berberah, Zeila, and Tajurrah has increased, and a number of Banians, Parsees, and other merchants have settled there. It is expected that the whole commerce of the Red Sea, and especially that of Yemen and Hadramaut, will soon be transferred to Aden.

(Lord Valentia, *Voyages and Travels to India, Ceylon, the Red Sea*, &c.; Salt's *Voyage to Abyssinia*, &c.; Captain Haines's *Memoir to accompany a Chart of the South Coast of Arabia*, &c., in 'London Geogr. Journal,' vol. ix., and Notes indicative of the Progress of Geographical Discovery, in 'London Geogr. Journal,' vol. xiii.)

ADERSBACH ROCKS, an extraordinary mountain-mass in the environs of Adersbach, a village in Bohemia, on the frontier of this country and the Silesian county of Glatz, in a valley of the Riesen-Gebirge, or Giant Mountains; it lies in the circle of Königsgrätz. About twelve miles north-east of the town of Glatz the traveller reaches the mountain of Heuscheuer, which forms the beginning of the rocky labyrinth. The summit of this mountain, or rather winding ridge, is cut perpendicularly like a wall to the depth of from six hundred to twelve hundred feet, and there are only a few paths by which a descent is possible into the labyrinth below, which consists of masses of rock detached and laid one over another in all directions. Some are as large as moderate houses, and others have the size and shape of churches, pyramids, and similar buildings, or at least appear so to a lively imagination. On following a stream of pure water, which has its source in the centre of the labyrinth, the traveller passes by means of small crevices through a wall of sandstone of stupendous height, and he then enters a chaos of isolated columns, walls, towers, and other fragments of rock, of the most extraordinary description, varying in height from 100 to 200 feet. Some of these rocks are bounded at the top by irregular curve-lines, but the lower parts of their sides are as perpendicular and straight as if they had been cut artificially. The most remarkable is that which is called 'Der Umgekehrte Zuckerhut,' or 'The inverted Sugarloaf,' which is surrounded by a great number of pillars, which, though most of them are only three or four feet in diameter at their bases, are as high as the more massy rocks, and appear like a group of lofty chimneys. The width of the paths or winding crevices between the rocks varies from two to twenty feet; they are in many places covered with deep and light sand produced by the fragments of the summits which have been operated on by the atmosphere and rains; for the sandstone is generally very friable, and is often an unconsolidated agglomerate of quartzose sand. In the middle of the labyrinth there is a large opening, overhung by the surrounding rocks, covered with plants and trees, and watered by the above-mentioned stream, which falls in a cascade from a fissure in the principal hill, on the top of which there stands a ruined Gothic castle. This remarkable spot is annually visited by many travellers, and has especially attracted the attention of geologists. It is generally supposed that the whole, which extends over many square miles, was originally one solid mass of sandstone, which has been split by volcanic action, and afterwards washed out by the waters. Similar groups, though of comparatively little importance, are found in the slate-sandstone (sandstein-schiefer) region of the Middle Weser, and especially in the district called Saxon Switzerland, where volcanic action has left many traces.

(Langhans, *Das Adersbachische Steingebirge*; *Neuestes Conversations-Lexicon*; *The European Magazine*, August, 1822, contains an account which seems to be translated from the German of either Zöllner or Weiss; Ersch and Gruber, *Allgemeine Encyclopädie*.)

ADJUDICATION, in the law of debtor and creditor in Scotland, is a process for attaching heritable or real property. It is applicable not merely to land and its accessories, but to all rights 'bearing a tract of future time,' as annuities, pensions, lands, &c.; and has in general been extended to all such property capable of being applied to the liquidation of debts as is not attachable by the simpler process of arrestment. The origin of this process of adjudication is to be found in a very antient practice called Apprising, by which the debtor who refused to satisfy his creditor, either with money or land, might be compelled to part with so much of the land as the award of a jury found commensurate with the debt. This form was the object of legislation so early as the year 1469, when provision was made for compelling feudal superiors to give the proper investiture to those who acquired lands by such a title. The debtor who is compelled to part with his lands under the old apprising might redeem them within seven years; but it is said that this privilege was often defeated by dexterous expedients, and that the system was a means of judicial oppression, the genuine creditor being often defeated by the collusive proceedings of the debtor's friends; and, on the other hand, a creditor to a mere nominal amount was often enabled to carry off a large estate. The system was amended by the Act 1672, c. 19. According to modern practice, there are two alternatives laid before the debtor in the process—that the debtor is to make over to the creditor land to the value of his debt and one-fifth more, redeemable within five years; or that the property in general against which the process is directed shall be adjudged to the creditor, liable to be redeemed within ten years, on payment of the debt, interest, &c. The latter is the alternative universally adopted. The lands do not pass into the absolute property of the adjudger at the end of the ten years without judicial intervention, in 'an action of declarator of expiry of the legal,' in which the debtor may call on the creditor to account for his transactions, and may redeem the property on paying any balance that may be still due.

There are arrangements for preserving equality among adjudgers, and preventing the more active creditors from carrying off all the available estate. Taking the point of time when the first process has been made effectual by certain proceedings for the completion of the adjudger's title, all others in which the decree is either prior to that event or within a year and a day after it, rank with it and with each other, and they are all preferable to posterior adjudications. (Acts 1661, c. 62; 1672, c. 19; 54 Geo. III. c. 137, §§ 9—11.) When there are so many adjudications in process against an estate that it may be considered as bankrupt, while the debtor does not come within the class of persons liable to mercantile bankruptcy, it is usual to sweep all the operations into one process, called a 'Judicial Sale and Ranking.' A factor or assignee is appointed, under judicial inspection, and to a certain extent, but very imperfectly, the property is realized and distributed among the creditors, after the manner of a bankrupt's estate. (Acts 1681, c. 17; 1695, c. 24; 54 Geo. III. c. 137, §§ 6, 7; Act. Sed., 22nd Nov., 1711; 17th Jan., 1756; 11th July, 1794.) Where sequestration has been awarded against a person liable to mercantile bankruptcy, the award involves an adjudication of the bankrupt's adjudgable property from the date of the first deliverance. (2 & 3 Vict. c. 41, § 82.)

The form of an adjudication has long been in use for the completion of defective titles to landed property, and when so employed, it is called 'adjudication in implement.'

ADJUTAGE, or AJUTAGE, is a name given to a tube, generally not exceeding a few inches in length, which may be applied to a vessel or reservoir, in order to facilitate the discharge of a fluid from such vessel.

Experiment agrees nearly with theory, in showing that the velocity with which a fluid issues from a very small orifice in the side of a reservoir is equal to that which is due to a body falling in vacuo through the vertical distance of the upper surface of the fluid from the level of the orifice: but the discharge given by this rule must be considerably diminished, when we would estimate that of a fluid through a large aperture, on account of the contraction which takes place in the vein of effluent water at a short distance from the orifice. The application of a short tube to the orifice increases, however, the quantity discharged in a given time; and the fact must have been known to the antients, since Frontinus has a passage indicating such an effect in his treatise 'De Aquæductibus,' part of which was written under the Emperor Nerva, by whom Frontinus was appointed to superintend the supply of water to Rome. His words are:—'Sed et calicis positio habet momentum, . . . ad cursum aquæ si oppositus devexusque, amplius rapit,' &c.

The cause of a contraction in the stream of a fluid issuing from an orifice is noticed in HYDRODYNAMICS, P. C., p. 391, col. 1, and the latest experiments prove that the mean velocity of the particles flowing through a section of the vein, at the place where it is the most contracted, is equal to that which is due to the height of the fluid. It follows therefore that the quantity discharged in a given time through a simple orifice may be estimated by such velocity, provided the area of the orifice be considered as equal only to that of the most contracted section; or, if the area of the section be taken as equal to that of the orifice itself, that the velocity be such as is due to a height less than that of the fluid in the reservoir.

Neither the ratio between the diameters of the orifice and of the contracted stream (the sections of both being generally circular), nor the distance of the latter from the former, is well known; and, in fact, the ratio alluded to is variable, depending on the thickness of the plate in which the orifice is formed, and on the velocity of the fluid, as well as on the figure of the orifice itself, yet that of 1 to 0·8 is generally adopted.

Now, from the experiments of Mr. Vince, it appears that a discharge corresponding to the height of the fluid in the vessel and the area of the contracted vein takes place when the adjutage is a tube less than one inch long; and the reason given is, that a vena contracta is formed in such tube as one would have been formed beyond a simple orifice. But when the tube, whether inserted in the side or in the base of the vessel, is longer than an inch, no contraction takes place, but the effluent particles reaching the interior surface of the tube become adherent to it by a force similar to that which produces the phenomena of capillary contraction; this causes a quantity of fluid to accumulate and completely fill the nearer part of e tube, along which, then, the particles flow in directions nearly parallel to its axis, with nearly equal velocities, those near the surface being carried on with those about the axis, in consequence of the lateral communication which takes place in fluid currents. Atmospheric pressure seems, however, necessary to the production of such effects, since, from the experiments of Venturi and Dr. Matthew Young, the accumulation and increase of discharge in tubes do not take place in a vacuum.

The increased discharges in cylindrical and conical tubes have been stated in HYDRODYNAMICS, P. C.; but it may be noticed that they cease when the water separates itself from the surface of the tube, so that the latter is no longer filled with the fluid; and such separation may be produced by the concussion arising from a slight blow given to the tube. M. Eytelwein found, that if a cylindrical tube be allowed to project within a reservoir, it reduces the discharge through a simple orifice by one-half, probably in consequence of its interference with the tendency of the particles to converge towards the latter. It may also be observed that horizontal bends in tubes projecting from the sides of vessels diminish the discharges considerably. From the experiments of Venturi, it was found that with three tubes of equal diameters and lengths, of which one was straight, another in the form of a quadrant of a circle, and the third consisted of two parts at right angles to one another, the discharges were, to one another, as the numbers 70, 50, and 45.

The most remarkable circumstance respecting the discharge of water through adjutages, is that which took place when the tube consisted of two parts, one in the form of a cylinder, and the other a frustum of a cone diverging towards the extremity. The diameter of the cylinder was equal to that of the contracted vein; and this part was connected with the reservoir, at the orifice, by a short conic frustum having nearly the form in which the contraction takes place: the two diameters of the frustum, at the opposite extremity, were to one another as 1 to 1·8, but the length of this part was equal to nine times the diameter of the cylinder. The quantity discharged through such a tube was found by Venturi to be, to the quantity discharged through a simple orifice, equal in diameter to the cylinder, in the ratio of 24 to 10; and, to the discharge due to the height of the fluid, as 24 to 16. These results were confirmed by the experiments of Eytelwein and Hachette. The whole length of the tube must not however exceed a few inches.

ADMIRALTY, COURT OF. After the passing of the statute 28 Hen. VIII. c. 15, which put an end to the exclusive jurisdiction of the Court of Admiralty, offences committed on the high seas were tried under a commission specially directed for that purpose. By 7 & 8 Geo. IV. c. 28, offences tried in the Court of Admiralty are to be punished in the same manner as if committed on land, and there is a similar provision in 9 Geo. IV. c. 31. A still greater change has been effected by 7 Vict. c. 2, under which offences committed on the high seas are to be tried by the ordinary commissions of oyer and terminer, or general gaol delivery. The venue is to be the same as if the offence had been committed in the county where the trial is had. Maritime offences may, however, still be tried if necessary by commissions according to the act 28 Hen. VIII. In the act for establishing the Central Criminal Court (4 Wm. IV. c. 36) the judges are empowered to try in that court offences committed on the high seas and other places within the jurisdiction of the Admiralty of England, and to deliver the gaol of Newgate of persons committed for such offences. There is a clause in the act 7 Vict. c. 2, which preserves the jurisdiction of the Central Criminal Court as a Court of Admiralty. The Admiralty Sessions are held twice a year at the Old Bailey, in March and October. The Judge of the Admiralty presides, and two of the Common Law Judges sit with him. By 3 & 4 Vict. c. 65, the High Court of Admiralty is empowered to decide upon all matters and questions concerning booty of war which may be referred to it by the Privy Council. Before the passing of this act there was no court authorized to adjudicate respecting property captured by land forces, or booty, as it is commonly termed by writers on the law of nations; but when occasion required, commissioners were specially appointed for the purpose.

By § 108 of the Corporations Reform Act (5 & 6 Wm. IV. c. 76) all chartered Admiralty jurisdictions in England were abolished, but that of the Cinque Ports, attached to the office of Lord Warden, was expressly reserved. The Court of Admiralty for Scotland was abolished by 1 Wm. IV. c. 69, and the cases formerly brought before it are now prosecuted in the Court of Session or in that of the Sheriff, in the same way as ordinary civil causes. The inferior Admiralty jurisdictions of Scotland were not abolished by the above act.

The constitution of the Court of Admiralty has been affected by two recent acts, the 3 & 4 Vict. c. 65 and c. 66. The first of these acts empowers the Dean of Arches to sit as assistant to or in place of the Judge of the High Court of Admiralty, and admits to this court advocates, surrogates, and proctors of the Court of Arches. The Judge of Admiralty is authorized to make rules of court, and to enjoy all the privileges which pertain to the judges of the superior courts. The Court has power to adjudicate on claims for services and necessaries to ships which may not have been on the high seas but within the body of a county at the time when such services were rendered. It is empowered to direct issues on questions of fact arising in any suit to be tried before a judge of the superior courts of common law, and to direct new trials, or grant or refuse them, subject to an appeal. The 3 & 4 Vict. c. 66, is an act for regulating the salaries and in some respects the duties of the judge and officers of the court. It fixes the salary of the judge at 4000*l.*, with a retiring pension of 2000*l.* after fifteen years' service, or on becoming permanently disabled. It also prohibits the judge from sitting in parliament. The salary of the registrar is 1400*l.*, without fees. In time of war, or in case of a great increase of business, the registrar's salary may be increased to 2000*l.* He must perform his duties personally; but if, in case of illness or absence, he neglects for two days to appoint a deputy, the judge is empowered to appoint one, and to fix his salary, which is to be paid out of the salary of the registrar. The registrar is appointed by the judge, and must be a proctor of not less than ten years' standing. In case of necessity, the judge may direct the registrar to appoint an assistant, subject to the approval of the judge, with a salary of 1200*l.* One of the duties of the registrar is to attend the hearing of appeals befort the Privy Council, instead of the registrars of the Court of Chancery, on whom this duty devolved under 3 & 4 Wm. IV. c. 41. The marshal's salary is 500*l.*, without fees, and it may be increased to 800*l.* in time of war, or if the business of the court should increase. The fees of the court are carried to an account called the fee-fund, out of which all the officers are paid except the judge.

The business and fees of the Court of Admiralty are always much greater in time of war. From 1778 to 1782 Judge Marriot received 4500*l.* a year, the salary being 800*l.*, and the fees averaging 3700*l.* a year. On the return of peace his salary was increased to 980*l.*; and his total income during the peace averaged 1380*l.* a year. In 1794 the salary of the office was increased by the addition of 400*l.* a year. In the first ten years of the French revolutionary war, the income of Sir W. Scott averaged 5700*l.* a year, the salary being 2500*l.* and the fees 3200*l.* About a thousand cases a year were determined by the court during the war. (Evidence of Dr. Nichol before Select Committee on Admiralty Courts, in 1833; reprinted in 1843, by order of the House of Commons.) The Prerogative and Admiralty Courts were presided over by one judge on two occasions in the last century, from 1710 to 1714, and from 1773 to 1778. The Parliamentary Committee of 1833 recommended that the two judges of these courts should sit interchangeably, when occasion may require, either in one court or the other.

ADMISSIONS IN A SUIT are those facts or matters necessary to support the case of the plaintiff, or of the defendant, in a suit in equity, the necessity of proving which is removed by the opposite party admitting them.

Admissions are either, I. Upon the record, or II. By agreement between the parties.

I. Admissions upon the record are either, 1, *actual*, that is to say, positively contained in the pleadings; or, 2, *constructive*, that is to say, to be drawn by necessary inference from the form of the pleadings adopted.

1. The statements in a bill in equity, the truth or correctness of which is distinctly admitted in the answer, become thereby evidence for the plaintiff, and may be used by him to show the extent of the admissions made by the defendant. But when the bill contains a statement of an instrument, as of a deed or will, and the defendant, while he admits it to be to the tenor and effect set forth in the bill, refers to the document itself for greater certainty, he has a right to insist upon the document itself being read.

When a bill has been taken *pro confesso* against the defendant, under the stat. 1 Wm. IV. c. 36, it may be read in evidence against the defendant against whom it has been taken *pro confesso*.

In an answer, not only the simple admission of a fact, but the statement of a defendant that 'he believes,' or has been 'informed, and believes' such a fact to be true, is sufficient, unless when the statement is accompanied by some clause to prevent its being considered as an admission. However, an exception to this rule is made as to the statement of an heir at law, that he believes a will to have been duly executed. In that case the court requires either a direct admission or proof of the execution. The answer of an infant, being in fact the answer of his guardian, cannot be used against the infant, though it may, it seems, against the guardian in respect of his own interest. But the rule is different with respect to the answer of an idiot or lunatic put in by his committee, or that of a person of weak intellect put in by his guardian. In these cases admissions in the answers are evidence against them. The joint answer of a husband and wife may be read against them in matters relating to the wife's personal estate; but neither the joint answer, nor the separate answer of the husband, with relation to her inheritance. The answer of one defendant is not evidence against a co-defendant, unless where a defendant makes it so by referring to a statement in the answer of his co-defendant.

The courts of equity permit the plaintiff to read any portion of the answer which he thinks will support his case, provided that, in reading the admission of a fact, he reads at the same time any admissions or qualifications with which it is accompanied, and the whole of the passage in which the admission is contained. The rule is different in courts of law, in which, if an answer in equity is offered in evidence against a party, he has a right to insist upon the whole being read.

2. With respect to constructive admissions, the most common instance of them is when a plea has been put in by a defendant, either to the whole or part of a bill; in which case the bill, or that part of it which is pleaded to, and not controverted by the plea, is admitted to be true. So when a special replication (a form now almost disused) is put in to an answer, all parts of the answer not denied by the replication are admitted to be true. Again, the statement of facts contained in a plaintiff's bill is in equity, but not at law, constructive admission as against him of the facts as stated, when the allegation of them is positive, as of his own acts, or of facts within his own knowledge, though not when they are stated by way of pretence or hypothetical allegation, for the purpose of raising an answer to an anticipated defence, with a protest against their being considered as admitted; and the bill may be read as evidence of the facts so positively averred, not only in the suit in which the bill is filed, but even in another suit, upon proof that the bill containing the statements was filed with the privity of the plaintiff; which is necessary, because any person may file a bill in another's name. The right of a defendant to read the plaintiff's bill is confined to the bill as it stands upon the record, and therefore where the bill has been amended the defendant cannot read the original bill in evidence of the facts of the case, though he sometimes may for other purposes.

There is great difference between actual and constructive admissions, in the manner in which they are presented to the court: the former are read to establish the case of the party reading them, in the same manner and at the same time as the other evidence in the cause; the latter are stated to the court when the pleadings are opened, for the purpose of showing what are the matters in issue between the parties, and what are the facts which by the form of the pleadings they are precluded from disputing.

The rules as to admissions upon the record, whereby the necessity of evidence is precluded, are applicable to suits in equity only. (Daniel's *Practice in Chancery*, vol. ii. p. 396 et seq.)

II. Admissions by agreement between the parties are those which the parties or their attorneys or solicitors agree upon between themselves, for the sake of saving expense or preventing delay. They are usually made in writing, and signed by the parties or their solicitors, but not necessarily so. Agreements for admissions will not be sanctioned by the court, if they violate any known principles of law. Thus, there can be no agreement to admit a wife as a witness for or against her husband, nor to waive an objection to an instrument for want of a stamp. For the same reason that an infant cannot be bound by his answer, he cannot be bound by admissions made on his behalf, unless such admissions are for his benefit.

ADMITTANCE. [COPYHOLD, P. C.]

ADULTERATION (from the Latin *Adulteratio*) is the use of ingredients in the production of any article, which are cheaper and not so good, or which are not considered so desirable by the consumer as other or genuine ingredients for which they are substituted. The sense of the Latin word is the same. (Pliny, *Hist. Nat.* xxi. 6.) The law does not consider adulteration generally as an offence, but relies apparently on an evil of this nature being corrected by the discrimination and good sense of the public. The selling of unwholesome provisions, as meat or fish, is punishable under most local acts; and is also an offence at common law. In Paris, malpractices connected with the adulteration of food are investigated by the Conseil de Salubrité, acting under the authority of the prefect of police. In this country, where the interests of the revenue are concerned, strict regulations have been resorted to in order to prevent adulteration. It is not, however, heavy customs or excise-duties alone which encourage adulteration, for the difference in price between the genuine and the spurious article, when both are free from taxation, presents great inducement to the practice. The following is an abstract of the law respecting the adulteration of some of the principal articles of revenue:—

Tobacco-manufacturers are liable to a penalty of 200*l.* for having in their possession sugar, treacle, molasses, honey, commings or roots of malt, ground or unground roasted grain, ground or unground chicory, lime, umbre, ochre, or other earths, sea-weed, ground or powdered wood, moss or weeds, or any leaves, or any herbs or plants (not being tobacco leaves or plants), respectively, or any substance or material, syrup, liquid, or preparation, matter, or thing, to be used or capable of being used as a substitute for, or to increase the weight of, tobacco or snuff (5 & 6 Vict. c. 93, § 8). Any person engaged in any way in the preparation of articles to imitate or resemble tobacco or snuff, or who shall sell or deliver such articles to any tobacco-manufacturer, is also liable to a penalty of 200*l.* (§ 8). The penalty for actually adulterating tobacco or snuff is 300*l.* (§ 1); and for having such tobacco or snuff in possession, 200*l.* (§ 3). The Excise-survey on tobacco-manufacturers, abolished by 3 & 4 Vict. c. 18, has been re-established in consequence of the extraordinary extent to which adulteration was carried.

The ingredients used in the adulteration of beer are enumerated in the following list of articles which brewers or dealers and retailers in ale and beer are prohibited from having in their possession under a penalty of 200*l.* (56 Geo. III. c. 58, § 2). These articles are—molasses, honey, liquorice, vitriol, quassia, cocculus Indicus, grains of Paradise, Guinea pepper, and opium; and preparations from these articles are also prohibited. They are used either as substitutes for hops or to give a colour to the liquor in imitation of that which it would receive from the use of genuine ingredients. By § 3 of the same act a penalty of 500*l.* is imposed upon any chemist, druggist, or other person, who shall sell the articles mentioned in § 2 to any brewer or dealer in beer. The penalties against dealers in beer in the above act are extended to beer-retailers under 1 Wm. IV. c. 64, and 4 & 5 Wm. IV. c. 85, which acts also contain special provisions against adulteration applicable to this particular class of dealers; and the licence also prohibits the sale of ale, beer, and porter, made otherwise than from malt and hops; or adulterated with drugs; or fraudulently diluted, adulterated, or deteriorated.

Tea, another important article of revenue, is protected from adulteration by several statutes. The act 11 Geo. I. c. 30, § 5, renders a tea-dealer liable to a penalty of 100*l.* who shall counterfeit, adulterate, alter, fabricate, or manufacture any tea, or shall mix with tea any leaves other than leaves of tea (§ 5). Under 4 Geo. IV. c. 14, tea-dealers who dye, fabricate, or manufacture any sloe-leaves, liquorice-leaves, or the leaves of tea that have been used, or any other leaves in imitation of tea; or shall use terra japonica, sugar, molasses, clay, logwood, or other ingredients, to colour or dye such leaves; or shall sell or have in their possession such adulterated tea, are liable to a penalty of 10*l.* for every pound of such adulterated tea found in their possession (§ 11). The 17 Geo. III. c. 29, also prohibits adulteration of tea (§ 1).

The adulteration of coffee and cocoa is punished with heavy penalties under 43 Geo. III. c. 129. Any person who manufactures, or has in his possession, or who shall sell, burnt, scorched, or roasted peas, beans, grains, or other grain or vegetable substance prepared as substitutes for coffee or cocoa, is liable to a penalty of 100*l.* (§ 5). The object of § 9 of 11 Geo. IV. c. 30, is similar. Chicory has been very extensively used in the adulteration of coffee in this country. This root, which possesses a bitter and aromatic flavour, came into use on the Continent in consequence of Bonaparte's decrees excluding colonial produce. Coffee with which a fourth or a fifth part of chicory has been mixed is by some persons preferred as a beverage to coffee alone; but in England it is used to adulterate coffee in the proportion of one-half. The Excise has for some time permitted the mixture of chicory with coffee. In 1832 a duty was laid on chicory, and this duty has been increased: chicory itself is also adulterated. Besides the quantity imported, chicory is also grown in England, and to prevent fraud it will be necessary to place the cultivation under some restriction, or perhaps, as in the case of tobacco, to prohibit the growth of it altogether.

The manufacturer, possessor, or seller of adulterated pepper is liable to a penalty of 100*l.* (59 Geo. III. c. 53, § 22). The act 9 Geo. IV. c. 44, § 4, extends this provision to Ireland.

In the important article of bread there are prohibitions against adulteration, though they are probably of very little practical importance. The act 6 & 7 Wm. IV. c. 37, which repealed the several acts then in force relating to bread sold beyond the city and liberties of London, and ten miles of the Royal Exchange, was also intended to prevent the adulteration of meal, flour, and bread beyond these limits. No other ingredient is to be used in making bread for sale except flour or meal of wheat, barley, rye, oats, buckwheat, Indian corn, peas, beans, rice, or potatoes, mixed with common salt, pure water, eggs, milk, barm, leaven, potato or other yeast, in such proportions as the bakers think fit (§ 2). Adulterating bread, by mixing other ingredients than those mentioned above, is punishable by a fine of not less than 5*l.* nor above 10*l.*, or imprisonment for a period not exceeding six months; and the names of the offenders are to be published in a local newspaper (§ 8). Adulterating corn, meal, or flour, or selling flour of one sort of corn as flour of another sort, subjects the offender to a penalty not exceeding 20*l.* and not less than 5*l.* (§ 9). The premises of bakers may be searched, and if ingredients for adulterating meal or flour be found, the penalty for the first offence is 10*l.* and not less than 40*s.*; for the second offence 5*l.*, and for every subsequent offence 10*l.*; and the names of offenders are to be published in the newspapers (§ 12). There are penalties for obstructing search (§ 13). Any miller, mealman, or baker acting as a justice under this statute incurs a penalty of 100*l.* (§ 15).

The above act did not apply to Ireland, where the baking trade was regulated by an act (2 Wm. IV. c. 31), the first clause of which, relating to the ingredients to be used, was similar to the English act just quoted. In 1838 another act was passed (1 Vict. c. 28), which repealed all former acts relating to the sale of bread in Ireland. The preamble recited that the act 6 & 7 Wm. IV. c. 37, had been found beneficial in Great Britain; and the clauses respecting adulteration are similar to the English act.

The several acts for regulating the making of bread within ten miles of the Royal Exchange (which district is excluded from the operation of 6 & 7 Wm. IV.) were consolidated by the act 3 Geo. IV. c. 106. Under this act any baker who uses alum, or any other unwholesome ingredient, is liable to the penalties mentioned in § 12 of 6 & 7 Wm. IV. c. 37. Any ingredient or mixture found within the house, mill, stall, shop, &c. of any miller, mealman, or baker, and which shall appear to have been placed there for the purpose of adulteration, renders him liable to similar penalties.

Other articles besides those which have been mentioned are adulterated to a great extent, and there is scarcely an article, from arrow-root to guano, which escapes; but perhaps the remedy for the evil is not unwisely left to the people themselves, who probably are less likely to be imposed upon when depending on the exercise of their own discrimination, than if a commission of public functionaries were appointed, whose duty should consist in investigating and punishing persons guilty of adulteration. The interference of the government in this country with the practice of adulteration, except in the case of bread and drugs [Apothecaries' Company, P.C.S.], has evidently had no other object than the improvement of the revenue.

Adulteration and the deceitful making up of commodities appear to have frequently attracted the attention of the legislature in the sixteenth century, and several acts were passed for restraining offences of this nature. The act 23 Eliz. c. 8, prohibits under penalties the practice of mixing bees'-wax with rosin, tallow, turpentine, or other spurious ingredient. The following acts have reference chiefly to frauds in the making up of various manufactured products:—3 Hen. VIII. c. 6; 23 Hen. VIII. c. 17; 1 Eliz. c. 12; 3 & 4 Edw. VI. c. 2; 5 & 6 Edw. VI. c. 6; 5 & 6 Edw. VI. c. 23.

ADVOCATES, or FACULTY OF ADVOCATES. [Barrister, P. C., p. 504.]

AE'LODON, the generic title applied by H. von Meyer to the fossil crocodile or gavial of Monheim.

ÆOLHARMO'NICA. [Harmonium, P. C. S.]

ÆOLI'NA, a very small musical instrument, consisting of a number of short elastic metallic laminæ, or springs, fixed in a frame, and acted on by the breath of the performer. The best of the kind comprise three octaves of diatonic sounds, and are also capable of giving the three simple harmonies of the key. This instrument was the first formed on such a principle that appeared here, and became exceedingly popular in every sense of the word, but was very speedily superseded by a much more perfect thing of the kind, the Accordion, and has already fallen into disuse. [Accordion, P. C. S.; Concertina, P. C. S.]

ÆOLO'DIKON. [Harmonium, P. C. S.]

ÆO'LOPHON. [Harmonium, P. C. S.]

ÆPI'NUS, FRANCIS MARIA ULRIC THEODORE, a celebrated electrician of the eighteenth century, who was born at Rostock in Lower Saxony, December 12, 1724, but of whose life few particulars have been preserved: he died at Dorpat in Livonia, in 1802.

Several memoirs by Æpinus, relating to mathematical and philosophical subjects, were printed in the 7th, 8th, 9th, and 10th volumes of the 'Novi Commentarii Petropol.,' and in the 'Mémoires' of the Berlin Academy for 1755 and 1756. In the volume for the latter year, and also in a 'Recueil de Mémoires' published at St. Petersburg in 1762, is his paper entitled 'De quibusdam Experimentis Electricis,' &c., which contains the discovery of the electrical polarity of tourmaline, a mineral which has since been so much noticed on account of its properties with respect to polarized light. Æpinus found that on exposing a piece of the mineral to a heat between 99¼° and 212° Fahrenheit, one extremity of it acquired the vitreous and the other the resinous electricity. In the tenth volume of the 'Novi Comment.' is his paper concerning the effect of parallax on the duration of a transit of Venus over the disk of the sun, in consequence of the position of the observer on the earth's surface; and in the same volume is one on the accidental colours produced by looking directly at the sun. Also, in the twelfth volume of the same work there is contained an account of the electrical properties of the Brazilian emerald, a crystal which has been since found to be merely a variety of tourmaline. In 1758 he published at St. Petersburg an academical discourse concerning the similarity of electricity and magnetism; and in 1761, at the same place, a treatise entitled 'Cogitationes de Distributione Caloris per Tellurem.'

But Æpinus is chiefly distinguished by his 'Tentamen Theoriæ Electricitatis et Magnetismi,' which, in 1759, was published also at St. Petersburg. In this work he sets out by assuming that there exists in all bodies a fluid whose particles mutually repel one another with forces decreasing as the distances between them increase, and, according to the same law, attract the particles of the bodies with which they are in combination. He assumes also that the electrical fluid penetrates with difficulty through the bodies called electrics, as glass, resin, &c.; and that it meets with no sensible obstruction in passing through such as are called non-electrics or conductors, as the metals, unbaked wood, &c.: and he has succeeded in showing, by the strict processes of mathematical analysis, that the phenomena of electricity depend chiefly on the tendency of the fluid to attain a state of equilibrium, by passing from a body which contains an excess to those about it which may have less than the natural quantity. The intricate subject of the distribution of electricity and magnetism on the surfaces of bodies of given forms, as spheres or spheroids, is however left untouched; and though the results of the investigations, so far as they extend, accord satisfactorily with phenomena, yet there remains an unsurmounted difficulty in the fact that, when a body is deprived of the electrical fluid, its particles are held together by cohesion, while the theory requires that in such a state the particles should exert on one another repulsive forces.

In the 'Philosophical Transactions' for 1771 there is an elaborate paper containing a mathematical theory of electricity, on the same principles as those assumed by Æpinus, which was written by Mr. Cavendish without any knowledge of what had been previously done by the continental philosopher. And an abridgment of the Theory of Æpinus was published by M. Haüy in 1787, under the title 'Exposition de la Théorie de l'Electricité.'

Æpinus discovered the means of charging a plate of air with electricity, when it is confined between two boards. He appears to have directed his attention to mechanical subjects; for he discovered that when any forces, acting upon the arms of a balance, keep them in equilibrio, the sum of the forces, decomposed in the direction of the arms, is a maximum.

(*Biographie Universelle.* The brief notices of the discoveries of Æpinus are taken from the works named above.)

AERIAL IMAGES. This name is given to those which are caused by the convergence of reflected or refracted rays of light, when they appear to be suspended in the air.

The images which are caused by the refraction of light in the strata of air near the surface of the earth or sea, when these strata, from heat or moisture, differ considerably in density from the strata above them, have been described under Mirage, P. C.; and it is intended here to mention only those which are perceived on looking in or towards a concave mirror.

If an object be placed, or if a spectator place himself, directly in front of such a mirror, at a greater distance from it than the centre of its curvature, the pencils of light diverging from points on the surface of the object, or from that part of the spectator's person which is turned towards the mirror and is not very far from its axis, will, after reflexion, converge to corresponding points between the object or spectator and the mirror, and will constitute an inverted image of either. Now, let the spectator be himself the object: then the rays in each pencil, crossing one another at the image, and falling afterwards in a divergent state on his eye, will produce vision of the image; but those which enter the eye being in this situation few in number, and the eye not being capable of making the diverging rays unite on the retina, the image will appear faint and indistinct: in these circumstances also it usually appears to be within or behind the mirror.

But, as the spectator approaches the mirror, the reflected rays which form the image converge less rapidly, and meet at a greater distance from the mirror in its front; the eye at the same time, being nearer the image, receives pencils which are reflected from parts of the mirror at greater distances from the axis, so that the image appears both greater and more distinct; and if the mirror be at least 18 or 20 inches in diameter, the image of the spectator will be seen hanging in the air, in an inverted position, between himself and the mirror.

If, while the spectator is yet farther from the mirror than the centre of curvature, he advance his hand towards the mirror, the hand of the image will seem to advance to meet it; and at a certain place, which is the centre of the mirror's curvature, since there the rays in the pencils which proceed from the hand will be reflected back in the same lines, the hand and its image will appear to coincide. In this situation the inverted image of the spectator will be very distinctly seen between the mirror and his hand.

If the spectator now advance towards the centre, the image will advance to meet him, but it will become indistinct, and at the centre it will be entirely lost. Proceeding beyond the centre towards the mirror, the reflected pencils will converge to points beyond the centre in the opposite direction, that is, behind the spectator, and the rays of the pencils will enter the eye before they can unite to form the image: then the spectator will perceive the reflexion of himself in the mirror in an erect position; and the figure will become more distinct as he approaches nearer to the mirror, since the reflected rays in each pencil approach nearer to parallelism, and become quite so when he is at the principal focus, or midway between the mirror and its centre of curvature.

ÆTHERS. The most common of these, with the methods of preparing them, have been previously described in P. C. vol. i. p. 159. It is intended here only to notice the medical uses of those long known, with a few of those more recently introduced. The first to be treated of, after giving a brief general view of their modes of action on the human system, is sulphuric æther, which is always understood to be the one indicated when the term æther is employed absolutely. The German chemists and therapeutists designate them *naphthae*, a term liable to cause them to be confounded with *bitumens*. Æthers present the most perfect examples of volatile stimulants, being unequalled for rapidity of action, when immediate aid must be imparted to the muscular system, especially the involuntary muscles, by augmenting the nervous power, and by quickening its development. Whether they effect this by a direct impression on the nerves, or by previous absorption into the circulation, it is very difficult to determine, since most of them are absorbed so rapidly, as almost instantly to mix with the circulating mass. They bear the greatest resemblance to alcoholic stimulants; but are distinguished by more instantaneous effects. These however are more transient, and a more frequent repetition of the dose is therefore required. Fatal results are less likely to follow from large doses of æther than of alcohol, a fact which can only be accounted for by the excess being more speedily thrown out of the system, especially by pulmonary and in some degree by cutaneous exhalations; for the more highly carbonized constitution of æther would lead us to expect a contrary result. This furnishes the proper guide for the treatment of cases of poisoning by them, viz. placing the patient where he may respire as pure air as possible, and in the light, carrying on artificial respiration if needful, occasionally dashing cold water on the face and temples, and cautiously using venesection or cupping. Transmitting a galvanic current of a moderate force along the eighth pair of nerves is often beneficial. Perseverance in the use of these means for hours is frequently successful. Sulphuric æther is the most powerful of ætherial preparations, and therefore of diffusable stimulants. It is distinguished from the others likewise by having less secondary effects upon the system. Hence it is more employed for its primary effects than for both primary and secondary effects. It is of a peculiar, strong, penetrating, rather agreeable odour; the taste is at first cooling, afterwards hot, leaving a feeling of dryness in the mouth and throat. Its volatility is very great, and though it does not excite redness of the mucous membrane of the stomach in a moderate dose, yet being quickly changed into vapour by the heat of that organ, it causes contraction of its muscular coat, and expulsion of gas, thus acting as a carminative, or it produces most painful distension if that viscus be not powerful enough to resist its local action, and is followed by slight cerebral excitement, and even a feeling similar to intoxication may be experienced, which however soon passes off, without leaving any marked depression; though a disposition to sleep, and sometimes tendency to perspiration, are the ultimate consequences. The lungs are the common channel by which it is eliminated; this æther having less influence on the kidneys or skin than the other sorts. If spasm, irregular action, or debility of the organs of circulation, respiration, or digestion, existed previous to its administration, these generally disappear speedily, or are alleviated by its use. Hence it ranks as an antispasmodic of the highest kind. It is therefore resorted to in all cases of imminent danger, from difficulty of breathing, colic, flatulence, and deep depression, such as occurs in cholera Asiatica, or the later stages of fever. In relieving paroxysms of asthma it is unrivalled, and may be inhaled along with the vapour of warm water, or by being dropped on a portion of sugar held between the teeth. Like all stimulants, habit diminishes its influence on the system, so that the dose requires greatly to be increased. So much as two ounces have been taken by an adult in twenty-four hours. This is hazardous, and the necessity for it may be diminished by alternating sulphuric æther with some of the other æthers, which, though little known or used in this country, are found very effectual by the German, French, and American practitioners. An increase of our ætherial preparations would be a valuable accession to our curative agents. Economy and physiology alike recommend this proceeding. The great solvent power of sulphuric æther renders it an eligible menstruum for the administration of a variety of articles; by these its own powers are heightened. It has also been attempted to take advantage of its power in this respect, by employing it in cases of biliary calculi, not merely to alleviate the agonizing pain, but from a belief that it would dissolve the calculus, and so lessen its bulk. Oil of turpentine is a good addition. It has also been recommended against tape-worm, from a notion that the volatilized æther would greatly annoy the worm, and allow it to be easily removed by a dose of castor oil or other purgative. This is not free from inconvenience and even danger to the feeble persons who are infested with the tape-worm. The antispasmodic powers of æther are much increased by adding tincture of opium, or a solution of the hydrochlorate of morphia. This combination furnishes the most effectual means of warding off a paroxysm of hysteria or epilepsy, if administered promptly. This is an object of great moment, as every fit, if allowed to take place, predisposes to a recurrence of them. Externally, æther is applied to the temples to relieve nervous headaches; and also over hernial tumours, in order that by the cold consequent on its evaporation the hernia may contract and be reduced: a portion of thin oiled silk should lie interposed between the æther and the skin.

Sulphuric æther is rarely found in the shops perfectly pure. The casual or intentional adulterations interfere more with its chemical properties as a solvent of various substances than with its medicinal powers. Time however resolves it, particularly if kept in the light, into acetic acid and alcohol. It ought therefore to be recently prepared, and preserved in an obscure place. The spirit of sulphuric æther is only a weaker form, with some ætherial oil, of the pure æther.

Nitric or hyponitrous æther is never employed pure in medicine, but only as the spirit of nitric æther. This has considerable resemblance to the sulphuric æther, but is more miscible with water. It likewise has more marked secondary effects, especially on the kidneys and skin. Hence it is much employed as a diuretic. Its impression on the organ of taste is aromatic, sweet, and cooling, and it is known familiarly as the *sweet* spirit of nitre. Its restorative action is neither so quick nor so certain as that of sulphuric æther; but where dropsical effusions co-exist with disease of the heart, it merits the preference. It is charged with uncertainty as a diuretic, less perhaps from its own nature than from want of accurate discrimination of the varieties of condition both of the system at large and of the kidneys, when diuretics are indicated, and from the very common error of mingling in the same formula medicines of very opposite modes of action, though each singly may be diuretic. [DIURETICS, P. C.] The vapour of this, as well as of sulphuric æther, when copious, has proved fatal to those exposed to it. All bottles containing them should be kept well stopped or corked. Sweet spirit of nitre is a useful addition to copaiba both as aiding to convert it into the form of mixture, and as a diuretic for diluting the acrimony of the urine, where copaiba is given in diseases of the bladder and urethra. (Christison.) Nitric æther is often fraudulently added to malt spirits to give them the flavour of French brandy. (Paris.)

Chloric æther is also markedly diuretic. It is a most valuable analeptic in the sinking stages of fevers, and much commended by Dr. Copland (see his Dictionary, vol. i. p. 927) and the best American physicians. By them it is much used in asthma, and asthenic diseases of various kinds.

Acetic æther is a very agreeable stimulant, possessing a grateful odour, resembling Rhine-wine, and a cooling, aromatic, somewhat bitterish taste. Its action is similar to that of the other æthers, and though not so potent, it is more agreeable to take. Its long continued use however oppresses the digestive organs. Nevertheless it deserves to be employed in adynamic fevers, its action on the skin rendering it very advantageous. In tendency to fainting it is very serviceable; also in asphyxia. In some local affections it is of great utility applied in the form of vapour, such as some forms of deafness. (See Pilcher *On the Ear*.)

Phosphoric æther is a valuable restorative in the paralytic stage of fever.

AESHNA. In this recent genus of Libellulidæ Mr. Strickland ranks a fossil insect from the lias of Warwickshire.

AETHOPHY'LLUM, a fossil genus of plants from the keuper. (Brongniart.)

AË'TION (Ἀετίων), a celebrated Greek painter, and, according to Lucian, one of the best antient colourists; that writer mentions Aëtion, Apelles, Euphranor, and Polygnotus as the most successful of the antient Greek painters in the mixing and laying on of colours. Aëtion's exact time is uncertain, although from the manner in which he is mentioned by Lucian, notwithstanding the names he is associated with, he lived probably in Lucian's own time, or at most very shortly before him. He speaks of him as the most distinguished painter of his time, and describes a very celebrated picture by him of the marriage of Alexander and Roxana, which the painter exhibited at the Olympic games, and which pleased Proxenidas, one of the judges, so much that he gave Aëtion his daughter in marriage. 'It may be asked,' says Lucian, 'what was there so marvellous in that painting, as should induce a man of such high rank to reward the painter, who withal was a stranger, by bestowing on him his daughter? The picture is still in Italy, and I am able to speak of it from personal inspection. It represents an extremely magnificent bed-chamber with a nuptial bed. In it is seen sitting Roxana, the most beautiful virgin that can be conceived. Her eyes are modestly fixed on the ground before Alexander, standing near her. She is surrounded by several smiling Cupids. One of them behind her lifts up the bridal veil from her forehead, and shows it to the bridegroom. Another, in the attitude of a slave, is officiously employed in drawing off her shoes, that she may no longer be detained from lying down. A third has hold of Alexander's robe, pulling him with all his might towards Roxana. The king presents the maiden with a crown, and beside him stands Hephæstion as a brideman, holding a lighted torch in his hand, supported by a wonderfully fine youth, whom I guess to represent the god of marriage, for the name is not beneath. On the other side of the piece are drawn several more Cupids, playing with the arms of Alexander. Two of them carry his spear, and seem almost overburdened with the weight of it. Another couple take his buckler, with a figure like the king stretched upon it, trailing it along by the handles. Another creeps backwards into the coat of mail, where he seems to lurk in order to frighten the two little porters as they come on.' 'These collateral incidents,' continues Lucian, 'are by no means the mere wantonness and idle sport of the artist's fancy; they are to show the martial disposition of the bridegroom, and that his love for Roxana had not effaced his passion for arms and military glory.' (Tooke's Translation.)

From this description Raphael is said to have made a design, of which there are duplicates or copies, and it was executed in fresco, in the so-called Villa of Raphael, in the garden of the Villa Borghese at Rome; but the composition is puerile, and does not at all merit the praises which Lucian has given to the antient performance of Aëtion: it has been several times etched or engraved, by J. Caraglio, Volpato, and others.

Lucian in the above description remarks, that he guesses a fine youth to represent the god of marriage, *as the name is not beneath*. He alludes to an antient custom which prevailed among the Greeks, of attaching the names in their pictures to the figures represented; the names in most cases were probably written below the feet of the figure. In the pictures on vases we find the name sometimes written by the side of the figure, but the practice was not universal. In this case, from Lucian's remark, it would seem that some of the figures had names attached to them, as he speaks of the other characters with certainty, and guesses only at the god of marriage, because there was no name attached. It was a practice, however, seldom if at all had recourse to in later times, and in case of its employment the name was probably so placed as not to disturb the pictorial effect. Sometimes sentences were inscribed on pictures, as for instance Zeuxis wrote upon his picture of Helen three lines from Homer, celebrating her extraordinary beauty. (*Iliad*, iii. 156-158; Valerius Maximus, iii. 7, § 3.) There are similar examples on works of the middle ages, and also of much later times: inscriptions below allegories are very common.

The circumstance that Pliny has not mentioned Aëtion is an additional reason for concluding that he lived about Lucian's own time, or in the early half of the second century of our æra, subsequent to Pliny. Some however have supposed that the Echion of Pliny and Cicero is the Aëtion of Lucian, especially as the former was celebrated for a picture of a bride distinguished for the modesty of her expression; but this implies a great blunder in Lucian, who speaks of him as a painter of his own time, and there is no sufficient reason for such a supposition.

(Lucian, *Herodotus* or *Aëtion*, *De Mercede Conductis*, 42, and *Imag.* 7; Pliny, *Hist. Nat.* xxxv. 10. 36; Cicero, *Brutus*, 18; *Parad.* v. 2.)

AË'TIUS (Ἀέτιος), of Amida in Mesopotamia, a Greek writer on medicine, who probably lived about the end of the fifth and the beginning of the sixth century of our æra, as we may infer from the persons whom he mentions in his work. He studied medicine at Alexandria, then the seat of the most celebrated medical school, and afterwards he went to Constantinople, where he appears to have been raised to a high office at the court, since Photius (*Biblioth. Cod.* 221) calls him κώμης ὀψικίου, that is, *comes obsequii*, a title belonging to the principal officers attending upon the person of the emperor Aëtius was a Christian, but not free from the superstitions which at that time were introduced into Christianity from Egypt, and which were connected with his profession. His work contains some curious examples of the pretension to cure diseases by means of superstitious ceremonies. The work of Aëtius which has come down to us entire bears the title of Βιβλία ἰατρικά or βιβλίον ἰατρικόν, and consists of 16 books. The whole however was afterwards divided by some editor into four sections, each of which contained four books, from which the work is also called Tetrabibli (Τετράβιβλοι). According to Photius (*l. c.*), who gives a brief summary of the work, it is a compilation made from the writings of Oribasius, Galen, Archigenes, Rufus, Dioscorides, Herodotus, and other eminent medical authors; but the compilation is made with judgment, and Aëtius appears to have introduced into it many new and original things. The book is a kind of systematic encyclopædia of medicine, embracing the whole range of medical and surgical knowledge of the antients. A complete edition of the Greek original has never yet been published. The first eight books appeared at Venice (1534, fol.), but the second volume, which was to contain the remaining eight books, never made its appearance. Particular chapters on separate subjects have been edited at different times; but an edition of the whole, though it has often been contemplated and promised, has not been made. The Latin translations are numerous. One by Janus Cornarius, containing books 8, 9, 10, 11, 12, and 13, appeared at Basel (1533, fol.), and one of the remaining 10 books, by J. B. Montanus, was published at Basel (1535) in 2 vols. fol. Complete translations of the whole work appeared at Venice (1534, 4to., 1543, &c., 8vo.), Basel (1534 and 1539, fol.), Lyon (1549, fol.), and at Paris (1567, fol.) among H. Stephens's 'Medicae Artis Principes.'

(Fabricius, *Biblioth. Graec.* ix. p. 228, &c., where a full account of the modern literature on Aëtius is given.)

AETO'BATES. Two species of this genus of Rays occur in the London clay of Sheppey. (Agassiz.)

AFFEERERS. [LEET, P. C.]

AFGHANISTAN, or the country of the Afghans, comprehends the eastern portion of the table-land of Iran, and lies between 28° and 35° 30′ N. lat., and between 62° and 73° E. long. It extends from north to south about 450 miles, and more from east to west; its mean width, near 31° N. lat., is about 470 miles. This gives an area of more than 211,500 square miles, so that it is somewhat larger than France. To the north of it is Turkistan, to the east the Panjab, to the south Beloochistan, and to the west Persia. Beloochistan is properly a part of Afghanistan, but is at present politically separated from it.

Afghanistan is an elevated table-land, the eastern base of which is washed by the Indus river. A comparatively narrow tract of low ground divides the river from the mountain-masses which constitute the eastern edge of the table-land. These masses generally rise with a steep acclivity to an elevation of about 6000 feet above the sea, and on their summit the table-land extends westward to the boundary-line of Persia. But in proceeding in that direction the elevation of the table-land diminishes, so that along the western boundary-line of the country it is probably less than 3000 feet above the sea-level, except towards Beloochistan, from which it is divided by a range which seldom sinks below 5000 feet and often rises to 9000 feet. These masses however are not extensive, nor can they be called very elevated when compared with the elevated mountain-region which encloses the table-land on the north. These mountains rise in some parts to 18,000 and 20,000 feet, and may be considered as an offset of the Himalaya mountains of Hindustan. In Afghanistan they form four mountain-regions, which from east to west are known by the names of Hindoo-coosh, Pughman Mountains, Koh-i-Baba, and Paropamisus. The last name is taken from the Greek authors. The mountain-regions to which it is applied are now known as the Mountains of the Hazarah and Eimack, from the names of two tribes that inhabit them, and in history are mentioned as the Ghor mountains. The southern declivity of all these northern mountains is mostly included within the boundaries of Afghanistan, and it is not near so rapid as the northern, which sinks down to the plains drained by the Amoo or Oxus river, which are at least 3000 feet lower than the table-land.

Surface; Soil; Rivers:—Northern Mountain-Regions.—I. Between 35° and 34° N. lat. the Indus runs in a south-south-west direction, and between two very elevated mountain-ranges, of which the eastern is undoubtedly a part of the Himalaya mountains; and as the western is a direct continuation of this great range and resembles it in other respects, the name of Himalaya mountains is now also applied to the western mountains as far as 70° E. long. This range however, which runs from east-south-east to west-north-west, though it rises in some places as high as 20,000 feet above the sea-level, does not constitute the water-shed of the rivers of this mountain-region, which occurs farther to the north in a range that runs nearly due east and west, and appears to be a continuation of the great mountain-range called Kuenluen, which traverses the interior of Asia between 36° and 38° N. lat. This continuation of the Kuenluen is called in Afghanistan, the Hindoo-coosh. As the Himalaya mountains and the Hindoo-coosh do not run parallel, but converge, they unite in one mountain-mass between 70° and 69° E. long. The country included by these two ranges is called Kaferistan. It includes the northern declivity of the *Western Himalaya Mountains*, the southern only belonging to Afghanistan. When seen from the plains at their base, these mountains rise in terraces; the northern and higher mountain overtopping the southern and lower, and thus at some places four ridges are visible. The valleys which are enclosed within this range are of considerable width, but the cultivable soil is confined to a narrow strip along the line of drainage. The space between the higher portion of the ridges and the base of the hills is an inclined plane, sometimes very wide, strewed or entirely covered with boulders and shingle without a particle of soil. But the declivity of the hills is covered with a rich soil of considerable depth, the bare rock being only exposed where the inclination of the upper strata approaches so near the perpendicular, that no lodgement of soil can take place. A considerable portion of these declivities is under cultivation, and the remainder, to an elevation of 10,000 feet above the sea-level, is overgrown with high forest-trees; near the base and to an elevation of 4500 feet above the sea the forests consist of baloot, a species of oak, but above that line they are mixed with zaitoon, a species of olive. The last-mentioned species forms the chief if not the only forest-tree as high as 6500 feet, where it is gradually replaced by the deodara, a species of fir. The forests that cover the Himalaya mountains are the most extensive in Afghanistan.

Near 70° 12′ E. long. and 37° 55′ N. lat., where the Himalaya already seem to be connected with the Hindoo-coosh, the nature of the mountains changes suddenly. The valleys indeed do not differ much in extent and fertility, but the sides of the mountains are destitute of trees. They are almost entirely devoid of soil, and the rocks project in every direction, and the intervening places are strewed with angular débris very little comminuted. These slopes are never cultivated, and sustain nothing but arid and thorny bushes, which almost invariably stand alone. Such is the nature of the Hindoo-coosh as far west as 68° E. long., where that high summit or rather mountain-pass occurs which properly is called Hindoo-coosh, and has given name to the whole range, and rises to more than 15,000 feet above the sea-level. There are however many other peaks which are always covered with snow. Some of the valleys included in this range are very populous. The best known is that of Panchshir, through which one of the roads passes which lead from Kabool to Kundus, and which at the upper end of the valley traverses a mountain-pass, 13,200 feet above the sea, called the mountain-pass of Khawack. The valley of Panchshir, its sinuosities included, is 70 miles long, and in most places about a mile and a half wide; no part exceeds twice that breadth. The upper part of it, about 25 miles, is not inhabited, probably on account of the severity of the cold in winter, but in the lower part there are seven thousand families. The soil is naturally sterile, and the land fit for cultivation only to a small extent, but every foot of it is cultivated. The orchards and the mulberry plantations constitute the wealth of its inhabitants; the mulberries are dried, and yield a good flour, which forms the principal food of the people. Another road, which traverses the Hindoo-coosh and leads to the plains of the Oxus, lies farther west, and runs through a similar valley watered by the river Parwan. The mountain-masses are at least as high as the Pass of Khawack.

The high summit of the Hindoo-coosh above mentioned terminates the range just described. At this point the range changes its direction, running nearly due south between 35° and 34° 20′ N. lat., and decreasing somewhat in elevation. This portion of the range goes by the name of the Mountains of Pughman. It consists of two parallel ridges, and includes a valley more than 10 miles in width, which has a hilly surface, and seldom sinks so low as 10,000 feet above the sea. This valley is unfit for cultivation on account of its elevation, but it is the favourite resort of the nomadic tribes in its vicinity in summer time, on account of its excellent pastures. The two ranges which enclose the valley are from 2000 to 3000 feet higher. As these ranges are free from snow in summer, several passes lead over them to the valley of Bameean, which is west of the western range and only 8500 feet above the sea. The best known of these passes are those of Ghorbund, of Erak, which attains 12,909 feet, and that of Kulloo, which is 12,481 feet above the sea-level.

The Koh-i-Baba range may be considered the commencement of the Paropamisus; north of it lies the mountain-region of the Hazarah. The Koh-i-Baba is not a mountain-region, but a single range, which rises suddenly where the Pughman mountains terminate (near 34° 20′), and hence runs due west. At its eastern extremity it presents an immense mass of rocks, overtopped by three snow-clad peaks. The great mass attains an elevation of about 14,000 feet above the sea, and the peaks rise about 1000 or 1500 feet higher. Patches of snow are found on it in sheltered elevations at 13,500 feet, and towards the summit there are beds of great extent. Farther westward the range presents a succession of lofty peaks, but it is not known how far they extend; it is however certain that no continuous range is found in the country of the Eimack, about 150 miles from the eastern end of the Koh-i-Baba. These mountains are barren, for the rocky masses have no covering except angular fragments of rocks which cover the declivities.

To the north and west of the Koh-i-Baba are the mountain-regions of the Hazarah and Eimack, which occupy, including the Koh-i-Baba, the whole country between 34° and 36° N. lat. and between 68° and 63° E. long., comprising an area of nearly 50,000 square miles, equal to the extent of England without Wales. The eastern part, or that which is north of the Koh-i-Baba, and is in possession of the Hazarah tribes, is the more elevated. Its surface presents a succession of high mountains with rather gentle slopes, which are traversed by numerous open valleys of moderate width. The declivities of the mountains are covered with a soil which produces abundance of grass, and various shrubs and herbs, but is destitute of trees. Some of the higher valleys can also be used only as pasture-ground; in the lower valleys barley is cultivated, and in the lowest good crops of wheat, barley, and millet are obtained. The domestic animals are horses of a small breed, cattle, and sheep, but as the country is so high the climate is very severe, and the Hazarahs are obliged to cut great quantities of grass for their sheep, which during three months of the winter usually sleep under the same roof with their master. The general level of this country appears to be about 10,000 feet above that of the sea.

The mountain-region of the Eimack does not materially differ in its surface and soil from that of the Hazarah, except that the mountains are less elevated: their general level does not much exceed 9000 feet above the sea. The valleys also sink deeper, and are fitter for cultivation, which is also carried on to a greater extent, but even here the produce of the domestic animals constitutes the wealth of the population. They are not obliged to procure winter fodder for their sheep and cattle in such large quantities as the Hazarahs, for in the valleys, to which they return in autumn from the mountains, grass is commonly found in sufficient quantity. In summer, in this region, as well as in the country of the Hazarah, the pastures are so abundant, that several tribes of Dooranees, which inhabit the Zemin Dawar, or the country between these mountain-ranges and the river Helmund, bring their flocks to these higher regions, because at that season the grass in their own countries is burnt up.

II. *The Valley of the Kabool River.*—This valley lies along the southern base of the eastern portion of the mountain-region just described, beginning on the west at the foot of the Pughman mountains, and stretching eastward to the banks of the Indus river, through a space measuring nearly 200 miles in a straight line. At its western extremity the valley is about 10,000 feet above the sea-level; but where it terminates on the Indus its elevation does not exceed 750 feet.

The southern boundary of the valley is formed by an uninterrupted chain of heights varying in elevation. This chain is not connected by any ridge with the Mountains of Pughman, but separated from them by a narrow plain called the Valley of Mydan, which is 7747 feet above the sea-level, and is well cultivated, and covered with orchards and fields. Through his plain the road runs from Kabool to Ghuznee and Kandahar. On the east of the road rise some hills of moderate elevation, which at first are rather isolated, but soon unite in a continuous chain. Baber describes them as low, with little grass, bad water, and not a tree on them; and adds that in the whole world he had not seen such a dismal-looking hill-country. This is commonly the case with mountain-regions that contain great metallic riches. During the British occupation of the country it was discovered that extensive beds of very rich copper-ore exist in many places, though the natives only work them to a small extent. These hills change their aspect about 20 miles from Mydan, at Tezeen, where they rise higher and are covered with trees. East of 69° E. long. these mountains attain their greatest elevation in the Sufaid-Koh, or White Mountain, which is covered with snow all the year round. This elevated rocky mass appears to extend 30 or 40 miles from west to east, and perhaps half as much from north to south. Its summit rises about 16,000 feet above the sea. The declivities of this mountain, to an elevation of more than 10,000 feet, are covered with forests, especially the species of deodara; and near the base are plantations of fruit-trees. In some places they are cultivated, and the pasture-grounds are extensive and good. From the snow there rise numerous streams, which preserve a considerable volume of water all the year round, an inestimable advantage in a country which has a dry air, and where in summer the largest rivers, when they have not a similar supply of water, dwindle down to mere brooks. The high mountains appear to terminate near 70° E. long., and the range of lower mountains which runs hence eastward to the Indus is called the Kyber or Tira range. Near the Sufaid-Koh these heights certainly rise to 10,000 feet; but they grow lower farther to the east, and where they terminate on the Indus with a precipitous declivity they can only be called high hills. This portion of the range descends with rather rapid slopes towards the north, and its sides in many places are bare, but in others clad with a scanty grass, except after the great rains in July and August, when the grass is abundant. Cultivation is limited here, but their tops, which present plains of moderate extent, have a deep soil, which yields good crops where it can be irrigated.

The Kabool river originates at Sir-i-Chusmah, about 37 miles west of the town of Kabool, drains the Mydan valley, and passes through the town of Kabool, where it is an insignificant stream. Below the town it is joined by two more considerable rivers, the Logur on the south, and the Ghorbund on the north. On leaving the plain of Kabool it enters the mountainous district which divides the basin of Kabool from that of Jellalabad, and in this part of its course the river descends about 4000 feet in a space of 30 miles in a straight line, and its banks are lined with rocks; there are also rocks in the bed of the river. Two or three miles below Jellalabad the Kabool is joined by the large river which drains the Koonur valley in the Himalaya range, and is generally called Koonur. The Kabool river then ceases to be fordable. Leaving the Jellalabad basin it enters another mountainous tract, and it emerges from it at Mucharr into the Plain of Peshawur, or Peshawr, where its current is very moderate. A short distance below Mucharr it divides into two branches: the lesser, or Shuhalum river, passes only four miles north of Peshawur, and unites, 25 miles in a straight line from the point of division, with the Hadezy, or other branch. After a course of thirty-five miles more it enters the Indus. The island formed by the two branches is inhabited by a tribe called Daoodzyes, and called after them. In its upper course the Kabool river is not navigable, and of no importance except for irrigating the contiguous fields. Small poplar timber is floated down the Logur during the floods for the consumption of Kabool. From Jellalabad downwards the river supplies the means of safe and generally rapid descent. It is navigated by rafts floated on inflated skins, which are admirably adapted to the rivers of Afghanistan. During the floods the distance between Jellalabad and Peshawur may be traversed in 12 hours, which by land is not less than 100 miles. The conveyance of goods on such rafts holds out a prospect of enlarging the navigability of the Indus river itself. No river vessels can ascend this last-mentioned river farther than Kalabagh, the current between that place and Attock being too rapid. But the rafts would experience no difficulty in proceeding to Kalabagh, and there discharging their loads into the boats which navigate the Indus. The Kabool river is lowest in the winter, notwithstanding the heavy rains which in that season fall in the Plain of Peshawur. It is sensibly affected by the spring rains in February and March. It falls after they have passed over, but not to its level in the winter, for at this time the snow of the lower hills begins to thaw. At the end of May the middle snows begin to descend, and after them the upper snows, which bring the river to its greatest height in the beginning of August. In September the waters begin to decrease, and in the beginning of December they sink to the lowest level.

The Valley of the Kabool river contains three basins, which are divided from each other by two extensive mountain-regions. The three basins receive their names from the principal towns, and are called, from west to east, Kabool, Jellalabad, and Peshawur. Of the two mountain-regions between them, the western is called Lattabund, and the eastern Kyber, from the two most frequented passes which lie across them.

The Basin of Kabool extends about 36 miles from west to east, and from 8 to 16 miles in the opposite direction. It is divided by two ridges of hills into three plains. The town of Kabool is built at the base of a ridge of hills which runs across the plain from south to north, and through which the Kabool river passes by a gorge. From its highest summit, called Takt-i-Shat, at the foot of which Kabool stands, the whole ridge has obtained the same name. That portion of the plain which lies west of the Tukt-i-Shat ridge is called Chahar Deh. It is about 8 miles wide and 12 long. This is a very fertile tract, presenting one continuous mass of verdure, and a succession of extensive orchards and meadows, between which a great number of villages are dispersed; they are surrounded by cultivated fields, divided from one another by rows of poplar and willow. Fruit is so abundant that the poorer people live entirely on it for many months of the year, though corn is raised to a considerable amount.

The eastern and wider portion of the basin is divided by another ridge of heights, which is connected with the Takt-i-Shat at its northern extremity, but runs in the opposite direction, from west to east, being at its western end united to the Pughman mountains. Its eastern extremity does not reach the Hindoo-coosh, as it is separated from this great mass by a low depression, through which the drainage of the northern districts is carried by the river Ghorbund to the Kabool river. These northern districts go by the name of Koh-Daman. On the west they are surrounded by the Pughman mountains, and on the north and east by the Hindoo-coosh range and its offsets. The Koh-Daman has a length of thirty miles and a medium width of seven. The western side of this plain is much higher than the eastern, along which the drainage of the opposite mountain flows. The mountains surrounding it are split by numerous ravines, through which rills of the purest water fall. The slopes enclosing these ravines are thickly planted with the mulberry, and every moderately level spot is planted with fruit-trees or the vine. The southern part of the plain is a stony and comparatively barren tract, the principal produce of which is fruit, for which both the soil and climate are well suited; the northern and larger portion yields grain, cotton, tobacco, artificial grasses, and vegetables, but scarcely any fruit except the mulberry, of which there are many plantations. Here, as in the valley of Panchshir, which opens into this plain, the mulberries, when dried and ground, produce a flour, which is used in making bread. Koh-Daman is a favourite country residence of the wealthy inhabitants of Kabool, and is almost as thickly studded with castles as with gardens. They are strongly built, and may be compared with the old baronial residences in England.

South of the Koh-Daman is the *Plain of Logur*, so called from the river which traverses its southern portion before it joins the Kabool river. It extends about 20 miles from west to east, and half as much in the opposite direction. In the middle there is a ridge of higher grounds, which divides the Logur and Kabool above their junction. The ground is so level that it appears to have been formerly a lake, and at present a large portion of it is a swamp during nearly the whole year, especially along both banks of the Logur river. This is the least fertile part of the Basin of Kabool, and the cultivated grounds occupy only a small portion of the surface; but it is very rich in grass, an important object for a nation which keeps so many horses as the Afghans. It contains also extensive orchards and vineyards.

The dried fruits of the Basin of Kabool constitute the principal article of trade. They go to Hindustan. Grapes of a dozen different kinds are grown, but only two species bear exportation. There are six varieties of apricots; of the mulberry as many, besides endless varieties of apples, pears, peaches, walnuts, almonds, quinces, cherries, and plums. Red and white melons are raised in abundance. The wild rhubarb root is used to make preserves. The vegetables are excellent, but not plentiful. They have cabbage, lettuce, turnips, carrots, onions, leeks, cucumbers, gourds, beans, peas, endive, celery, and cauliflower: these are generally cultivated in the fields, the gardens being reserved for fruits and flowers. Irrigation is common wherever water is found.

The town of Kabool is 6396 feet above the sea-level, and even the most eastern part of the basin of Kabool is 6000 feet above it; whilst the western rises, in the Mydan valley, to 7747 feet. It has therefore a much colder climate than could be expected from its geographical position. It is warmer in summer than England, but in winter it is much colder But even in summer the heat is so moderate as never to be disagreeable in the shade, and no night is so warm that a thick covering can be dispensed with. The winters however are very cold. In that of 1839-40 the thermometer was often 4° and 6° below zero of Fahrenheit. On the 3rd of September the first snow fell. The snow generally covers the ground for three months at least; but after the vernal equinox it disappears from the higher places. At this season of the year there are copious falls of rain, sleet, and snow. The changes in the temperature are greater than in England, even in the warmest season. The range of the thermometer in August (1839) was from 46° to 74° at four o'clock in the morning, and at three in the afternoon from 72° to 96°; in September, in the morning from 50° to 64°, and in the afternoon from 70° to 90°; in the first half of October, in the morning from 30° to 56°, and in the afternoon from 64° to 92°. The quantity of snow which falls is very considerable, and is justly considered one of the principal reasons of the vigorous vegetation in the hot and dry season. There is a favourite proverb in Kabool: 'Let Kabool be filled with snow rather than gold.' In spring the rains are rather abundant, especially in April. In May they are rare, and when heavy do great damage to the fruits. In the following months only light showers are experienced.

Between the Basin of Kabool and that of Jellalabad is *the mountain-region of the Lattabund Pass*. It occupies about 30 miles in extent, and is filled by numerous offsets from the southern range of mountains, which approach to the banks of the Kabool river, and between them are several narrow valleys. The whole is a succession of steep ascents and descents, and the ridges frequently rise 1000 or 1500 feet above their base, and are broken into crags and precipices. Both mountains and valleys are of the most barren description; they present no sign of vegetation, except in the immediate vicinity of the Kabool river, where some stunted trees are met with, but not a blade of grass. This tract is almost uninhabited. The few families here are wretchedly poor, and live in caves.

East of the mountain-region of Lattabund is the *Basin of Jellalabad*, which extends about 40 miles from west to east, and has an average width of about 10 miles. The surface is in general much diversified by ascents and descents of moderate elevation. Along the Kabool river is a tract varying between one mile and one mile and a half in width, which is level, and low, fertile, and well cultivated. Fine meadows alternate with groves of fruit-trees and fields, on which the sugar-cane, rice, jowary, and maize are grown to a great extent. Villages and mud castles are very numerous. But at the back of this fertile strip the country is a stony desert, overspread with numerous low and bare hills, which gradually rise higher as they approach the high masses of the Sufaid-Koh. In the vicinity of these mountains the country improves, and contains numerous villages surrounded by orchards, and between the villages a considerable portion of the surface is under cultivation. The soil of the middle tract is very stony or sandy. Towards the eastern extremity is a tract covered with an efflorescence of soda. As the level of this plain varies in elevation above the sea between 1400 and 3000 feet, the climate is much warmer than in the Basin of Kabool. Towards the eastern extremity is a barren stony desert surrounded with low hills, where, in the months of April and May, a pestilential wind or *simoom* prevails, which sometimes proves fatal to the traveller.

The *mountain-region of Kyber* sends its offsets to the banks of the Kabool river, east of the Basin of Jellalabad. It occupies 20 miles along the river, which is about 20 miles distant from the main range. This tract also is covered with numerous ridges, which grow lower as they approach the river. Narrow passes, with numerous ascents and descents, lead over them; one of them is the famous Kyber Pass, whose summit is 3373 feet above the sea, nearly 1400 feet above Jellalabad, and 2300 feet above Peshawur. It is from 18 to 20 miles long in a straight line, and about 30 miles by the road. The hills along this road, and between it and the river, are precipitous, and only covered with bushes; but towards the main ridge there are several smaller table-lands which are tolerably level, and, being partly irrigated, yield tolerably good crops of grain. There are also extensive orchards, and groves of poplar and willows.

The *Plain of Peshawur* extends from west to east about 60 miles, with a width varying from 30 to 40 miles. The surface is not level, but presents only long and gentle slopes, in some places broken by ravines. The greater part of it has a clayey or loamy soil, which in some places is of great depth. It requires much watering and much stirring, but when properly treated it bears very heavy crops. The soil of those tracts which lie in the immediate vicinity of the river, and that of the island of the Daoodzyes, contains a considerable quantity of alluvial earth mixed up with clay, but it is inferior in fertility to most other parts of the plain. Towards the mountains, which surround it on the south like a semicircle, the country is stony, and in some parts also sandy, and of indifferent fertility. The orchards that are scattered over the plain contain abundance of plum, peach, pear, quince, and pomegranate trees, and the greater part of the plain is in the highest state of cultivation, being irrigated by many watercourses and artificial canals. Thirty-two villages have been counted within a circuit of four miles. This shows that the inhabitants are wealthy and industrious. The principal cultivated grains are rice, maize, wheat, and barley. During the summer the heat is very great, and at the solstice almost insupportable. It moderates however in the month of July, when either showers of rain fall or the air is cooled by winds from the east, in which quarter the rains have commenced. Sometimes a fall of snow occurs, but it melts instantly. Frost however is very frequently experienced in every season. The rains which are carried to Hindustan by the south-west monsoon reach Peshawur, but they do not last more than about four weeks in July, nor are they abundant: in some seasons they fail entirely. But the winter rains are plentiful, and more so in the second than in the first half of winter. The rains in spring are much more abundant, and they are heavier at that time than in any part of Hindustan, Cashmere excepted. This large plain is more than 5000 feet lower than that of Kabool, the town of Peshawur being only 1068 feet above the sea.

The plain of Peshawur does not extend to the Indus. From both the southern and northern mountains a ridge runs out which skirts the river at the distance of a few miles; between them the Kabool river flows in a narrow gorge, which is not traversed by any road. But at no great distance from its banks on the south is a depression in the ridge, which forms a defile, called Geedur Gulla (or the Jackal's Pass), which is about two miles long, and leads to the bridge over the Indus opposite to Attock.

III. *The Suliman Range and Eastern Declivity of the Table-land.*—What are called the Suliman Mountains is nothing but the elevated crest of the eastern declivity of the table-land itself. The level of the Indus is seldom more than 500 feet above the sea-level, but the level of the crest of the table-land varies from 5000 to 7000 feet. When seen from the banks it appears like a very elevated mountain-range, though it hardly rises a few hundred feet above the general level of that portion of the table-land which is contiguous to it on the west.

The *Suliman Mountains* are closely connected with the snow-capped mass of the Sufaid-Koh, which must be considered its most elevated summit. They extend thence southward, keeping always in the vicinity of 70° E. long. until they reach 29° N. lat., where they may be said to terminate, nearly due west of the confluence of the Indus with the Garra. A little north of 29° N. lat. the crest of the table-land turns suddenly to the west, and continues in that direction between 70° and 68° E. long., when it meets the Hala mountains of Beloochistan. That portion of the crest which lies from east and west, is called the Muree and Boogtee mountains. There are very few summits which rise above the general level of the Suliman mountains, and none of them attain the snow-line. The most elevated has given its name to the whole range. It is the Takt-i-Suliman, which lies near 31° 30′ N. lat., and rises, according to Lieut. Wood, to nearly 11,000 feet above the sea. That portion of the range which lies north of the Takt-i-Suliman constitutes a continuous chain, with the exception of one break, not far north of the Takt-i-Suliman, through which the Gomul river, which rises far in the interior of the table-land, descends to the Indus. The space which lies between the Suliman mountains and the river Indus is occupied by the declivity of the table-land. The river however does not run parallel with the range; at the northern extremity the distance between them exceeds 100 miles, but it is less farther south. South of 32° N. lat. it falls short of 50 miles.

One of the most remarkable features of the northern portion of the declivity is the *Salt Range*, which is broken by the Indus river near 33° N. lat., nearly at a right angle, and extends from its western bank west-north-west to the Suliman mountains, which it reaches a few miles south of the Sufaid-Koh. It is composed of sandstone, containing very thick and extensive layers of rock-salt, which are largely worked near the town of Kalabagh, just on the banks of the Indus, whence it is exported to different parts of Hindustan and other countries. The Salt range does not appear to rise more than 2000 feet above the banks of the Indus; but it is probably higher farther to the west. The rivulets and springs are brackish, and the land very poor. A few flocks of sheep and goats are kept. The cultivated land is scattered here and there in small patches. It requires patient labour and a continuance of favourable weather to raise the coarsest kind of grain.

Between the Salt range and Kyber mountains lies a table-land called Bungash, which is from 500 to 700 feet above the level of the Indus; for this is the elevation of the precipitous rocks which here form its western banks. The surface of this table-land is traversed by several ridges, rising from 500 to 1000 feet above their base; they are covered with soil, but of indifferent fertility. The depressions however between them, especially those near the river Toe, have great productive powers, as the soil rests on limestone. They are almost entirely covered with well-cultivated fields, carefuly enclosed and abundantly irrigated by the waters of the Toe or other perennial streams, which receive their supply from the Sufaid Koh or its neighbourhood.

The country south of the Salt range is drained by the river Kooram, which also rises in some of the southern offsets of the Sufaid-Koh. The country along its banks appears to descend gradually to the Indus, until it terminates in a plain of considerable extent called Bunnoo. The higher part of the valley bears the name of Bungash-i-Bala, or Upper Bungash. The soil of this region consists of clay mixed with sand, and possesses a considerable degree of fertility, especially where the crops do not depend on the rain, but on irrigation from the river or its affluents. The whole, but especially Bunnoo, is well cultivated and populous. The principal crops are barley, rice, maize, and wheat. The sugar-cane is also grown to a great extent. Rice and sugar are exported. Turmeric is cultivated in Bunnoo: it is of the best quality, and its exportation is considerable. The villages are numerous, but small: except along the mountains which enclose this region, no domestic animals are kept but those which are used in cultivation, cattle and buffaloes.

That part of the declivity of the Suliman mountains which lies south of the Kooram river goes by the name of Daman. Here the nature of the country is changed. It does not descend by an inclined plain, but by terraces, each of which is enclosed by two ridges running south and north. In some places there are three, in others four such terraces. Some of the ridges are overgrown with forest-trees; in general they are only covered with shrubs and bushes, but contain pasture-ground. Some of the valleys between the ridges are sandy, and can only be used as pasture for camels, goats, and sheep: but the larger number of them have a good clayey soil, intermixed with sand, especially in the neighbourhood of the Indus; their fertility is considerable. Wheat, barley, and several of the grains of Hindustan, as jowary, bajra, &c., are cultivated to a great extent. Considerable quantities of cotton are raised and exported. There is little fruit except dates. Cattle are the chief stock, but sheep are also numerous, both of the heavy-tailed and light-tailed species. Each of the valleys is inhabited by a different tribe; sometimes two tribes live in one valley. Their villages are numerous and frequently large; the head towns of the tribes contain from 2000 to 4000 houses, with bazars and numerous shops, in which most of the Indian goods are sold by the Hindu families settled in these places.

Our knowledge respecting that portion of the declivity which lies south of the Gomul river is incomplete. It appears that here also it consists of terraces rising one above the other, and that there are valleys between the ridges; but we know nothing of these valleys and their inhabitants. This declivity however does not descend to the banks of the Indus; it is separated from them by a rather level tract from 15 to 20 miles wide. The soil consists of a stiff and hard clay of an ashy colour, which is very difficult to be cultivated. Towards the river however it is mixed with a portion of sand, which has been introduced by the waters, and has improved its quality. Near the base of the mountains the soil is partly covered with stones or sand, or both, which have been washed down by the rains. At the southern extremity of this region, north of Mittun-kot, is a sandy desert of some extent called Dajel; the hardness of the clay prevents the greater part of this tract from being cultivated. It is chiefly covered with jungle, but there are other tracts which are without jungle or nearly so, and also without grass. In the depressions moderate crops of jowary, bajra, &c. are raised, if the rains have been abundant. Along the *Indus* and smaller watercourses the country is well cultivated, as the means of irrigation are at hand. Wheat, barley, and jowary are the chief crops. The principal domestic animals are camels; but cattle, sheep, and asses are also kept in most places. The villages are small and distant from one another, except on the banks of the Indus.

IV. The *Eastern Portion of the Table-land* has rarely been visited by Europeans, and is very little known. As far as our information goes, it is from 5000 to 7000 feet above the sea-level, and its surface is a plain, frequently interrupted by shorter or longer ridges, which rise several hundred feet above its general level. During three or four months of the year it is covered with snow, which so fertilizes the arid and sandy soil as to enable it to produce abundance of coarse grass. It does not appear that there is any tract of considerable extent which is cultivated or fit for cultivation. The whole is in the possession of several nomadic tribes, who live in tents, and wander from place to place with their herds of horses and cattle, and their flocks of sheep and goats. In winter they retire to the lower depressions or to the lower countries in their vicinity. The most numerous of these tribes are the Ghiljies in the north, the Kankers in the south, and Wuzerees in the east. The river Gomul drains the northern part of this region; though it runs 100 miles, it brings but little water to the plain, where it is used for irrigation, and it reaches the Indus only when swollen by the melting of the snow. This region reaches from the Suliman mountains to the watershed between the rivers that run eastward to the Indus and westward to the Helmund. This watershed is formed by a ridge which rises about 1000 feet above the table-land, and is called Sir-i-Koh, at least in its northern part. The top of this ridge is flat, but of narrow width, and only a few trees are scattered over its sides and summit, chiefly wild olives and mountain ash.

V. *The Central Table-land, or that of Ghuznee and Kandahar.* The ridge of the Sir-i-Koh runs from north-north-east to south-south-west until it reaches 32° N. lat., where it declines to the south-west. It continues in that direction to 66° E. long., in the vicinity of which it terminates in the Desert of Beloochistan. The last-mentioned part of the ridge is called the Khojeh Amram or Toba mountains. They rise nearly 2000 feet above their base. The Khojuk Pass, through which the road from Kandahar leads to the Bolan Pass and Shikarpoor, rises to 7457 feet above the sea-level. The ridge occupies about six or seven miles in width. It rises with a gradual ascent, but is only covered with grass, except in the dells, where trees and shrubs are found. In some parts the sides of the hills and even the tops are said to be cultivated.

This ridge forms the eastern boundary-line of the Central Table-land. Its western boundary lies along another ridge, which is connected at its northern extremity with the eastern chain of the Pughman mountains, and may be considered a continuation of it. Towards the north they are called the Narawah mountains, and have a considerable elevation, but towards the south, where they separate the valley of the Helmund from that of its affluent the Urgundab, they grow much lower. The ridge terminates several miles north-west of Kandahar. Its direction lies from north-east to south-west.

The Central Table-land confined between these two ridges extends from north-east to south-west. At its northern extremity it opens into the Basin of Kabool by the plains of Mydan and Logur, and here it is hardly more than twenty miles wide. At its southern extremity near Kandahar it is nearly a hundred miles across, and this may be its average width between Kandahar and Ghuznee; but north of the last-mentioned place its grows lower. Its elevation above the sea-level varies greatly. Its highest elevation is about eight miles north of Ghuznee, where there is a hill pass called the Gund-i-Sher Pass, which is about 9000 feet above the sea. From this place to the valley of Mydan the distance is about 40 miles, and the country sinks to 7747 feet. The distance from the pass to Kandahar in a south-western direction is nearly 200 miles, and the level of the table-land lowers from 9000 to 3484 feet. Thus the country gradually descends from a very temperate and almost cold region to one that may be called hot.

The surface of this extensive tract is greatly diversified. There occur some ridges of considerable extent, which rise from 1000 to 2000 feet above their bases. The most extensive are the Djara-Koh, north of 33° N. lat., which runs parallel to the Sir-i-Koh mountains and is not much lower than that range, and the Gantee hills, east of Kandahar, which extend east and west. The most northern district, or that between the Mydan valley and the town of Ghuznee, is the most uneven. It presents hardly a level tract of any extent, but is in general broken by ravines and watercourses, most of which exhibit numerous ascents and descents of moderate elevation, but steep declivities, and at several places many isolated hills occur, which are only separated from each other by ravines. The valleys however in this tract have a very good soil, and are well cultivated. South of Ghuznee the surface is less broken. The hills are at great distances from one another, and the plains are frequently 15 or 20 miles long and wide, and it is only in a few places that their surface is broken by low hills or deep ravines and watercourses. The soil here and farther north is a loam with a great proportion of clay, but stones, gravel, and sand have been lodged by the rain under the hills. As the quantity of rain which falls on this region is small, the lands require irrigation in order to be productive, but the rivers are small and cannot yield a large supply. To obtain this supply the inhabitants have constructed a kind of aqueducts, by which the water of a hill or rising ground is brought out at its foot in a rivulet, to be disposed of at the pleasure of the farmer. Such aqueducts, called karezees, are made in the following manner. A well is made at the spot where it is intended the water shall issue; above it in the acclivity is dug another at the distance of five to twenty yards, according to circumstances. The wells are continued at distances generally equal, until the quantity of water collected in them is deemed sufficient, or until the depth of the wells becomes so great that the expense exceeds the advantage. If the acclivity is not very gentle, the highest wells must be very deep, as their bottom must be only slightly elevated above the level of the water in the lower wells. All these wells are then connected by means of aqueducts made under the surface of the ground, through which the water from all of them flows to the foot of the hill. Very good karezees will turn a small mill of the country. This ingenious contrivance of irrigating the fields appears to be of long standing in the country, as in the neighbourhood of Ghuznee a karezee of great extent is found which is ascribed to Sultan Mahmood. Including its branches it is asserted to be nearly 30 miles long, but this is probably an exaggeration. Many however are two or three miles long. These karezees are found in other parts of Afghanistan and in some parts of Persia and Turkistan, but nowhere are they so numerous as in this part of the table-land, which thus produces rich crops of wheat and barley. There are also numerous orchards, but the fruit is inferior to that of the valley of Kabool. There are numerous villages, and they are tolerably large. They are enclosed by mud walls, as these districts are surrounded on three sides by nomadic tribes, which frequently make predatory excursions into the lands of their neighbours South of the fortifications, which are called Kelat-i-Ghilzie, the aspect of the country changes. The surface is much more broken; flats are rare and of small extent; hills and even short ridges are common. Water is scarce, and only to be found at greater depths below the surface. The soil chiefly consists of sand, which in a few places is intermixed with clay, and moreover it is covered with stones, which in some parts are so numerous as to prevent the scanty grass from springing up. This is especially the case with those tracts which lie at the foot of the Khojeh Amram range, where a large space appears like a sea of rocks and stones. In this country cultivation is limited to the banks of the larger rivers, where some level tracts of moderate extent are found, and where a small river of fresh water can be turned to account for irrigation by damming up its bed. Nearly the whole of this country is pasture-ground, in possession of nomadic tribes, the Ghiljies. There is only one considerable tract where cultivation is carried on to a great extent. This lies in the vicinity of the town of Kandahar, on both sides of the river Urgundab, from whose banks it extends at some places seven miles inland. Wheat, rice, barley, and Indian corn are grown. There are also numerous orchards, which contain vines of various kinds, apples, pears, quinces, nectarines, peaches, figs, plums, apricots, and cherries. The pomegranates of this place are held in great esteem. Except these plantations, the whole of this region is without trees. Poplars and willows are planted along the watercourses. Ghuznee, which is near the highest part of the table-land, is very cold. The winter lasts four or five months. The frosts are hard, but little snow falls. Whilst the British army was there (1840) the ice in the pools of water and the ditches of the fort was several feet thick, though the winter was considered mild. From this place to Kandahar the temperature increases every stage. Kandahar has a very temperate climate: slight frosts and snow occur every year, but the snow melts in a few hours. In summer the heat is very great, but the nights are rather cold. The thermometer between sunrise and three o'clock in the afternoon varies frequently 40° and even 50°. From the 26th of April to the 26th of June the thermometer ranged from 50° to 72° at four and five o'clock in the morning, and from 85° to 110° at three o'clock in the afternoon. In April the mean heat was 72°, in May 77°, and in June 81°. Between the middle of May and the end of August two hot periods each of forty days occur; the second period is hotter than the first. In summer rain is very rare and only falls in short showers. The greatest quantity of rain falls before the vernal equinox, but only in showers.

VI. The *Southern Table-land* lies between the Kojeh Amram range and the Muree and Boogtee mountains, and descends to the west, where it terminates in the Desert of Beloochistan before it reaches 65° E. long. It consists of the valley of the river Lorah and the country of Shawl. The Lorah rises on the borders of the Eastern Table-land, and as it runs eastward drains the valley of Pisheen, and then enters the Desert of Beloochistan, where it is said to terminate in a lake, which in spring is of considerable extent, but nearly dry at the end of the summer. The elevation of this region above the sea along the road leading from the Bolan Pass to the Khojuk Pass, which traverses it nearly in its middle, is from 5000 to 6000 feet. Near the Kojeh Amram mountains the country is rather level, but interspersed with numerous low hills; along the banks of the river only few hills occur, but they are numerous near the Muree and Boogtee mountains. The greater part of the lower country is not cultivated, and is overgrown with wild thyme or a jungle of tamarisk. Some tracts are cultivated with wheat, but they are not extensive, as the water for irrigation is derived from karezees, the bed of the river being from 200 to 300 feet depressed below the general surface, so that its water cannot be raised for that purpose. The hills are without trees, but afford indifferent pasture to sheep and goats. It is stated that farther towards the sources of the Lora, and also lower down, the cultivation is much more extensive, and it appears that in these two districts the river does not run in such a deep bed and that the waters are applied to irrigation. The soil is a mixture of clay and sand, but in most parts interspersed with boulders and rocks. The crops are indifferent.

The town of Quettah in Shawl is 5637 feet above the sea-level. The winters are much colder than in England, but the summer temperature is much higher. In May (1839) the thermometer at sunrise ranged between 49° and 68°, and at three o'clock in the afternoon between 80° and 100°, and the mean heat was 74½°. In June it ranged at sunrise between 47° and 69°, and at three o'clock between 87° and 99°, mean heat 73°; in July the thermometer ranged at sunrise between 56° and 72°, and at three o'clock between 79° and 96°, mean heat 76°; in August it ranged at sunrise between 53° and 67°, and at three o'clock between 88° and 97°, mean heat 75°; in September the thermometer at sunrise was between 42° and 63°, and in the afternoon between 67° and 91°, mean heat 66½°. In winter it freezes every night, and in spots which are not open to the sun the ice does not melt during the day.

South-south-east of Quetta is the upper entrance of the Bolan Pass, through which the great commercial road lies which leads from Kandahar to Shikarpoor, and connects Persia with Hindustan. The northern entrance of the pass is more than 5800 feet above the sea-level, and the southern opening only 904 feet. The northern most narrow and steep part of the pass lies between almost perpendicular cliffs which vary in height from 100 to 600 feet, and the southern in the bed of a torrent covered with loose gravel. When there is rain in the higher parts of the mountains, the stream at times comes down in an almost perpendicular volume, without warning, and sweeps all before it. In a wider part of the pass there are a few spots under cultivation. The mountains that enclose the pass are composed of rocky ranges of hills very abrupt, between which regular sloping plains fill up the valleys. They are covered with gravel and boulders of various sizes, sometimes round large stones, in others smaller pebbles. These plains are cut into deep perpendicular ravines by the torrents from the hills. In the spring they are covered with a coarse herbage, affording pasture to sheep and goats. The length of the pass is 59 miles. In summer it is not used, on account of the pestilential air, which is produced, as it is stated, by the sun's heat between these steep rocky masses causing the evaporation of the pools of stagnant water left by the mountain-torrent.

VII. On the south-west of the Central Table-land is the Desert of Beloochistan and the country known under the name of Seistan. [Seistan, P. C.] The river Helmund, the largest of the rivers of Afghanistan, rises between the two ridges of the Pughman mountains, at an elevation of more than 11,500 feet above the sea-level.

VIII. That portion of the table-land which lies west of the Central Table-land, and extends from the road which leads from Girishk to Furrah to the base of the mountains of the Hazarah and Eimack, is called the Zemin Dawar. This region is traversed by several ridges, which are offsets of the mountain-region north of it, but they are neither high nor do they occupy a large extent of country; their sides, which are rather steep, are very bare. Between them there are wide valleys, some of which are 30 or 40 miles across. The soil varies. Near the southern extremity of the ridges it is generally sandy and nearly a desert; but higher up it contains a very large portion of loam, which extends northward into the valleys of the mountain-regions. The worst part is that on both sides of the Kash-rood river, which is covered with grass during the spring and winter, and then it is a favourite pasture-ground of the Dooranees. The best part is the plain which is traversed by the Furrah-rood, which is nearly as large as that of the Kash-rood. A large portion of it is irrigated with water from the river and from karezees; and where the water is abundant, crops of wheat and other grain are obtained. The same observation applies to the plain through which the Helmund runs, on the banks of which river there are many villages. In other places cultivation is limited: cotton is cultivated to some extent. This region appears to be divided between agriculturists and nomadic tribes. The climate is not so cold as that of the northern portion of the central plain, and probably as temperate as that of Kandahar. Rain is scanty, but as in spring the melting of the snow in the mountain-regions of the north fills the wide beds of the rivers, there are ample means of irrigation. On the higher grounds however the grass is burnt up after the summer solstice, and then the nomadic tribes wander with their herds to the mountains of the Hazarah and Eimack, especially to the elevated plain on which the Helmund rises.

IX. The *Table-land of Herat* comprehends that part of Afghanistan which lies west of the mountain-region of the Eimack, and extends westward to the boundary-line of Persia. The mountains of the Paropamisus lower gradually until they constitute low ridges of rocky hills, which run in different directions, but generally from north-north-east to south-south-west. They are mostly bare, except for a few months in the year, when they supply pasture-ground for sheep and goats. Between these ridges there are level tracts. Some of them are sandy and sterile, and nearly uninhabited; but others have a soil in which the sand is mixed with a great proportion of clay or loam, and are very fertile—such are the plains of Subzawar and Herat. The first is 30 miles long and 20 wide, and partly cultivated. The plain of Herat is about 30 miles long and 18 wide. It is watered by the Heri-rood, a river which rises far to the east in the mountains of the Hazarah, and all the year round brings a considerable volume of water to the plain, over which it is spread by numerous canals. A bund or dam is thrown across the river, and thus the waters are turned into the canals, and conducted over the whole plain, which is covered with fortified villages, vineyards, orchards, gardens, and corn-fields. The heat is excessive for two months in summer, but the winters are cold, and much snow falls in this region.

Climate.—The degree of heat and cold experienced in Afghanistan differs greatly in different places, in proportion to the elevation of the different parts of the table-land. The heat is insupportable in Seistan, especially in the Gurmsur and round Lake Hamoon, where the thermometer rises to 120° and even 130°, but in Ghuznee and Kabool it is very moderate. The rains which accompany the south-west monsoon extend to the eastern border of the table-land, but at this distance from the sea they are scanty, and last only about a month, from the middle of July to the middle of August. In the valley of the Kabool river they never extend beyond Jellalabad, where only a few showers fall; but they are much more abundant in Bunnoo and Bungash-i-Bala, and in Daman and other countries between the table-land and the Indus. These rains do not appear to be experienced on the table-land itself. The winter rains, accompanied with falls of snow, and the spring rains with sleet, are abundant in the valley of the Kabool river and the central table-land; but not so on the eastern table-land, which has a very moderate share of moisture, which is the reason why it is unfit for agricultural purposes. The summer is dry, and generally no rains fall in the higher regions from May to September or October; even in November they are rare in most parts.

Productions.—Afghanistan has great mineral wealth. Gold is found in several streams which originate in the Himalaya mountains or in the Hindoo-coosh and fall into the Indus or Kabool river, and it is collected in some places. Silver is said to exist in the Hazarah mountains. Copper-ore is abundant in the hills which extend west of the Sufaid-Koh to the neighbourhood of the town of Kabool, and at some places it is so rich as to yield from 60 to 80 per cent. of metal; but it is not much worked. Iron is found in the greatest abundance in the Himalaya mountains north of the Plain of Peshawur, and of the best quality. It is extensively worked in a district called Bajour, whence it goes to Cashmere, the Panjab, and to the other parts of Afghanistan; in Kandahar it is used for the fabrication of matchlocks. It is supposed that if prepared with more care it would equal the best Swedish iron. Other iron-mines of great extent are on the eastern table-land, at Foormool, in the country of the Wuzoorees, not far from Kanegorum; their produce is generally of inferior quality, but some of it is converted into steel. Iron-mines are also worked in the mountains of the Hazarah. Lead of excellent quality is worked in the Hazarah mountains, and also in the Pughman range. In the last-mentioned mountains plumbago is found, and sulphur in the Hazarah districts. Salt is obtained in the greatest abundance from the Salt range. Lignite has been discovered in the country of the Wuzoorees, not far from the iron-mines of Foormool; on the mountains east of the central table-land, and in the Bolan Pass; and lastly it is said also to exist in the Hazarah mountains. Saltpetre is obtained in considerable quantities from some pits in the vicinity of Furrah. Near Kalabagh on the Indus great quantities of alum are got.

The grains cultivated are wheat, barley, peas, beans, maize, rice, and some other grains of Hindustan, as jowary, chuna, musoor, bajra, moth, moong, oord, and murhwa; and two crops are annually obtained in the valley of Kabool as far west as Jellalabad. The most common vegetables are carrots, turnips, radishes, lettuce, cauliflowers, onions, garlic, melons, and cucumbers, with a few others from Hindustan. The fruit-trees have been mentioned in noticing the valley of the Kabool river. No natural grass is cut for hay, except in the Hazarah mountains; several kinds of artificial grasses are grown, but they are different from ours. Barley is cut when green near Peshawur twice or thrice, with little injury to the crop; but wheat is more delicate in this respect, and can only be cut once. Madder is extensively grown on the central table-land, and in Zemin Dawar, and goes from Kandahar to Shikarpoor. Turmeric is cultivated in Bunnoo, and also exported to Sinde. Assafœtida grows in many parts which are very elevated; the greatest part of the produce is taken to Shikarpoor. There are several shrubs used for tanning, but the leather is indifferent. Several wild shrubs furnish food from their roots, bark, flower, or fruit. The fruits of some kinds of berberry and of the wild vine are much used.

Forests are only found on the Himalaya mountains and the Sufaid-Koh. There are no woods on the table-land, and all the trees found there are planted, generally in rows along the water-courses and canals, and around the orchards. Only willows and poplars are found there, and those trees are used chiefly as timber, and in some places as fire-wood. The dung of camels and other animals is often used as fuel. The mulberry-tree grows wild in all the valleys which are not hot. The fruit is much improved by cultivation, and there are at least twelve varieties of the plant, all of them good. In the valleys of the Hindoo-coosh the mulberry is ground into flour, and forms the chief food of the country. The plantations are very extensive there, and some individuals are said to possess 10,000 trees. A very good tree will bear ten maunds, or 800 pounds, of mulberries, and if the average produce is one-third of this, it is calculated to support a far greater population than tillage. The produce is little affected by the seasons, and is very regular. Silk is not produced to any great amount, except in a few places. Nearly all the fruits cultivated in these countries are also found in a wild state, chiefly in the valleys of the cool mountains, such as apples, pears, cherries, plums, apricots, peaches, quinces, and pomegranates.

The most important of the domestic animals are the sheep. There are two kinds, both with the broad fat tail, which in some parts of the Eimack mountains is so large that a small cart is put under the tail. Herodotus (iii. 113) says the same of the sheep of the Arabs. They constitute almost all the wealth of the mountain-region of the Hazarah and Eimack, the inhabitants of which sell wool, woollen stuffs, dried curds, and ghee. These sheep yield two fleeces: the spring or coarser fleece is used for carpets, grain-bags, and other coarse stuffs; the autumn or finer fleece is manufactured into cloth, cloaks, and mummuds or rugs. The numerous flocks which pasture on the table-land yield only one fleece. Goats are nearly as numerous as sheep. Those in the Koh-i-Baba mountains and the Paropamisus yield, like those of Cashmere and Tibet, a fine and remarkably soft down, which grows at the root of the hair. The hair is long and usually jet black, but the down is of a shade more or less intensive. The down is in great demand, and exported to Persia, Kabool, Kandahar, Herat, and Shikarpoor, where it is employed in different manufactures.

Horses are plentiful, but of an inferior breed, except in Bunnoo and Daman, where there is a good breed. In some places there are good ponies; mules and asses are numerous, and in many places they are the principal animals of burden. Many camels are kept on the table-land; but they are not so tall as those of Hindustan: there is also the Bactrian camel with two humps. The number of cattle is small, as the pastoral tribes keep only a few bullocks to carry their tents, and a few cows which are fed near their residences. In the vicinity of Lake Hamoon great herds of cattle pasture on the marshy grounds. In Afghanistan they are of an inferior breed. Buffaloes are kept at some places, but they are not numerous. The cats of Kabool are distinguished by their long silky hair, and go under the name of Persian cats, though very few of them are found in Persia, and none are exported from that country. These cats are exported in great numbers from Kabool, where the people encourage the growth of the hair by washing it with soap and combing it.

Lions and tigers are said to exist, but they are comparatively weak and timid. Leopards are found in the Hindoo-coosh. Wolves, hyænas, jackals, foxes, and hares are common everywhere. The wild hog is not frequently met with, but wild asses are said to exist in the Desert of Beloochistan. Many kinds of deer, and also the elk, are found in the mountains, and a few antelopes in the plains. Wild sheep and wild goats are common in some parts of the mountainous countries. There are also porcupines, hedgehogs, ferrets, and wild dogs. Monkeys occur only in the mountains near the Indus.

The common fowl is kept by the pastoral tribes; in some places it is wild. Water-fowl are abundant on Lake Hamoon. Domestic ducks are found everywhere. Fish is very scarce. Locusts are most frequent in the eastern countries, but even there they rarely lay waste any part of the country.

Population and Inhabitants.—The population is estimated at 14,000,000, inclusive of Beloochistan, but many persons think that it is greatly overrated. The Afghans, who are the ruling nation, are dispersed over the whole of the table-land; but the mountains are mostly in possession of other tribes, such as the Hazarah and Eimack in the Paropamisus. Among the Afghans are settled Tajiks, Hindus, and Khuzzilbashes, Arabs, with a few families of Armenians, Abyssinians, and Kalmucks.

An account of the Afghans has been given in P.C., vol. i. p. 169. The Hazarah and Eimack, or the inhabitants of the Paropamisus, do not belong to the stock from which the other inhabitants of Afghanistan derive their origin, as their physical appearance shows. They are evidently of Mongol race, though at present they speak a dialect of the Persian language, and at the time of Sultan Baber they spoke a Mongol dialect. It is stated that they are a colony of Mongols left in this country by one of the armies of Manku Khan, one of the successors of Gengis Khan. There is some difference in the manner of life of these two tribes. The Hazarah, who occupy the higher part of the Paropamisus, have fixed abodes. They live in small villages consisting of low huts, where they pass the winter season under one roof with their cows and sheep, using as fuel small dry shrubs and the dung of their cattle. In summer they live with their animals on the slopes of the mountains. Near their villages they cultivate small fields, where they raise barley, and, when the elevation is not too high, wheat. The Eimack lead a more nomadic life, and reside the whole year round in tents made of dry sticks or felt, and go with their flocks in summer to the more elevated and in winter to the lower declivities of their mountains. They exact a tribute from all travellers who pass through their country. Both tribes are nominally dependent on the sovereign of Kabool; but they are governed by their own hereditary chiefs, who exercise despotic authority. These chiefs live in mud forts with a kind of state. Each tribe is divided into many divisions, each of which is independent of its nearest neighbour; and they have frequent feuds with one another, in which many young persons are taken prisoners and sold as slaves in Turkistan. They are visited by traders from Herat, Kandahar, and Kabool, who furnish them with some common articles of dress and utensils, and receive in return slaves, cattle, clarified butter, woollen cloth, grain sacks and carpet bags, felts for horse-clothing, and carpets, all made from the produce of their flocks. They also furnish lead and sulphur.

That portion of the population on the table-land which is occupied with agricultural pursuits is known by the name of Tajiks or Tadjiks. They are found in all the countries of Western Asia, from the Mediterranean to Chinese Turkistan; and even in the last-mentioned country many families of Tajiks are settled. In a few mountainous countries they have maintained their independence; in all others they are subject to the nations which have conquered them, and which have preserved their pastoral habits. Their condition may be compared to that of the serfs of the middle ages in Europe. They are the glebae adscripti, who work the cultivated grounds, and are obliged to give up to their masters one-fourth or one-half of their produce. They are peaceful, industrious peasants, more civilized, intelligent, and skilful than their masters. In the towns they constitute the labouring classes; they are tradesmen, mechanics, and labourers. They generally wear the dress and follow the customs of their rulers. They have preserved their language, which is however mixed with many terms derived from the language of the predominant nation. Their language is learned by all the Afghans who wish to be considered as men of education.

In the Plain of Peshawur and the neighbouring districts many Hindkees, as they are called, are settled as agriculturists. Their language is a kind of Hindustanee, resembling the dialect of the Panjab. The number of Hindus settled in Afghanistan is very great: there is scarcely a village of any extent without a family or two, and in the larger places there are many. They keep shops; are brokers, merchants, bankers, goldsmiths, sellers of grain, and other occupations. They retain the Hindu features, and some of them have nearly the Hindustanee dress. They are much employed by the great men of the country in every kind of business connected with money or accounts.

The Kuzzilbashes are only found in towns, except about Herat, where they are also settled in villages. A great number of them are in Kabool, where they were settled by Shah Nadir and Ahmed Khan. They are Turkomans, and their ancestors were members of some of the *ilats* which wander about in the plains of Persia. They are mostly soldiers, or employed by men of rank as secretaries, masters of the household, and stewards. Some of them have acquired landed property, which they let out to Afghans or Tajik tenants. They are lively, ingenious, elegant, and refined, but false, designing, cruel, and rapacious.

Arabs are settled in Kabool and Jellalabad. They are agriculturists, and do not mix much with the other inhabitants; they have lost their original language. According to Elphinstone, the number of their families amounts to about 2000. Armenians are settled in different towns as merchants. Abyssinians are imported into Afghanistan, as well as into Hindustan, as slaves, and generally form a part of the king's guards. There are also Calmucks in the king's guards; but some families of that nation are settled near Herat as agriculturists.

The population is very unequally distributed over the country. The most populous parts are the valley of the Kabool river, the country south of the Sufaid-Koh and of the Salt range, the central table-land north of Kelat-i-Giljies, and the immediate neighbourhood of the towns of Kandahar and of Herat. In all the other parts the population is scanty, as the inhabitants lead chiefly a nomadic life, with the exception of the fertile tract round Lake Hamoon, where there is a considerable agricultural population.

A very clear and interesting account of the Afghans is given by Wilken in the Transactions of the Scientific Society of Berlin, 1818-19, in which he compares the constitution of the tribes of the antient Persians, as exhibited by Herodotus and Xenophon, with those of the modern Afghans, and points out many striking resemblances between them, which elucidate in a curious manner several of the events and transactions of the time of the first Cyrus.

Manufactures.—Manufactures which supply articles of export are only produced at Herat and Kandahar. Those of Herat are silk and woollen stuffs and sword blades; and these articles find a ready sale in Persia. The manufactures of Kandahar are of the same description, with the addition of fire arms. Though the articles for exportation are few and in comparatively small quantities, it appears that the manufactures of the country are sufficient for the home consumption, as no manufactured articles are imported from India except cotton stuffs. As a knowledge of the manufacturing trades conveys an idea of a nation's civilization and of the comforts which it enjoys, we transcribe from Elphinstone's work the following list of the trades exercised in the town of Kandahar:—Jewellers, gold and silver smiths, booksellers, bookbinders, stationers, makers of kullumdauns (a sort of inkstand and pencase, of which every man who can write has one), seal engravers, sellers of armour, sellers of shields (these shields are of buffalo's or rhinoceros's hide), gunsmiths, sword-cutlers, polishers of steel, sellers of bows and arrows, sellers of glass ornaments for women, three descriptions of shoemakers, bootmakers, button-makers, silk thread sellers, gold wire and gold thread sellers, saddlers, farriers, painters, fruiterers, cooks, soup-sellers, tobacconists, druggists, perfumers, sellers of sherbet and of fullodeh, confectioners, embroiderers, and people whose business is to sew ornaments on clothes of all descriptions, from jewels to spangles. The inhabitants of the Eimack and Hazarah mountains do not export the wool of their numerous flocks of sheep in a raw state, but manufacture it into several kinds of cloth, carpets, grain-bags, saddle-bags, rugs, felt, felt cloaks, mittens, socks, and horse-cloths. The felt cloaks are called kosahs, and are extensively used in Kandahar, where they are much prized.

Commerce.—As Afghanistan has no navigable rivers, the transport of merchandise is expensive, and the expense is increased by the want of roads, which are not met with in all Western Asia from the Indus to the Straits of Constantinople. The conveyance of merchandise is therefore effected by beasts of burden. Camels are mostly used in the level countries, and mules or asses in the mountainous districts. Nearly all the land commerce existing between India on one side, and Persia, Turkistan, and China on the other side, must be carried through Afghanistan. If we except the difficult and dangerous road which leads from Leh in Ladak to Yerkand in Chinese Turkistan, no line of communication exists between India and the above-mentioned countries, except the three lines which traverse Afghanistan. The most northern of these lines begins on the frontier of the British Possessions at Ludiana on the Sutlege, passes through Lahore, and reaches the Indus at Attock. Hence it runs through Peshawur to Kabool, where it divides into two roads. One road runs over one of the elevated mountain-passes of the Hindoo-coosh range or the Pughman mountains and descends to the plains of Turan, leading to Kunduz and Khulum, and thence to Bokhara. The other road runs from Kabool south-south-west to Kandahar, at which place all three lines meet.

The middle line of commercial communication passes from Lahore direct west, crosses the Indus at Dera Ismael Khan and ascends the Gomul Pass, which is also called the Golair Pass, and which leads across the eastern table-land. When it reaches the central table-land it divides into two roads, of which one runs northward to Ghuznee and Kabool, and the other to the south-west to Kandahar.

The third road connects the Indian Ocean with the table-land. It begins at the seaport of Kurachee, situate north-west of the most western mouth of the Indus, and runs chiefly along the banks of the river to Shikarpoor, whence it diverges to the north-west, and passing through Dadur in Cutch Gundava, ascends the table-land by the Pass of Bolan. From this place it continues through Quettah over the Khojuk Pass to Kandahar.

The road from Kandahar to Persia passes westward, and crosses the Helmund river about two miles east of Giraskh. Thence it continues in the same direction to Furrah, and from Furrah northward to Subzawar and Herat, whence it passes through Meshed and Nishapoor to Tehran.

The commerce by the way of Peshawur does not appear to be very active. The exports are principally iron from the mines of Bajour, which is extensively used in the Panjab and in Cashmere, madder, assafœtida, tobacco, and fruits, such as almonds, pistachio nuts, walnuts, hazel-nuts, dried plums and apricots, and raisins; apples, pears, and pomegranates; there is also a large quantity of fresh fruit. A considerable number of horses and ponies are sent to the Panjab, and furs to Hindustan. The imports from the Panjab are coarse cotton-cloth, muslin and other fine manufactures, some sorts of silken cloth and brocade, indigo, ivory, bamboos, wax, tin, sandal-wood, and a large quantity of sugar, musk, coral, drugs, and some other trifling articles.

The traffic carried on by the Gomul Pass and Dera Ismael Khan appears to be more important. It is entirely in the hands of the Lohani merchants, a tribe which pretends to be of Afghan origin. They arrive annually with three kafilas at Kandahar and Kabool. The first kafila leaves Dera Ismael Khan about the middle of April; its merchandise consists of coarse cotton stuffs and salt, which are sold at Kandahar and Kabool. The second kafila brings indigo from Mooltan and Bhawulpoor, and chintz from Hindustan, and departs from Dera Ismael Khan towards the end of April; some part of these goods goes to Bokhara. The third kafila departs from Dera Ismael Khan about the middle of March, and the bulk of its cargoes consist of kimkal (or golden cloth of Benares), English chintzes and calicoes, gun-locks and similar articles; a great portion of these goods is taken to the plains of Turan. The last kafila only brings goods back, and arrives at Dera Ismael Khan in the middle of October with pomegranates, almonds, raisins, and rhubarb from Kabool and Kandahar, and with horses, cochineal, nankin, gold thread, raw silk, and other goods from Bokhara.

The commerce between Shikarpoor on one side and Kandahar and Herat on the other, is more important. It is carried on by kafilas, the number of which is about four, but they consist of a much greater number of camels. The articles which they import into Afghanistan are indigo, henna, metals of all kinds, country coarse and fine cotton-cloth, Mooltanee coarse cloth, silks manufactured at Shikarpoor and other places in Sinde, groceries and spices, raw cotton, coarse sugar, opium, hemp-seeds, shields of buffalo's and rhinoceros's hide, leather, embroidered horse-cloth, and dry grains. To these are added several articles of British manufacture, as red dyed cotton-cloth, white cotton-cloth partly dyed, long-cloth, glazed chintz, printed cottons, bleached cottons, unbleached cottons, red and white striped cottons, yellow cottons, chenai cottons, jugurnaut muslin, black cotton-velvet, a species of sheeting-cloth bleached and unbleached, a coloured coarse broad-cloth. The returns from Kandahar and Herat consist of raw silk to the amount of 50,000*l.* annually for the manufactures of Sinde, turquoise earth, churus (an intoxicating drug prepared from hemp-seed or bang, and used as opium), gum, silk stuffs of various kinds from Herat, dried fruits (such as prunes, black grapes, apricots, almonds, and dates in great quantities), tinsel thread for embroidery, broken copper and brass vessels (to be re-manufactured at Shikarpoor), madder (an important article), especially that grown near Kandahar, saffron from Bakna, west of Kandahar, safflower from Herat, gum salop from Herat, antimony from Beila in Lass (an important article), assafœtida (an important article) and other drugs, a very fine description of cotton from Herat, cochineal from Herat, and other materials used as dyes.

An active commerce is carried on between Herat and Meshed and other towns in Persia. The exports from Herat consist of shawls and shawl goods, indigo, carpets of Herat, Mooltanee chintz, Indian brocades, muslin and other cotton-cloth, assafœtida, lead (from the mines of the Eimack), cast-iron, saffron, pistachio-nuts, gums, a yellow dye, carraway seeds, and paper. The imports of Herat are chiefly silk, dates, tobacco, lemon-juice, and ivory heel-taps.

Several caravans go annually from Kabool to Bokhara. They export chiefly articles which have been imported from India, especially shawls and shawl-cloth, white cloth of all kinds, India turbans, Mooltanee chintz, indigo and spices; and they import from Bokhara principally horses, and gold and silver in coins and bars. Some articles brought from Russia are also imported by these caravans, especially cast-iron pots, cutlery and other hardware, needles, looking-glasses, Russia leather, tin beads, and spectacles. A fine cloth made of camel's wool, some raw cotton, and some lamb-skins are also brought from Bokhara and Balkh.

Towns.—A description of the towns of Kabool, Peshawur, Ghuznee, and Kandahar has been given under AFGHANISTAN, P. C., and that of Furrah is noticed under SEISTAN, P. C. Jellalabad, in the valley of the Kabool river, on its southern bank, is built at a nearly equal distance from Kabool and Peshawur. Though the river begins to be navigated by rafts at this place, it does not appear to be a commercial town. The population is stated to be 2000. The houses are low and the streets narrow. The town is surrounded with mud walls and has round towers. Quettah or Quote is not far from the northern entrance of the Bolan Pass, and as the kafilas between Kandahar and Shikarpoor pass through it, it has a more considerable trade than one would imagine from the appearance of the place. For it has only 400 small flat-roofed houses of one story each, which are surrounded by a thin mud wall. On the arrival of the caravans many merchants from the adjacent countries assemble here to purchase goods, which they retail among their own countrymen.

Towards the boundary of Persia are the towns of Herat and Subzawar. Herat is a well fortified town, three-quarters of a mile square. It contains about 50,000 inhabitants, among whom are about one thousand Hindus and forty families of Jews. It is enclosed by a high and thick wall surrounded by a wet ditch. There are five gates, defended each by a small outwork, and on the north side is a strong citadel, also surrounded by a wet ditch, which overlooks the town. The interior is divided into quarters by four long bazaars covered with arched bricks, which meet in a small domed quadrangle in the centre of the town. Many of the streets which branch off from the main ones are built over, and form low dark tunnels. The town contains 4000 dwelling-houses, 1200 shops, 17 caravanseras, and 20 baths, besides many mosques and fine public reservoirs of water. The manufactures of this place are numerous, but we possess very little information respecting the articles which are made and the extent of this branch of industry. It is stated that there are more than 150 shoemakers' shops in the city, but that they are unable to supply the demand of the province, and that many camel-loads of slippers are brought from Kandahar. Many lamb and sheep skins are made up into caps and cloaks. The manufactures sent to other countries consist of different kinds of silk stuffs, some woollen goods, sword-blades, and also the famous carpets of Herat. Subzawar is situated south of Herat in an extensive valley, and contains about 1000 houses.

There are two towns on the Indus which deserve notice. The most northern is Dera Ismael Khan, situated near the place where the Gomul river enters the Indus: in 1829 it was swept away by the floods of the river, but has been rebuilt since that time. It is well laid out; the streets are straight and wide, and the houses, built of sun-dried bricks, consist of a single story, rising from a basement or platform about a foot in height. The bazaar is spacious and well supplied. This town owes its importance to the caravans which assemble here to pass over the eastern table-land to Kandahar and Kabool. The town of Dera Ghazé Khan lies farther to the south, west of Mooltan (near 30° N. lat.), and is built on the alluvial bottom of the Indus, four miles inland, but it suffers from inundations when the periodical rise of the river is unusually high. It is surrounded by date-groves, and has a considerable traffic with the tribes which inhabit the eastern declivity of the table-land. From this place also a caravan road leads to Kandahar, but it does not appear to be much used. There are several considerable towns in the plain of Bunnoo and the mountain valleys of the Daman, but as they have never been visited by Europeans, we have no exact account of them.

Antiquities.—The antiquities of Afghanistan have lately attracted much attention. In the valley of Bameean, west of the Pughman mountains, are two colossal statues. [GHOOLGHOOLA, P. C., vol. xi. p. 208.] Many monuments have lately been discovered which the natives call topes or stupas, and which have excited great interest. As far as our present information goes, these monuments occur only in the valley of the Kabool river and its vicinity. The most eastern group is in the Kyber mountains, but it has not been examined, being difficult of access on account of the predatory habits of the Kyberees, or inhabitants of these hills. The greatest number of topes is in the plain of Jellalabad, particularly on both sides of the river Surkhrud; but they are also in other places, and on the northern side of the Kabool river. Others are found in the neighbourhood of Kabool. A few single topes occur in the Koh Daman, and a small group has been found at Wardeh, near the river Logur, before it enters the plain of Kabool.

All the topes, which are in a tolerable state of preservation, consist of two parts, a basement and a perpendicular body resting on it. This construction always terminates above in the form of a cupola, which is sometimes so depressed as to exhibit merely a convexity, but it generally approaches to the form of a cone. These edifices are substantially constructed of layers of large stones connected with well prepared and beaten earth. They vary greatly in dimensions, some of them having a circumference of 144 feet, and many of only 108 feet. The front, as it appears, is directed to the east, for all of them have flights of steps on that side; and some also on other sides. They are situated on the skirts of hills or elevations separated from each other by ravines, and in their vicinity there are always many caves, which apparently have been used as dwellings; they are supposed to have been the abodes of priests. Near them there are also always one or more tumuli, but there are tumuli where no topes are found; and in general such tumuli abound all over Afghanistan.

Most of the topes contain passages or tunnels extending from the centre to the circumference, and the centre is occupied by a small apartment. In these apartments or their recesses are found caskets or vases of copper or steatite. These vases are sometimes of a globular and sometimes of a cylindrical form, and usually contain smaller cylindrical cases of gold or silver, often of both. These vessels are often separate, but often also are one within the other. One of these smaller vessels generally contains a fragment or two of bone, and these appear to have been the relics over which the monuments have been raised. The whole is carefully wrapped up in an envelope of fine linen. The larger vases usually contain a portion of fine pulverized earth or of ashes; in which are found burnt pearls, beads, rings, seals, and other trinkets, with gems, coloured stones, pieces of crystal, fragments of mother-of-pearl shells, &c. In some the deposits have been accompanied by twists of tuz-leaves (probably the inner bark of birch), inscribed internally with characters, but they crumble away when they are handled. Some vases contain minute gold and silver cups, beads of pearls, of crystal, agate or coral, and small ornaments of gold and stones, and some coins.

The prevailing opinion respecting these extraordinary buildings is, that they were erected for the preservation of the relics of Buddha, and that this country was once peopled by nations which had embraced Buddhism. This opinion is supported by the accounts of two Chinese pilgrims, one of whom, Fa Hian, visited the Holy Land of Hianthu, *i. e.* Hindustan, about the year 400 A.D., and the other, Hiuan Thsang, about 630 or 650. Both of them state that a hundred years after the death of Buddha, or about a thousand years before the Christian æra, his adherents began to settle in this part of Afghanistan and to build their towers or stupas, and at the time of their travels they found numerous monuments of this description along the road.

Another kind of antiquities are the coins. Single coins have been found at several places. But they occur in great numbers in the Plain of Beghram, situated in the Koh Daman, where the rivers which drain that valley unite and take their course to the south-east towards the Kabool river. The plain contains about 24 square miles, and, except some slight ridges, the rubbish apparently of dilapidated buildings, it is a perfect level, on which rain stagnates as it falls. Mr. Masson employed several years to gather the coins found in this plain, and in 1837 he succeeded in collecting 60,000 copper coins, besides a number of silver and gold coins, a large number of engraved seals, some of them with inscriptions, figures of men and animals, particularly of birds, cylinders, parallelogramic amulets with sculptured sides, rings, and a multitude of other trinkets, generally of brass or copper. When Lieut. Wood in the following year visited the plain, some children were sent in search of coins, and in a few hours they returned with 35 copper pieces. It is further stated that from time out of memory coins have been collected on this plain, which have been sent to Kabool to be melted down, and that in some years as many as 30,000 pieces have been carried off. We are at a loss to explain in what manner or for what purpose such a number of coins have been heaped up at this place. Some think that it is the site of one of Alexander's frontier colonies, of Alexandria near Caucasus, and that it has been for a long time a very large town and the metropolis of a great empire. But in that case extensive ruins would exist, or the ground would be covered with small and low eminences; but only a few of such eminences occur, and it is far from being certain that they are the remains of buildings. But if it be admitted that the Plain of Beghram was the site of a large town, one would suppose that all the coins found there must belong to a comparatively short period. But the coins collected by Mr. Masson embrace a period of more than 1250 years, the oldest being coined 256 years before the birth of Christ, and the last about a thousand years after it. If the coins had been left there by the destruction of a town, the most modern coins would be most abundant, and those made in remoter times rare in proportion to the time which had elapsed when the destruction took place; but that is not the case: more than 2000 of them were struck during the reigns of the Bactrian kings Menander and Apollodotus, between 126 and 100 B.C.

The coins found on the Plain of Beghram are important historical documents. They throw light on the darkness in which the history of Turan and of Afghanistan is involved between the time when these countries were conquered by Alexander and governed by his successors, and the introduction of the Mohammedan religion, or from about 250 before Christ to about 1000 of our æra.

History.—Afghanistan was known to the Greeks under the name of Ariana [ARIANA, P. C.], which country however extended also over those parts of Persia which lie along the northern table-land of Iran, from Herat to Mount Elburz. It formed a part of the old Persian empire, and passed at its downfall, with the other provinces of Persia, under the dominion of Alexander the Great. After the disputes and wars between Alexander's successors had been settled, we find that this country, with Bactria, which was north of it, and comprehended the countries on both sides of the Oxus, formed part of the widely extended kingdom of Syria founded by Seleucus Nicator. It remained under the Syrian kings to B.C. 256 or 255, when Bactria, including the eastern part of Ariana, declared its independence under Theodotus or Diodotus. Before any attempt could be made by the Syrian kings to recover their dominion over these countries, Parthia, or the western portion of Ariana, revolted under Arsaces, who found means to strengthen himself so much, that the kings of Syria were unable to recover these countries. As Parthia was placed between the kingdom of Bactria and the eastern provinces of the Syrian monarchy, the Bactrians did not come frequently into collision with the Syrians and other nations of Western Asia, and accordingly mention is rarely made of this kingdom in the antient writers. It was not even known at what epoch Bactria had ceased to be governed by kings of Greek extraction; but the numerous coins which in the last twenty-five years have been collected in Hindustan, Afghanistan, and Bokhara, have in some manner filled up this deficiency in our historical knowledge. Under the article BACTRIA, P. C., a list of the Greek kings of Bactria has been given according to Bayer and Schlegel, but since the publication of that article the number of coins referring to the history of that country has been greatly increased, and the old lists are incomplete. The following lists of the Greek kings of Bactria have been made out by Professor Wilson and by Mr. H. T. Prinsep, the brother of the late Mr. James Prinsep.

B.C.	WILSON.	B.C.	PRINSEP.
256	Theodotus I.	256	Theodotus I.
240	Theodotus II.	240	Theodotus II
220	Euthydemus.	220	Euthydemus.
190	Demetrius.	190	Demetrius.
181	Eukratides.	178	Eukratides.
147	Heliokles.	155	Heliocles.
147	Lysias.	150	Antimachus.
135	Amyntas.	190	Agathocles.
	Agathoclea.	195	Pantaleon.
140	Antimachus.	155	Menander.
130	Philoxenus.	135	Apollodotus.
135	Antialkides.		Diomedes.
125	Archebius.		Zoilus.
126	Menander.		Hippostratus.
110	Apollodotus.		Straton.
100	Diomedes.		Dionysius.
98	Hermaeus.		Nicias.
135	Agathocles.	120	Hermaeus
120	Pantaleon.		

According to these lists, several kings reigned at the same time, or at least several persons acted as independent sovereigns and coined money. [Bactrian Coins, P. C. S.]

Besides the kings placed in Mr. Prinsep's list there is still a small number of others, namely, Antimachus, Archebius, Antialkides, Lysias, Philoxenus, and Amyntas, who appear to have been governors in Herat and Southern Bactria, and to have occasionally assumed the titles and prerogatives of kings.

Hermaeus, the last king of the series, is supposed to have been overpowered by Azes, a Scythian, who, as it appears, conquered these countries in company with Maues. Coins of these princes, and of their successor Azilides, are frequent. They have the Greek and Arianian inscriptions. It appears that these Scythians remained in possession of the country about thirty years, from 90 to 60 B.C. Before their arrival Mithridates the Second, of Parthia, had conquered a great part of Eastern Ariana; and though he was obliged to give way to the Scythian invaders, the Parthians do not appear to have entirely abandoned the country, as coins with Parthian names of kings are met with, which, to judge from the style in which they are executed, must have been made between 100 and 70 B.C. Professor Lassen, who has also occupied himself much with the coins of India, considers it as established, from the little that we have of Indian history, that Vickramaditya, king of Oojein, conquered Kabool about the middle of the century before our æra; but no coin is found of this person, which is not surprising, as no coins were in use at that period in Hindustan. The æra of Vickramaditya dates from a victory obtained over the Scythians in the Panjab, and begins 56 B.C. Though the conquest of Vickramaditya rests only on a supposition, an Indian conquest of the country which must have happened about this time is proved by the fact that after this time we find Hindu deities substituted on the coins for those of the Grecian mythology. On the coins of the sovereigns who governed Afghanistan after the decease of Vickramaditya, and who, as it appears, were called Kadphises, Siva appears in the mixed male and female character, and is very generally accompanied by the bull Nandi; but it is remarkable that the Greek legend on the obverse is preserved, and that the reverse has an inscription in Arianian characters and the Sanscrit language. The three princes called Kadphises appear to have got possession of Afghanistan in the time of Augustus Cæsar, or at the commencement of our æra, and to have maintained it through the whole of the first century.

The dominion of the family of the Kadphises seems to have been overturned at the close of the first century by the irruption of another nation of Scythians, for about this time a new series of coins begins, of a different device and style from any before current. These kings bear on the coins the name of Kanarkes, and they seem to have possessed the country nearly to the close of the fourth century. Their coins are not bilingual: the only characters are Greek, but they become at last so corrupt as to be quite illegible. On the reverse no mythological deity is impressed, but there are Mithraic representations of the sun or moon, with mystical names of these luminaries, also in Greek letters. A few of the Kanarki coins have Siva and the bull on the reverse, so that it appears that the Hindu religion was not wholly rejected, but that the Mithraic worship predominated.

It is not ascertained when the family of the Kanarkes ceased to reign in Afghanistan, but as the coins of Shahpoor, or Sapor II., and those of his successors to Khosru Nusherwan, are frequently met with, it is supposed that the country became subject to the Sassanian dynasty in Persia towards the end of the fourth century. That family probably kept possession of the country to the time when they were overpowered by the successful invasion of the Arabs under the caliphs.

It appears further that though the Sassanian dynasty was deprived by the Arabs of the western part of Iran, or the present kingdom of Persia, some princes of that family still kept a footing in the eastern part, or in Afghanistan, but their enfeebled power was unable to hold out for a long time against the repeated invasions of the Turkoman tribes, who were in possession of Turan. Some of these tribes settled during the seventh and eighth centuries in Afghanistan. Among them were the Afghans or Assakanes, mentioned for the first time by Ferishta under the year A.D. 681, who further notices that in the ninth century they inhabited the mountains of Goor or Ghor, under which name the mountain-regions of the Paropamisus were comprehended. The Afghans themselves maintain that they are descended from Afghan, the son of Irmia or Berkia, son of Saul, king of Israel, and all their histories of their nation begin with narrating the transactions of the Jews, from Abraham down to the captivity. After the captivity they allege that part of the children of Afghan withdrew to the mountains of Gohr, and part to the neighbourhood of Mecca in Arabia. After their settlement in these mountains had been effected, they appear gradually to have been converted to the Islam, but Ebn Haukal mentions that in the tenth century the bulk of the nation had not yet embraced that creed, though some Mohammedans were found among them. In the ninth century a Turkoman family, the Samanides, succeeded in establishing a regular government in Afghanistan, which lasted to 976. A dispute about the succession to the throne deprived the Samanides of the possession of the country, which was taken possession of by Subuktageen.

Subuktageen must be considered as the founder of that dynasty which is known by the name of Ghuzneevides, from the circumstance of their residing in the town of Ghuznee. Subuktageen had already made some incursions into the Panjab and with success, and his son Mahmood, more especially named the Ghuzneevide, is considered the first Mohammedan emperor of Hindustan. He undertook twelve expeditions against the Hindus, and laid the country waste as far as the plains of Bengal and the peninsula of Guzerat, but he did not establish a settled government in any part of the conquered countries. Like most of the wars of the nomadic tribes, his expeditions must be considered rather as predatory incursions than as well-conducted conquests. He plundered the country, and obliged the princes to pay a sum of money to withdraw with his army. Those princes whose dominions were contiguous to the territories of Mahmood were subjected to a regular tribute. His son Massood and his successors soon lost their influence over the countries east of the Indus, and the dynasty of the Ghuzneevides was overthrown in 1186 by the Afghans.

The Afghans inhabiting the mountains of Ghor had been much oppressed by the government of the Ghuzneevides, and rebelled in 1186, under their chief Mohamed, who not only overturned the existing government in Afghanistan, but also established his dominion over the northern districts of Hindustan, where the Afghan family of Ghor maintained its power up to 1288. Meanwhile Gengis Khan had begun his uninterrupted course of victories and conquests, and about 1224 his armies appeared in Afghanistan, and took Kandahar and other cities. But it appears that the Moguls did not settle permanently in Afghanistan before 1242, when they established there the kingdom of Zagatai, in which Kabool was included. The Moguls did not extend their conquest into Hindustan, but many of them went there to serve in the armies of the princes of the family of Ghor. The Afghans, especially those of the tribe of the Giljics, served also as mercenary troops. When the disorders in the Indian government began to increase through family discord and disputes about the succession to the throne, the mercenaries began to contend for supremacy, and the Giljies succeeded in putting an end to the dynasty of Ghor in Delhi, and taking their place under Feroze (1288).

It appears that the descendants of Gengis Khan, or at least a Mogul family, kept possession of Afghanistan to 1394, when Timur invaded the country on his famous expedition to Hindustan. Though he abandoned Hindustan as soon as he had conquered it, he annexed Afghanistan to his empire of Samarkand, and it seems that princes of his house were governors of this country up to the time of Baber, who took possession of Kabool in 1504, which remained his chief residence up to 1526, when he overthrew the Afghan dominion in Delhi, and established himself at Agra. Thus Afghanistan became a province of the Mogul empire of Hindustan, and remained so until it was conquered by Shah Abbas the Great, in about 1626, and annexed to the kingdom of Persia. It was retaken some years afterwards, but again conquered by Shah Abbas II. in 1645. As long as the government of Persia acted with vigour and treated the Afghans with justice, the peace of the country was not disturbed. But under the weak reign of Shah Sultan Hussein disorders crept into every branch of the administration, and a governor of Kandahar committed some acts of injustice against the chief of the Giljie tribe, Meer Veis, who killed the governor and revolted against the government (1709). Kandahar was besieged by a numerous army, which however was unable to take the town (1713). After the death of Meer

Veis, his son Meer Mahmood took the power into his hands, assembled a large army, and invaded Persia (1716). Not meeting with any resistance, he advanced to Ispahan, and besieged it in 1722. After a siege of several months, in which the inhabitants suffered all the horrors of famine, Ispahan was forced to capitulate. Sultan Shah Hussein resigned his crown to the conqueror, and with Meer Mahmood an Afghan family ascended the throne of Persia. Mahmood soon afterwards became mad, and died in 1725. His cousin Meer Ashruf took his place. But the whole of the Persian empire had not been occupied by the Afghans. The provinces surrounding the Caspian Sea on the south and west were still in possession of Thamasp, a son of Shah Hussein, who however was already reduced to great straits, when Nadir Koolly, better known as Shah Nadir, entered into his service. He vanquished Meer Ashruf in two battles in 1729, and entered Ispahan. Ashruf lost a third battle near Persepolis in 1730, and was soon afterwards slain. Shah Nadir then conquered Kandahar and the rest of Afghanistan, and, invading Hindustan in 1739, he took Delhi, but contented himself with the immense booty he got there, and turned his arms against the Uzbecks in Bokhara and Khiva, and the Turks. In 1747 he was murdered in his tent, and one of his generals, Ahmed Khan, became the founder of the Duranee dynasty.

Directly after the assassination of Shah Nadir, Ahmed Khan, accompanied by 2000 or 3000 horse, repaired to Kandahar, where he found a great sum of money sent from Hindustan as a tribute to Shah Nadir, and by seizing it he found himself enabled to gain the goodwill of his countrymen, the Afghans, of whom the Duranees, Beloochees, and the Hazaras assisted at his coronation as king of Afghanistan: the Giljies kept aloof. Having settled the country and assembled an army, he began a course of conquest, which only terminated shortly before his death. In 1748 he reduced the Giljies to obedience, and made himself master of the valley of the Kabool river, whence he invaded the Panjab, defeated the army sent against him, and entered Lahore. He then passed the Sutlege river, and defeated another army at Sirhind, but did not follow up this advantage, but returned to Kandahar. In the following year he established his authority in Herat and Meshed; in 1750 he took Nishapoor, and in 1751 he advanced even to Asterabad. In 1752 Ahmed Khan retook the Panjab, which had revolted, and added to it Cashmere. By a treaty with the Great Mogul he acquired all the countries of the Panjab and as far east as Sirhind. But in 1756, when the emperor of Delhi had again taken possession of the Panjab, and annexed it to his empire, Ahmed Khan entered Delhi with his army. The emperor was obliged to leave the Panjab and Sinde in his hands. The Mogul government had become so distracted that all its neighbours attacked it, with the certain prospect of reaping considerable advantages from their expeditions. The Mahrattas especially turned these circumstances to account. They for some time had made rapid progress, and in 1757 they took Sirhind and obtained possession of that part of the Panjab which lies east of the river Jheelum or Jilun. Ahmed Khan retook them in 1759, and entered Delhi, which however was besieged by the Mahrattas and retaken in the same year. The power of the Mahrattas had now attained such a height that all the Mohammedan princes of Hindustan began to fear that their supremacy was drawing to an end, and that they soon would be expelled from the country. This seems also to have been the object of the Mahrattas, to judge from the great preparation that they made for the campaign of 1760. The Indian princes therefore called Ahmed Khan to their assistance. He came, and the famous battle of Paniput (7th of January, 1761) put an end to the supremacy of the Mahrattas. Ahmed Khan could now have ascended the throne of Delhi, but he contented himself with the possession of the countries which had formerly been ceded to him, and returned to Kabool. None of the numerous victories which the British have obtained in Hindustan has more facilitated their conquests in that country than the battle of Paniput, in which they were not present. For the only power which was able to make a strong resistance to foreign conquerors had been broken down, and Ahmed Khan left, by his returning to Afghanistan, the government of all the Mohammedan princes in the most disjointed state. In the latter part of his life Ahmed Khan was almost continually contending with the Sikhs, who were settled in the mountains north of the Panjab, and they made several attempts to get possession of the plains drained by the Five Rivers. Ahmed Khan always succeeded in driving them back into the mountains, but the possession of the Panjab remained a precarious tenure. Ahmed Khan died in 1773, and to his praise it must be recorded that the memory of no Eastern prince is stained with fewer acts of cruelty and injustice. The empire which he had erected extended from Herat on the west to Sirhind on the east, and from the banks of the Oxus and Cashmere on the north to the Arabian Sea and the mouths of the Indus on the south. It may appear a matter of surprise how such an extensive empire could fall to pieces in such a short time as has elapsed since the death of Ahmed Khan. This may be accounted for by the peculiar organization of this as well as so many other extensive empires of Western Asia, which have had the same fate. Some of the conquered countries were left in possession of their native princes, who were only obliged to pay a tribute, as Beloochistan and Sinde. To others governors were sent with absolute power, as to Cashmere. Whenever the possessors of these countries perceived that their sovereign was unable to compel the tribute, they refused to pay it. The authority of the Afghan sovereigns in their own countries also was not great, as it was dependent on the good will of the chiefs of the different tribes, who frequently paid no attention to the orders of their master, and whom he was not always ready to compel to do their duty. It is evident that such an empire can only be kept together by a sovereign who is always at the head of a sufficient army, and always marching from one end of his country to the other, as Ahmed Khan really did. A sovereign gifted with a less active or restless mind soon found that his authority decreased. This happened to Timur Shah, the son and successor of Ahmed Khan. He removed the seat of government from Kandahar to Kabool, and seems to have made some attempts to establish a more settled administration, but he was almost always engaged in putting down the rebellions which broke out in the different provinces of his empire. In 1781 he was obliged to march into the Panjab to recover Mooltan, which had been betrayed into the hands of the Sikhs by the governor. He died in 1793. At his death the second of his sons, Shah Zeman, was raised to the throne by an intrigue. He had to put down several insurrections and rebellions, but the affairs of the Panjab and of Herat chiefly occupied his time and attention. The Sikhs had got possession of the Panjab, and in 1798 he advanced without molestation to Lahore, when Runjeet Singh submitted, did homage in person, and was installed by him as governor of the province. Shah Zeman did not dare to remain long in the Panjab, as his step-brother Mahmood, who was governor of Herat, and acted as an independent sovereign, was always ready to march to Kandahar to get possession of that town, and Zeman was unable to reduce Herat. In 1799 several great men entered into a conspiracy for the purpose of deposing Zeman and raising his brother Shoojah on the throne. The conspiracy was discovered and the conspirators were beheaded, among them Sirafrauz Khan, the powerful head of the Barukzyes, one of the principal clans of the Duranees. This estranged Futeh Khan, the son of Sirafrauz Khan, from his interests, and this warrior joined the party of Mahmood of Herat. By his assistance Mahmood got possession of Kandahar, and soon afterwards Shah Zeman fell into his hands, and was deprived of sight. Mahmood took possession of the throne in 1800. His reign lasted only three years. Prince Shoojah-ool-Moolk, the brother of the deposed king, made three attempts to drive Mahmood from the throne, but they were frustrated by the activity and valour of Futeh Khan. The powerful tribe of the Giljies, which had given kings to Persia and emperors to Hindustan, tried in 1801 and 1802 to raise one of their chiefs to the throne, instead of a Duranee, but they were defeated. Mahmood however was unable to give even a slight degree of stability to his government, and permitted the inhabitants of the towns and in general the agricultural population to be plundered and oppressed by an undisciplined soldiery. An insurrection took place in the town of Kabool. Prince Shoojah, being informed of it, advanced with an army, and found that the king was besieged in the Bala Hissar, or citadel of Kabool, which was closely invested by the populace. Futeh Khan advanced with an army to his relief, but Prince Shoojah succeeded in defeating him, and Mahmood was sent to prison.

Shah Shoojah occupied Kandahar, and, having settled the western provinces of his kingdom, gathered a strong army and began the wandering life of an Afghan sovereign. He marched to Sinde, which submitted and paid the tribute in arrear, and then returned by Peshawur to Kabool. Meanwhile Futeh Khan had tried to put Kamran, the son of Mahmood, who was governor of Herat, and acted as an independent prince, in possession of Kandahar, but he did not succeed. The Shah sent an army to Cashmere, the only province in rebellion, in 1805, and it was subdued in 1806. But at the same time Prince Kyser, a son of Shah Zeman, had been induced to rebel, by Futeh Khan, and had been proclaimed king of Kabool, but was beaten, and submitted in 1808. During this civil war Mahmood had been liberated, and had taken Kandahar. Shoojah marched against and defeated him. Cashmere had again rebelled, and the vizier of Shoojah, Akram Khan, was defeated and lost nearly the whole army. This event threw the affairs of Shah Shoojah into great disorder. Mahmood captured Kabool, whilst the Shah was at Peshawur. In the following year (1809) Shoojah marched to Kabool, but his vizier, Akram Khan, was beaten and killed. The Shah, abandoned by all, became a fugitive, and was soon led as a captive to Cashmere.

Shah Mahmood again ascended the throne in 1809. He sent his army in 1811 to Cashmere, and was supported by a force of Sikhs which Runjeet Singh sent to his assistance. Cashmere was obliged to submit, and Shah Shoojah was set at liberty and went to Lahore. Runjeet Singh acquired the fortress of Attock, and since that event the power of the Afghans has ceased on the eastern side of the Indus. In 1815 the Persians were about to attack Herat. Futeh Khan, the vizier of Mahmood, marched against them and defeated their army, but made himself master of the place, dismissing the governor, a brother of Shah Mahmood. In 1816 Futeh Khan was deprived of his sight by Kamram, the son of Shah Mahmood, and soon afterwards murdered. The consequence of this wanton and cruel act was a civil war between the powerful brothers of Futeh Khan and Shah Mahmood, by which the reigning family in progress of time was deprived of all its territories except Herat. Several princes of the royal family were raised to the throne, but soon lost it by another revolution, and then several members of the family of Futeh Khan occupied it for a short time, until at last the country was divided among them in 1824. Dost Mahomed Khan, one of the brothers, succeeded in appropriating to himself the valley of the Kabool river and the adjacent districts in 1826. Shah Mahmood died in 1829 at Herat, and was succeeded in that sovereignty by his son Kamram. During these troubles Runjeet Singh had made himself master of Cashmere and kept it. One of the brothers of Futeh Khan had been put in possession of the plain of Peshawur, but Runjeet Singh contrived matters so that Yar Mahomed Khan found himself compelled to pay tribute to the chief of the Sikhs, and at last he deprived him of his territories, and placed Peshawur under the government of the Panjab. If some valleys in the Himalaya Mountains are excepted, it may be said that the power of Maharaja Runjeet Singh was erected at the expense of Afghanistan. As late as the beginning of the reign of Shah Shoojah, the Panjab, Cashmere, with the adjacent countries, and the plain of Peshawur, were considered as appurtenances of Afghanistan, and these provinces constituted in 1832 the empire of the Sikhs. In 1808 Shah Shoojah still received a tribute from the Ameers of Sinde: but they had also become independent during the civil war. Between 1809 and 1839 Shah Shoojah made several attempts to re-conquer Afghanistan, but without effect. At last he retired to Ludiana on the Sutlege in 1835, where he received an annuity from the British government in India. When the British entered Afghanistan three brothers of Dost Manomed Khan were in possession of Kandahar and the contiguous countries, and Herat was governed by Kamram: all the rest of Afghanistan was subject to Dost Mahomed Khan.

Dost Mahomed resided at Kabool as his capital city, while Runjeet Singh was sovereign of Lahore, and was at the same time in possession of Cashmere and Mooltan. Dost Mahomed, desirous of securing the friendship of the British government, on the 31st of May, 1836, addressed a complimentary letter to Lord Auckland, who arrived at Calcutta towards the end of 1835, as Governor-General of India, and who appears to have soon adopted the notion that the British empire in India was in danger from the intrigues and forces of Russia, Persia, and Afghanistan. On the 20th of September, 1837, Captain Alexander Burnes reached Kabool as envoy from the governor-general. On the 24th of December a Russian agent arrived at Kabool, and Burnes was somewhat confounded to learn that he was honourably received by Dost Mahomed. On the 26th of April, 1838, Captain Burnes left Kabool on his return, and after visiting Runjeet Singh in Lahore, repaired to Simla to meet Lord Auckland. Here it was resolved that, as Dost Mahomed was treacherous, and disposed to enter into alliance with Russia and Persia, and could not be trusted, he should be dethroned, and Shah Shoojah sent with an English army to recover the throne of Kabool. Two months before Captain Burnes met the governor-general at Simla, a treaty had been made by Mr. MacNaghten and others with Runjeet Singh, in which he undertook to prepare the way for an easy advance of the British army through the Sikh country to Kabool. On the 1st of October, 1838, a proclamation of war was issued from Simla against Dost Mahomed. Sir Henry Fane was at that time commander-in-chief of the whole army of India, which was then raised to 203,000 men. Runjeet Singh, notwithstanding the late treaty, refused to allow the British troops to cross the Panjab, and the principal rendezvous was therefore appointed at Shikarpoor in Sinde, whence the line of advance was to be by the Bolan Pass, Quettah, and Kandahar. The force on the Bengal side, 9500 strong, was ready to advance to Sinde at the beginning of December; and a reserve division, 4250 strong, was stationed at Firozepoor, on the banks of the Sutlege, about 50 miles from Lahore. A Bombay column of 5500 men, under Sir John Keane, was to advance through Sinde, the Ameers having promised to provide supplies and the means of conveyance. Shah Shoojah's contingent was 6000 men. As soon as the Bengal division reached Firozepoor, Sir H. Fane resigned the command from ill-health, and Lord Auckland appointed Sir John Keane to the direction of the whole army of advance, Sir Willoughby Cotton, as senior officer, succeeding to the command of the Bengal division till its junction with that of Bombay. Runjeet Singh and the Sikhs having failed to afford the promised assistance, Sir Willoughby Cotton and the Bengal army, with 80,000 camp-followers, on the 20th of February, 1839, began to cross the broad desert towards the Bolan Pass, and reached Dadur, at the foot of the western mountains of Afghanistan, and close to the Bolan Pass, on the 6th of March, when provisions were already so short that the camp-followers were put on half-rations. The pass is 60 miles long, winding, rugged, and flanked by high rocks. The surrounding country is inhabited by the wildest tribes of Afghans, who live almost entirely by plunder. Fortunately little opposition was offered to the troops, and they reached Quettah, in a fertile valley, after losing a vast number of horses and camels owing to the extreme ruggedness and difficulty of the Pass. At Quettah they expected to find supplies, but there were none; and after some useless negotiations with Meerab Khan of Khelat, to whom the place belonged, the army was compelled to push forward, in a state approaching to famine, to Kandahar, distant 150 miles, which they reached on the 26th of April, having marched 1000 miles since they left Firozepoor.

On the 12th of April the Bombay column, after having endured terrible fatigues and privations, entered the Bolan Pass, and, in spite of considerable opposition, passed through it, and joined the Bengal division on the 4th of May. The united army then amounted to 10,400 fighting men. The camp-followers had been greatly reduced, but still amounted to 29,000.

Kandahar contained nearly 100,000 inhabitants. The rulers fled with their families, and the population seemed to give a warm welcome to Shah Shoojah. On the 1st of July the whole army had quitted Kandahar, and was in march for Ghuznee, 230 miles distant, the soldiers being on half-rations and the camp-followers on quarter-rations. On the 21st of July the army encamped under the walls of Ghuznee, which was found to be much more strongly fortified than Sir John Keane had expected. All the gates had been walled up except that opening upon the Kabool road, and it was resolved, as the only means which offered any prospect of success, to blow down this gateway with powder-bags, and attempt to take the town by assault. On the night of the 22nd of July the gate was blown open by 300 pounds of powder in twelve bags; the storming-party immediately rushed in, and, after a long and desperate and doubtful fight with the Afghans, carried the town, and by five o'clock in the morning, or little more than three hours after the gate had been blown open, the strong citadel was also taken, and the British colours waved from its battlements. Hyder Khan, the governor, one of the sons of Dost Mohamed, surrendered in the course of the morning, and was placed under the care of Sir Alexander Burnes, who had been knighted previous to the advance of the army.

On the 30th of July Sir John Keane marched with the main army from Ghuznee to Kabool; and Mahomed Akber Khan, Dost Mahomed's second son, who held Jelalabad, having been hastily recalled to assist in the defence of Kabool, Jellalabad was taken possession of by Colonel Wade, who attacked Akber Khan so vigorously in his retreat that he was compelled to abandon all his artillery, camp equipage, horses, bullocks, and 7000 rounds of ball-cartridge, which fell into the hands of the British.

As Sir John Keane drew near Kabool, Dost Mahomed abandoned his throne and capital, and fled with 600 horsemen to seek a refuge beyond the Oxus. At the same time the death of Runjeet Sing was announced. Sir John Keane and Shah Shoojah encamped under the walls of Kabool on the evening of the 6th of August, and on the following day the Shah, accompanied by the British officers, made his triumphal entry into his former capital; but there was no display of enthusiasm on the part of the natives, whose behaviour was orderly and respectful, but cold and cheerless.

The conquest was now considered to be complete. The Bombay column quitted Kabool on the 18th of September, the Bengal division on the 20th of October; and, leaving 8000 men, British and sepoys, besides the Shah's contingent, to secure him on his throne, the British army returned to India. Sir John Keane returned to England, and was raised to the peerage by the title of Baron Keane of Ghuznee and Cappoquin, with a pension of 2000*l.* a year.

Mr. MacNaghten, having been created Sir William Mac Naghten, was left at Kabool as envoy, and Sir Alexander Burnes as assistant to the envoy. In the spring of 1840 insurrections and attacks upon the British outposts began to break out, which, as summer advanced, assumed a bolder character, and were not kept down without a good deal of severe fighting. Dost Mahomed, having received some assistance, returned to Afghanistan, to stir up the insurrection; but as he advanced towards Kabool, he received such severe losses and was reduced to such extremity by the British troops, that he resolved to surrender to Sir William MacNaghten; and, on the 3rd of November, when Sir William was returning from his evening ride, Dost Mahomed rode up to him, alighted from his horse, and, presenting his sword to the envoy, sought his protection. His sword was returned, and the protection promised. He had ridden sixty miles from the field of the battle of Purwan Durrah, in which he had been defeated on the preceding evening, straight to Kabool, having been twenty-four hours on horseback. On the 12th of November he was sent to India under a strong escort. Mussooree, on the British north-west frontier, was assigned to him as a place of residence, and three lacs of rupees, or about 30,000*l.*, were allotted to him as a revenue.

The insurrections continued. At the end of 1840 the British had 16,000 men in Afghanistan; in November, 1841, they had 14,000, besides the Shah's contingent. In May, 1841, Major Pottinger warned Sir William MacNaghten of the dangerous situation of the British, of the insufficiency of the military force in some places, and the badness of the cantonments in nearly all. He was disregarded both by Mac Naghten and Burnes. By the end of September the neighbourhood of Kabool swarmed with predatory bands, and during the month of October the British officers were treated with insolence and insult in their cantonments at Kabool. On the 2nd of November, 1841, Sir William MacNaghten was in the cantonments, and Sir Alexander Burnes in his house in the city, when, about nine in the morning, Burnes's house was set on fire, and himself, his brother Lieut. Burnes, Lieut. Broadfoot, and every man, woman, and child on the premises murdered. The British officers in the cantonments seemed to be stupified, and did nothing. Major-General Elphinstone at this time held the chief command of the army, but was in such a state of nervous weakness from ill-health as to be utterly incapable of acting with the necessary decision and energy in such an emergency. The insurrections continued to increase; the British officers became more confused and indecisive; Sir William MacNaghten was murdered on the 23rd of December, in the presence of Akber Khan, who had invited him to a conference; and by a council of war held on the 26th of December, a treaty was ratified, by which it was agreed to leave behind all the guns except six, to relinquish all the treasure, to give up four officers as hostages, and to pay 40,000 rupees, in bills drawn upon India, but negotiated on the spot by some Hindu bankers, for which the whole army was to be escorted to Peshawur; but ultimately Akber Khan undertook to conduct it in safety to Jellalabad.

On the 6th of January, 1842, the bills having been drawn, and hostages given up, the army left its cantonments at Kabool, and began its retreat, one of the most disgraceful to the British army as well as the most disastrous that has ever been recorded. The whole force was estimated at about 4500 fighting men and about 12,000 men of camp-followers, besides women and children.

The work of massacre began immediately; on the 8th of January, Major Pottinger and Captains Lawrence and Mackenzie were given over to Akber Khan, as hostages for the evacuation of Jellalabad by General Sale; and the army entered the Khoord Kabool Pass, five miles long, shut in on either hand by a line of lofty hills, with a torrent dashing down the centre, whose course the frost in vain attempted to arrest. The destruction of life in this pass was very great. Lady Sale received a ball in her arm, and Lieut. Sturt, her son-in-law, was mortally wounded. On the 9th the married officers, with their wives and children, and two other wounded officers, were given up to Akber Khan. On the 10th the army made its way through the Tunghee Tarekee, or Dark Pass, only fifty yards long, and the Tezeen Pass, three miles long, with great loss. On the 11th General Elphinstone, with two other officers, fell into the hands of Akber Khan. On the 12th the army reached Jugdulluk, 23 miles from Tezeen, and at night entered the Jugdulluk Pass, two miles long, and exceedingly narrow, precipitous, and difficult. They found the exit from the pass closed up by two strong barriers of prickly holly-oak stretching completely across the defile. On the 13th, when the remnant of the force reached the neighbourhood of Gundamuk, where the final struggle took place, they had only about twenty muskets left. Captain Souter and seven or eight men were taken prisoners. Dr. Brydon reached Jellalabad. The rest were killed. During the whole time of the retreat the attacks of the Afghans were incessant, the cold was intense, and they were almost entirely without food. Including camp-followers, women, and children, about 26,000 individuals were destroyed.

General Sale held Jellalabad, General Nott maintained himself in Kandahar, and Colonel Palmer, with one native regiment and some artillery, retained Ghuznee, which however was afterwards taken from him, and Palmer and the remains of his army made prisoners. Akber Khan on the 18th of January laid siege to Jellalabad, and though the wretched mud walls as well as the fortifications thrown up by General Sale were shattered by a tremendous earthquake, and many other earthquakes occurred which obliged the soldiers to sleep in their clothes and accoutrements for fear of breaches in the walls and the risk of night attacks, Akber Khan was neither able to take the place nor prevent Sale's foraging-parties from supplying the garrison with the means of subsistence.

Lord Ellenborough succeeded Lord Auckland as Governor-General of India, where he arrived on the 28th of February, 1842, and the courage of the garrison of Jellalabad was kept up by the welcome intelligence that Colonel Wild would attempt to relieve them by forcing his way through the Khyber Pass, and that General Pollock was crossing the Panjab with a fresh army from India. Colonel Wild in vain attempted to get through the Khyber Pass, but General Pollock kept steadily advancing, and though the distance was from 500 to 600 miles, he arrived at Jellalabad on the 16th of April, having beaten the Afghans decisively in the Khyber Pass, and when he reached the fortress the beleaguering army was dispersed and in rapid flight. General Nott, on receiving some supplies in Kandahar, was ready to co-operate with General Pollock and General Sale in an advance upon Kabool. Shah Shoojah had some friends among the Afghan chiefs, and was able to maintain himself in the Bala Hissar, or citadel of Cabul, after the British had left him to his own resources; but he was assassinated by Shoojah Dowlah, and Futty Jung, Shah Shoojah's youngest son, was proclaimed king by one party and opposed by another.

On the 17th of January, the party of prisoners, consisting of 20 officers, 9 ladies, and 14 children, besides 17 European soldiers, 2 European women, and one child, reached the fort of Buddeabad, in the Lughman valley, where they were kept till the 10th of April, when they were marched back to a fort at Tezeen, Lady MacNaghten's baggage having previously been rummaged and plundered of jewels and shawls valued at 15,000*l.* General Elphinstone died in this fort on the 23rd of April, and his body was sent to Jellalabad for interment.

In consequence of the indecision of the Indian government and the deficiency of his supplies, General Pollock was not able to leave Jellalabad before the 20th of August. Meantime, on the 15th of August, General Nott, at the head of 7000 men, had left Kandahar for Ghuznee and Kabool. Sultan Jan attempted to stop his march, but sustained a complete defeat; Ghuznee was retaken, and General Nott continued his advance to Kabul.

On the 25th of August, Akber Khan hurried his prisoners off towards Turkistan, under a threat that he would make presents of them all to the chiefs of that wild country. On the 3rd of September they reached Bameean, where they were halted at an old fort till fresh orders were received from Akber. On the 11th of September the khan who had charge of them signed an agreement with five English officers, in which they undertook to give him 20,000 rupees and ensure him 1000 rupees per month for life, on condition that he assisted them to regain their liberty and rejoin their countrymen. The khan now hoisted the flag of defiance on the walls of the old fort, Major Pottinger was appointed commander, and some neighbouring chieftains, knowing that the British armies was drawing near to Kabool, came in and swore on the Koran allegiance to him and his companions.

On the 15th of September, General Pollock, after some hard fighting at the Jugdulluk Pass and elsewhere, having joined his forces with those of General Nott, entered Kabool; and one of his first acts was to send off a party of Kuzzilbashes, adherents of the late Shah Shoojah, to the aid of the prisoners, who on the same day had quitted the fort, resolved to fight their way back to Kabool. At two o'clock in the morning of the 17th of September they were aroused by the arrival of a horseman with a letter from Sir Richmond Shakespear, who was advancing with 600 mounted Kuzzilbashes to meet them. The party resumed their march at an early hour, and at midday reached some deserted forts, where they were sheltering themselves from the sun, when, at three o'clock, Sir Richmond Shakspear and his troop arrived. 'Our gallant countryman,' says one of the party, 'was greeted on our side with no boisterous cheers of triumph. Our joy was too great, too overwhelming for tongue to utter. That we should have escaped unhurt, with so many delicate women, young children, and tender infants, through such numerous perils, fatigues, and privations, and above all from the hands of such merciless enemies as Akber Khan and his Ghilzie confederates, seemed at first too much for the senses to realize.' The march was resumed on the 18th, and on the 20th they were met by General Sale's brigade, the gallant veteran being there in person to regain his long-lost wife and daughter, the widow of the brave Lieut. Sturt. On the 21st of September the happy party marched forward with General Sale's brigade, and entered General Pollock's camp at sunset, amidst the cheers of the soldiers, the congratulations of their friends, and the roar of the artillery, which announced their welcome arrival.

Victory now attended the British standard wherever it was raised, and the Afghan war was at an end. The prisoners had been restored to liberty and their friends, and by a series of well-fought battles the reputation of the British army had been retrieved. On the 1st of October, Lord Ellenborough issued a proclamation from Simla, stating that the disasters in Afghanistan having been avenged upon every scene of past misfortune, the British army would be withdrawn beyond the Sutlege.

On the 12th of October, after having destroyed the fortifications of the Bala Hissar at Kabool, the army began its march back to India, and on the 17th of December, 1842, reached Firozepoor, on the Sutlege, where, as Lord Ellenborough expressed it, they were 'within their native boundaries.'

General Sir William Nott died on the 1st of January, 1845, on his estate near Caermarthen, in Wales.

(Ferishta's *History of the Rise of the Mahomedan Power in India*, translated by Briggs; *Memoirs of Zeehir-ed-din Muhammed Baber*, translated by Leyden and Erskine; Hanway's *Revolutions of Persia; The Chronicles of a Traveller*, translated from the Latin of Clodius, by Mitford; Elphinstone's *Account of the Kingdom of Cabul and its Dependencies;* Burnes' *Travels into Bokhara;* Arthur Conolly's *Journey to the North of India, overland from England;* Wood's *Personal Narrative of a Journey to the Source of the River Oxus;* Hough's *Narrative of the March and Operations of the Army of the Indus;* Vigne's *Personal Narrative of a Visit to Ghuzni, Kabul, and Afghanistan; Narrative of the Present War of Afghanistan*, by an Officer; Masson's *Narrative of various Journeys in Beloochistan, Afghanistan, and the Panjab:* Wilson's *Ariana Antiqua; a Descriptive Account of the Antiquities and Coins of Afghanistan, with a Memoir on the Buildings of the Topes*, by Masson; Prinsep's *Note on the Historical Results deducible from the recent Discoveries in Afghanistan;* Irwin's *Memoir of the Climate, Soil, Produce, and Husbandry of Afghanistan*, in *Calcutta Asiatic Journal*, Nos. 93, 94, 95, 96, 97; Hutton's *Wool and Woollen Manufactures of Khorassan*, in *Calcutta Asiatic Journal*, No. 99; Edward Conolly's *Notes on the Eusofzye Tribes in Afghanistan*, in *Calcutta Asiatic Journal*, No. 105; Postan's *Memorandum on the Silk Trade between Shikarpore and Khorassan*, in *Calcutta Asiatic Journal*, No. 104; Edward Conolly's *Sketch of the Physical Geography of Seistan*, in *Calcutta Asiatic Journal*, No. 103; Arthur Conolly *On a Mission into Khorassan*, in *Calcutta Asiatic Journal*, No. 110; Edward Conolly's *Journal kept while travelling in Seistan*, in *Calcutta Asiatic Journal*, No. 112; Dr. Griffith's *Extracts from a Report on subjects connected with Afghanistan*, in *Calcutta Asiatic Journal*, No. 118; Postan's *Memorandum on the Trade between the Towns of Shikarpore and Candahar*, in *Calcutta Asiatic Journal*, No. 109; Agha Abbas' *Journal of a Tour through Parts of Panjab and Afghanistan*, in *Calcutta Asiatic Journal*, No. 139; Captain Drummond *On the Mines and Mineral Resources of Northern Afghanistan*, in *Calcutta Asiatic Journal*, No. 109; *The Bolan Pass*, in *London Geographical Journal*, vol. xii.; Forster's *Journey from Bengal to England, through the Northern Parts of India;* MacFarlane's *Indian Empire*, 2 vols. 12mo.)

AFRICA'NUS, SEXTUS CAECI'LIUS, a Roman jurist. Many excerpts from his Nine Books of Quaestiones are contained in the Digest. [JUSTINIAN'S LEGISLATION, P. C.] Africanus often cites the Responsa or opinions of Salvius Julianus, who lived under Hadrian; and he was a pupil or friend of Julianus, and consulted him. (*Dig.* 25, tit. 3, s. 3.) This fixes the period of Africanus to the reign of Hadrian, who died A.D. 138, and to that of his successor Antoninus Pius. The fact of Africanus being quoted by Paulus and Ulpianus shows that he was prior to these two jurists. In a passage in Gaius (ii. 218) which has been referred to in order to show that Julianus commented on Sextus, the true reading is probably 'et Sexto,' instead of 'ex Sexto;' and this Sextus may be Sextus Pomponius. As Julianus belonged to the legal sect of the Sabiniani, it is probable that Africanus also did. Aulus Gellius (xx. 1) has given the substance of a discussion between Sextus Caecilius, a distinguished jurist, and Favorinus, a philosopher, on the Twelve Tables; and the date of the Twelve Tables is fixed in this discussion as near seven hundred years prior to the time of Gellius. As Gellius probably was not living later than A.D. 170, and the Laws of the Twelve Tables were finally enacted B.C. 449, the number of seven hundred is too much by a century for the age of Gellius. This error is no objection to our concluding that the Sextus Caecilius mentioned by Gellius is Sextus Caecilius Africanus. The excerpts of Africanus treat of many subtle legal points, and have been well illustrated by Cujacius (*Opera*, tom. i. tract. 9).

The jurist Africanus mentioned by Lampridius (*Alex. Severus*, c. 68) as living in the reign of Alexander Severus is a different person from this Africanus: or Lampridius has made some blunder, either in the name or in the period to which he assigns this jurist.

AGATHARCHUS ('Αγάθαρχος), a Greek painter, who apparently, from a passage in Vitruvius, may be considered, if not the inventor, at least the first artist who applied the laws of perspective practically in painting. He painted a dramatic scene for Aeschylus in perspective, which was the first work of the kind exhibited to the Greeks; as the contemporary of Aeschylus therefore, he was a man of mature years about 480 B.C.

The words 'scenam fecit,' in the passage in Vitruvius referred to, have been interpreted, *he constructed a stage*, but this interpretation is shown by the context to be incorrect, the whole passage is as follows: 'When Aeschylus was exhibiting tragedies at Athens, Agatharchus *made a scene*, and left a treatise upon it. With the assistance of this treatise, Democritus and Anaxagoras wrote on the same subject, showing how the extension of rays from a fixed point of sight should be made to correspond to lines according to natural reason, so that the images of buildings in *painted scenes* might have the appearance of reality; and although painted upon flat vertical surfaces, some parts should seem to recede and others to come forward.'

This kind of scene-painting was termed Scenography (σκηνογραφία) by the Greeks, and was sometimes practised by architects; Diogenes Laertius mentions Clisthenes of Eretria as scenograph and architect. Aristotle gives Sophocles the credit of introducing scene-painting; he may have first treated it as indispensable in a dramatic representation, and rendered the practice common, or Vitruvius may have erroneously ascribed its introduction to Aeschylus instead of Sophocles.

There was another Greek painter of the name of Agatharchus, who lived about half a century later than the above. He was contemporary with Zeuxis, and Plutarch relates an anecdote of the two, how Zeuxis reproved Agartharchus for boasting in company of the rapidity with which he painted, by quietly observing that he (Zeuxis) painted very slowly. This Agatharchus is the painter whom Alcibiades shut up in his house until he had painted certain pictures in it. The circumstance is noticed by Plutarch and by Andocides, but they give different accounts of the conclusion of the affair.

(Vitruvius, vii. *Praef.*; Diogenes, ii. 125; Aristotle, *Poetic*, iv.; Plutarch, *Pericles*, 13, *Alcib.* 16; Andocides, *Orat. in Alcib.* 7.)

AGA'THIAS ('Αγαϑίας), a Greek historian and poet, who lived under the emperors Justinian and Justinus the Younger. He was a son of Memnonius, and born at Myrina in Asia Minor, about A.D. 536, but he received his education at Alexandria, whence he went in A.D. 554 to Constantinople, where his father seems to have settled during his son's stay at Alexandria. Agathias now commenced studying the law, and afterwards distinguished himself as a speaker in the courts of justice. The title of Scholasticus (Σχολαστικός), which some writers give him, and which appears in the MSS. of his work, refers to his profession of advocate, for scholasticus at that time signified an advocate. But notwithstanding the great reputation he thus acquired, he never liked his profession, which he practised, according to his own account, only for the sake of gaining a livelihood: his favourite pursuits were poetry and history. He was esteemed by many of the most distinguished men of the time, and seems to have been rather given to courting the great. Some of his epigrams, which are still extant, contain incontrovertible proofs that Agathias was a Christian. He died about A.D. 582, in the reign of Mauritius Thrax.

Agathias was the author of the following works:—1, 'Daphniaca' (Δαφνιακά), or a collection of erotic poems in hexameter verse. It consisted of nine books, but is completely lost. Agathias himself calls it a juvenile production. 2, 'Cyclus' (Κύκλος), that is, a poetical anthology, in which he collected the poems of his contemporaries, especially of his illustrious friends, and also many of his own. The collection itself is lost, with the exception of the introduction, which Agathias wrote. His epigrams, which are still extant in the 'Greek Anthology,' may originally have formed a part of the 'Cyclus:' they show that Agathias had considerable poetical talent and wit. 3, 'History of his own Time,' is the most important among his works, and is complete, at least as far as he wrote it; for it breaks off abruptly in the twenty-fifth chapter of the fifth book, probably in consequence of the author's death; for he himself states that this history was commenced at a late period of his life. It contains the history of the short period from A.D. 553 to 559. He appears throughout this work as a good and honest man, and as a faithful historian. His great faults are ignorance of historical and geographical matters, especially with regard to everything connected with the west of Europe. His language is a tasteless compound of nearly all the dialects of antient Greece, in which however the Ionic predominates. Among the editions of this work the most important are that of Bonaventura Vulcanius (Lugdun. 1594), those in the Paris and Venice collections of the Byzantine writers, and above all that of B. G. Niebuhr, which forms the third volume of the 'Corpus Scriptorum Historiae Byzantinae' (Bonn, 1828, 8vo.), and contains a good account of the life of Agathias, and also his Epigrams.

A'GATHON, a native of Sicily, succeeded Domnus in the see of Rome, A.D. 678. The Emperor Constantine Pogonatus having convoked a general council at Constantinople, A.D. 680, Agathon sent legates to it, who concurred in condemning the heresy of the Monothelites, who contended that, in consequence of the union of the two natures in the person of Christ, there was in him only one will and one operation, an opinion which appears to have been till then countenanced by many prelates, and even by Pope Honorius I. These subtle metaphysical distinctions, to which the minds of the Orientals were prone, seem to have puzzled at times the more sober and matter-of-fact divines of the West. Constantine remitted in favour of Agathon the usual fine which the see of Rome paid to the emperor at every new election previous to obtaining the imperial confirmation of the bishop elect. The confirmation itself however continued to be required for a considerable time after, if not from the emperor, at least from the Exarch of Ravenna, who was the emperor's representative in Italy. Agathon died A.D. 682. He is numbered by the Church of Rome among its saints.

(Sandini, *Vitae Pontificum Romanorum ex Antiquis Monumentis collectae.*)

AGATHO'TES CHIRAYTA (Don, in *London and Edinb. Philos. Mag.* 1836), the latter being the specific name, an imitation of the Sanscrit and Bengalee names of a plant of the tribe of the Gentianeae, and so greatly resembling a Gentian, that it is referred to that genus by Dr. Wallich, who has figured it in his 'Plantae Asiaticae Rariores,' vol. iii. p. 33, t. 252. It has been known for a great length of time as a remedy in India, but has only recently been introduced into European practice. Indeed it has not yet been received into the London Pharmacopoeia; but has found a place only in that of Edinburgh: that it merits however a more extended use is certain. It is probable that even in India two distinct plants, both gentianaceous, are designated by the name Chirayta; at least Dr. F. Hamilton Buchanan found in Nepaul two so termed. The smaller of the two is that which is here treated of. Continental pharmacologists have had sometimes the one, sometimes the other, supplied to them. Hence very erroneous accounts are met with of the habitudes and physical characters of the Chirayta. Geiger describes it as a perennial plant, native of Egypt as well as India, and of larger dimensions than the plant now intended. The genuine Chirayta is an annual plant, about three feet high, flowering in the rainy season. The whole plant is taken up, and the proper time for collecting it is just when the flowers begin to wither. When dried it has an intensely but agreeable bitter taste, and is destitute of aroma. The root is possessed of the greatest bitterness. The bitter principle is readily imparted to water and to alcohol. As it is not easy to ascertain what plant the continental chemists analyzed, it seems best to follow the analysis of Mr. Battley, whose specimens must have been genuine, having been furnished by Dr. Wallich. According to this chemist, it contains a free acid, a bitter resinous extractive, with much gum, and chlorates, with sulphates, of potass and lime. No alkaloid has been detected in it; what is therefore sold as a sulphate of chiraytine is well known to be only the disulphate of quinia. In regard to the pharmaceutical preparations of chirayta, infusion and watery extract, or a tincture of it, are alone to be recommended. Not only is the decoction a most improper form, but an infusion made with warm water is to be condemned, as this causes most distressing headache. Even to form the cold infusion a pint of water should not stand more than twenty minutes on half an ounce of the bruised plant. The tincture is a grateful addition to it.

Chirayta possesses the general properties of bitter tonics, but has at the same time some peculiar to itself, which fit it well for certain forms and complications of disease. Unlike most other tonics, it does not constipate the bowels, but tends to produce a regular action of the alimentary canal, even in those subject to habitual constipation. During its use, the bile becomes more abundant and healthy in character. The tendency to excess of acidity in the stomach, with disengagement of flatus, is much restrained by its use. These qualities fit it in a most peculiar degree for the kind of indigestion which occurs in gouty persons. It may, when necessary, be associated with alkaline preparations or with acids; the latter are generally preferable. The same remark applies to its employment in the treatment of scrofula, in which alkalies are so freely and often injuriously employed. As a remedy against the languor and debility which affect many persons in summer and autumn, nothing is equal to the cold infusion of this plant. It may be taken twice or even more frequently daily, for a considerable time; then discontinued, and afterwards resumed. Children take it more readily than most other bitters. It is found to be a very efficacious remedy in India against intermittents, particularly when associated with the Guilandina Bonduc, or Caranga nuts. The debility which is apt to end in dropsy is often speedily removed by infusion of Chirayta; to which is added the tincture formed of it with orange-peel and cardamoms. Its efficacy in worm-cases has procured for it the name of *worm-seed* plant. The extract is given with great benefit in some forms of diarrhoea and dysentery, particularly if combined with ipecacuan, the emetic tendency of which it very markedly controls.

It is unnecessary to enter here into a review of the arguments adduced by Fee (*Cours d'Histoire Naturelle Pharm.* ii. p. 395) and Dr. Royle (*Flora of the Himalayas*, p. 277), to disprove the notion of Guibourt that this was the *Calamus verus* of the antients. It is more probable that it was a grass, possibly that which in the present day is said to yield the *grass-oil* of Namur. Whencesoever obtained, this oil possesses great virtues. It is much used in India against rheumatism. It has the power in a most remarkable degree of preventing the hair of the head from falling off after acute diseases, such as fevers, or after confinements or prolonged nursing. It even restores it after it has fallen off. But it must be strong and pure; not the diluted feeble oil sold by perfumers under the name of oil of grass.

AGEN. [Lot and Garonne, P. C.]

A'GLAOPHON ('Αγλαοφῶν). There were two distinguished Greek painters of this name, who were probably related. Böttiger supposes that the younger was the grandson of the elder, and the son of Aristophon, the brother of Polygnotus.

The elder Aglaophon lived about 500 B.C., and was a native of the island of Thasos, where his son Polygnotus was also born. Aglaophon's greatest distinction is that of having been the father and the instructor of Polygnotus, who is the first painter recorded in history who attained great fame. Quintilian is the only writer who speaks of the style of Aglaophon, but he indiscriminately couples him with Polygnotus. He says, 'Notwithstanding the simple colouring of Polygnotus and Aglaophon, which was little more than the crude beginning of what was afterwards accomplished, many have, certainly with some affectation, preferred their works to those of the greatest masters who succeeded them.' There can be as little doubt that this passage refers to the elder, as that the following from Cicero refers to the younger: Cicero says, speaking of styles, Aglaophon, Zeuxis, and Apelles were all different in their several styles, yet each was perfect in his own style.

None of the works of the elder Aglaophon are particularly mentioned, unless the Winged Victory spoken of by the scholiast on the Birds of Aristophanes (v. 573) may be attributed to him.

The two pictures of Alcibiades mentioned by Athenaeus must have been by the younger. After Alcibiades, says Athenaeus, returned to Athens a victor at the Olympic games, he exhibited two pictures of himself, one representing Olympias and Pythias crowning him, and in the other he was painted extremely beautiful, lying on the knees of Nemea. Plutarch attributes the latter of these pictures to Aristophon, the brother of Polygnotus, and the supposed father of the younger Aglaophon, but as the account of Athenueus accords better with the time, it is more probably correct, at least under the supposition that there were two artists of this name. The beautiful horse spoken of by Aelian was probably the work of the younger Aglaophon.

(Suidas, 'Αγλαοφῶν; Quintilian, *Inst. Orator*. xii. 10. 3; Athenaeus, xii. 534; Plutarch, *Alcibiades*, 16; Cicero, *De Orat*. iii. 7; Aelian, *De Anim. in Epilogo*.)

AGNO'STUS, the remarkable fossil genus of Crustacea usually found with Asaphus Buchii and other trilobites in the lower Palæozoic strata. (Brongniart.) Called Battus by Dalman. It abounds near Llandeilo and Christiania.

AGNOTHE'RIUM, a fossil genus of Mammalia. (Kaup.)

AGRICULTURAL INSTITUTIONS. In this article it is proposed to give some account of various institutions for the improvement of agriculture, beginning with the Board of Agriculture.

This semi-official institution was established chiefly through the exertions of the late Sir J. Sinclair, and was incorporated in 1793. It was annually assisted by a Parliamentary grant. One of its first proceedings was to commence a survey of all the English counties on a uniform plan, which brought out, for the information of the class most interested in adopting them, improved practices, originating in individual enterprise or intelligence, and which were confined to a particular district. The 'Surveys' are many of them imperfectly executed, but they were useful at the time in developing more rapidly the agricultural resources of the country. During the years of scarcity at the end of the last and beginning of the present century, the Board of Agriculture took upon itself to suggest and, as far as possible, provide remedies for the dearth, by collecting information and making reports to the government on the state of the crops. The statistics which the Board collected were also at times made use of by the minister, or at least were believed to be so, in connection with his schemes of taxation. The Board encouraged experiments and improvements in agriculture by prizes; and it naturally exercised considerable influence over the provincial agricultural societies. The Board of Agriculture was dissolved in 1816. The Smithfield Cattle Club, which has been in existence half a century, and some of the provincial agricultural societies, especially the Bath and West of England society, which commenced the publication of its 'Transactions' nearly seventy years ago, have been very useful in promoting agricultural improvement. Until within the last few years, the exertions of Agricultural Societies have been too exclusively devoted to the improvement of stock.

With the establishment of the 'Royal Agricultural Society of England' a new æra commenced in the history of institutions for the improvement of English agriculture. This Society, when it was established, in May, 1838, consisted of 466 members. At the first anniversary, in May, 1839, the number of members had increased to 1104; in May, 1840, there were 2569 members; in December of the same year, 4262; in December, 1841, 5382; in May, 1842, 5834; and by the following May, 1843, the number had been increased by the election of 1436 new members. At the sixth anniversary of the Society, in May 1844, the number of members was 6927, of whom 274 had been elected in the preceding three and a half months; and there had previously been struck off the list 249 names of members who were either dead or had not paid their subscriptions. The number of life-governors (who pay on admission the sum of 50*l.*) was 97 in December, 1844; and there were 208 annual governors, who pay 5*l.* yearly; of life members, who pay 10*l.* on admission, there were 470; and of annual members, who pay 1*l.* yearly, there were 6827. At the above date the funded property of the Society amounted to 7700*l.*, and the current cash balance to 2000*l.* On the 26th of March, 1840, the Society received a charter of incorporation, on which it assumed the designation of the 'Royal Agricultural Society for England.' By the 22nd rule of the Society, 'No question shall be discussed at any of its meetings of a political tendency, or which shall refer to any matter to be brought forward, or pending, in either of the Houses of Parliament;' and this rule is made permanent by the charter of incorporation.

The objects of the Royal Agricultural Society, as set forth in the charter of incorporation, are: 1, To embody such information contained in agricultural publications and in other scientific works as has been proved by practical experience to be useful to the cultivators of the soil. 2, To correspond with agricultural, horticultural, and other scientific societies, both at home and abroad, and to select from such correspondence all information which, according to the opinion of the Society, may be likely to lead to practical benefit in the cultivation of the soil. 3, To pay to any occupier of land, or other person, who shall undertake, at the request of the Society, to ascertain by any experiment how far such information leads to useful results in practice, a remuneration for any loss which he may incur by so doing. 4, To encourage men of science in their attention to the improvement of agricultural implements, the construction of farm-buildings and cottages, the application of chemistry to the general purposes of agriculture, the destruction of insects injurious to vegetable life, and the eradication of weeds. 5, To promote the discovery of new varieties of grain, and other vegetables, useful to man, or for the food of domestic animals. 6, To collect information with regard to the management of wood, plantations, and fences, and on every other subject connected with rural improvement. 7, To take measures for the improvement of the education of those who depend upon the cultivation of the soil for their support. 8, To take measures for improving the veterinary art, as applied to cattle, sheep, and pigs. 9, At the meetings of the Society in the country, by the distribution of prizes, and by other means, to encourage the best mode of farm cultivation and the breed of live stock. 10, To promote the comfort and welfare of labourers, and to encourage the improved management of their cottages and gardens.

The Society has already directed its attention to nearly all the objects above mentioned. The country meetings which take place annually in July, have perhaps been more serviceable in stimulating agricultural improvement than any other of the Society's operations, by concentrating the attention of the Society upon each part of the country in succession, and by exciting the attention of each district to the objects which the Society is intended to promote. England and Wales are divided into nine great districts, and a place of meeting in each is fixed upon about a year beforehand. In 1839, the first meeting was held at Oxford; and others have been successively held at Cambridge, Liverpool, Bristol, Derby, and Southampton. The meeting for 1845 will be held at Shrewsbury; in 1846, in some town in the Northern district; and in 1847 the circuit will be completed by the meeting being held in the

South Wales district. The value of the prizes distributed in 1839, at Oxford, amounted to 790*l.*; and in 1844, at the Southampton meeting, to 1400*l.* The show of agricultural implements at Derby comprised 700 different articles, and the aggregate value of implements, according to the selling price of each, declared by the makers, was about 7400*l.* There can be no doubt that the mechanics of agriculture have made great progress since the establishment of the Society. The opportunity of contrasting and estimating the utility of various implements used for similar purposes in different districts or in different soils, cannot fail to extend improvement from one district to another. It has been said that even down to the present time the north and west of England have little more acquaintance with the practices of each other than two distinct nations might be supposed to possess; and one of the principal results effected by such institutions as the Royal Agricultural Society is to introduce the best practices of husbandry from the districts where agriculture is in its most improved state into those where it is most backward. Attached to the Society's house there is a reading-room, and a library, to which has recently been added by purchase the books forming the library of the late Board of Agriculture. As a means of diffusing information on agricultural subjects, the publication of the 'Journal' of the Society was commenced in April, 1839, and it has at present a circulation of nearly 9000. The prize essays and all other communications intended for publication in the 'Journal' are referred to the Journal Committee, who decide upon the arrangements of the work. The 'Journal' contains besides very valuable contributions of a practical as well as scientific character. Prizes have already been awarded for essays on the agriculture of Norfolk, Essex, and Wiltshire; and the agriculture of Nottinghamshire, Cornwall, and Kent will be the subject of essays to be sent in by March, 1845.

The success of the Royal Agricultural Society has revived the spirit of existing associations, or led to the formation of new ones. In Johnson and Shaw's 'Farmer's Almanac' for 1845, there is a list of agricultural societies in the United Kingdom, but it is confessedly imperfect: the number cannot be less than four hundred. Some of the provincial agricultural societies are on a scale which a few years ago could scarcely have been anticipated. The Yorkshire Agricultural Society holds its annual show in the different towns of that county in rotation, a plan which is very successful in rendering them attractive. Farmers' clubs have also recently become very numerous. The 'Farmers' Almanac' for 1845 gives a list of above one hundred and fifty of these clubs. They are eminently practical; but the local results which they collect and discuss may become applicable to other parts of the country placed under similar circumstances of aspect, soil, and situation. It would stimulate the exertions of these clubs, if a department of the 'Journal of the Royal Agricultural Society' were reserved for some of the best papers read at their meetings. The annual report of every farmers' club should be transmitted to the secretary of the Royal Agricultural Society; and the title at least of all papers read at the meetings during the year should be given in the 'Journal.'

The agriculture of Scotland has been largely indebted to the societies which have been established at different periods for its improvement. A 'Society of Improvers in the Knowledge of Agriculture in Scotland' was established in 1723, and some of its Transactions were published. The society becoming extinct, was succeeded by another in 1755; and the society which now stands in the same relation to Scotland as the Royal Agricultural Society to England was established in 1784. It is entitled the 'Highland and Agricultural Society of Scotland.' The constitution and proceedings of the society are as nearly as possible similar to the English society. The society publishes quarterly a very excellent Journal of its Transactions, which has at present a circulation of 2300. The Agricultural Museum at Edinburgh was assisted in 1844 by a parliamentary grant of 5000*l.*

The Royal Dublin Society, like the Society of Arts in England, awarded prizes for the promotion of the useful arts generally, and are neither of them, properly speaking, agricultural institutions. In 1841 the 'Royal Agricultural Improvement Society of Ireland' was established on the plan of the Royal Agricultural Society of England; and in May, 1844, the number of subscribers was 581. The society already possesses funded property to the amount of 4859*l.* Since its establishment great progress has been made in the formation of local societies in connection with the central society. This is the best means of ensuring the support and co-operation of the agricultural class in every part of the country. In 1841 there were only twenty-three of these bodies in existence, and at the half-yearly meeting in May, 1844, it was stated that the number was not less than one hundred. A very judicious arrangement has been made relative to the prizes distributed at the local meetings, which are now given for the operations in husbandry only, the premiums for stock being furnished by the local association. The society is establishing an agricultural museum in Dublin for the reception of implements of husbandry, seeds, grasses, &c.; it circulates practical information connected with husbandry by means of cheap publications; and one of its objects is the organization of an agricultural college.

In England there are no institutions of a public nature which combine scientific with practical instruction in agriculture. The advantage of establishing such an institution was suggested by the poet Cowley; and in 1799 Marshall published 'Proposals for a Royal Institute or College of Agriculture and other branches of Rural Economy.' There is the Sibthorpian Professsorship of Rural Economy in the University of Oxford; at the University of Edinburgh there are professorships of agriculture and agricultural chemistry; and at the University of Aberdeen there are lectures on agriculture. The botanical, geological, and chemical professorships and lectures in the different universities are however, to a certain extent, auxiliary to the science of agriculture. In the absence of such establishments as the one at Grignon in France, young men are sent at a great expense as pupils to farmers in the counties where the best system of agriculture is practised, especially Norfolk, Lincolnshire, Northumberland, and the Lothians; but although this may be a good plan for obtaining practical knowledge, it is imperfect as regards acquiring a knowledge of the scientific principles of agriculture. The Earl of Ducie has established a model or example farm on his estate in Gloucestershire; and farms of this description are of considerable local advantage. Such a farm, says Dr. Daubeny, 'if well conducted, cannot fail to benefit the farmers around; by exhibiting to them improved implements; by introducing greater economy of labour, demonstrating for instance the possibility of ploughing with two horses on land where three or four are usually employed; by reducing to ocular proof the benefits of thorough-draining; by showing the methods of preserving the liquid portion of the manure most effectually; and by suggesting a thousand other improvements upon the ordinary routine;" but he contends that a model farm on a private estate cannot be wholly managed with an eye to the instruction of others, and instead of being conducted on a sound system it may be devoted to fanciful experiments at the caprice of the proprietor. (Dr. Daubeny's Lecture, May 14, 1844.) In 1839 the late B. F. Duppa, Esq., published a short pamphlet entitled 'Agricultural Colleges, or Schools for the Sons of Farmers,' which contains many useful suggestions for the establishment of such institutions. He laboured indefatigably in the promotion of this object, and probably would have succeeded, but for his premature death. In the projected Agricultural College and model Farm at Cirencester, the pupils will receive an education at once practical and scientific, under a person thoroughly acquainted with the management of a farm, associated with a professor of chemistry, mechanics, &c.

Schools of industry, similar to the one established by the late Rev. W. L. Rham at Winkfield, may be made the medium of imparting an acquaintance with the principles of agriculture, which at present the labouring classes do not usually obtain; and they obviate the objection that a child who remains long at school is unfitted for hard labour. To Winkfield school there are attached about four acres of good land; and under the guidance of so accomplished an agriculturist as the late Mr. Rham the scholars enjoyed the advantage of pursuing all the details of the most skilful husbandry, and undergoing a course of training in garden and farm management of no ordinary excellence. Schools of a similar kind to the one at Winkfield have been established at Ockham, near Ripley, in Surrey; at Lindfield in Sussex [ALLEN, WILLIAM, P. C. S.]; at Horne, near Eye, Suffolk; at Ealing Grove, Middlesex; at Crowborough, Kent; and at Tunbridge Wells. On Mrs. Davies Gilbert's estate there is a school of manual labour, and the principle on which it is established might perhaps be made conducive on a large scale to the two objects of enabling the scholars to acquire the elements of learning and of fitting them by proper industrial training to become expert and industrious in field and garden work. At the school here spoken of, the master is paid one penny per week for each boy; but the chief emolument of the master arises from the labour of the boys on the school land. Their time is divided into two portions, one part of which the master devotes to their instruction in reading, writing, &c., and in return they employ another portion of their time in cultivating his land. (*Committee of Council on Education*, 1844.)

In Ireland the government affords direct encouragement to agricultural education through the instrumentality of the Board of National Education. The persons who are trained for the office of teachers in the national schools are required to attend the lectures of a professor of agricultural chemistry; and during a portion of the time occupied in preparing for their future duties they are placed at the model farm at Glassneven, where they are lodged, and where, during five mornings of the week, they attend lectures on the principles of agriculture; and an examination subsequently takes place. On the sixth morning they are taken over the farm, and the various operations going forward are explained to them. The Board admits a certain number of in-door pupils for the term of at least two years, who pay 10*l.* a year for board, lodging, and education. They work on the farm, attend the lectures, and receive such instruction as qualifies them to fill the office of bailiffs. There is likewise a class of schoolmasters trained to conduct agricultural schools. It is intended to establish twenty-five agricultural model schools in different parts of the country. The Agricultural Seminary at Temple-Moyle, six miles from Londonderry, is one of the most successful experiments which has yet been made in the United Kingdom to establish an institution for agricultural education. It was founded by the North West of Ireland Society in 1827, and up to 1840 had been attended by 418 pupils. The plan is in some degree taken from the institution established by the late M. Fellenberg, at Hofwyl, in Switzerland. In 1841 the house contained 70 young men, as many as it can accommodate and the farm afford instruction to; and there were 40 applications for admission. The size of the farm is 172 acres. An account of the institution and of the course of instruction will be found in the 'Minutes of the Committee of Council on Education,' 1842-3, p. 565, 8vo. ed.

Such societies as the Scottish Agricultural Chemistry Association, established at the close of 1843, are very well calculated to advance the progress of scientific agriculture; and they can be established in any district where a sufficient number of subscribers can be obtained to command the services of a competent chemist. Associations of this nature show how much can be done in this country without any assistance from the state. The object of the Scottish association is the diffusion of existing information, theoretical and practical, by means of occasional expositions, addresses, and correspondence; and secondly, the enlargement of the present store of knowledge by experimental investigations of practical agriculturists in the field and of the chemist in the laboratory. Landed proprietors who subscribe twenty shillings yearly, and tenants who subscribe ten shillings yearly, are entitled to have performed analyses of soils, manures, &c., according to a scale fixed upon; and if more than a certain number are required, a charge of one-half above the scale is made. Letters of advice, without an analysis being required, are charged 2*s.* 6*d.*, and at present the number which each subscriber may write is not limited. Every agricultural society subscribing 5*l.* yearly to the funds of the Association is entitled to one lecture from the chemist; if 10*l.* to two lectures, &c. Counties which subscribe 20*l.* annually are entitled to appoint a member of the Committee of Management. The Society in question has raised a fund sufficient to defray all expenses for the ensuing four years. The chemist of the association has his laboratory at Edinburgh, but he has to visit various parts of Scotland according to certain regulations.

In England, soils are analyzed at the Museum of Economic Geology, London, at a charge of one guinea. The establishment is under the superintendence of her Majesty's office of Woods and Forests.

In France there are schools assisted by the state, where young persons can obtain instruction in agriculture both practical and theoretical. The principal institution of this kind is that at Grignon, where one of the old royal palaces and the domain attached to it, consisting of 1185 acres of arable, pasture, wood, and marsh land, have been given up on certain conditions. The professors are paid by the government, and the pupils are of two grades, one paying 48*l.* a year, and the other 36*l.* For the purpose of imparting theoretical knowledge, courses of lectures are given on the following subjects:—1, The rational principles of husbandry, and on the management of a farm. 2, The principles of rural economy applied to the employment of the capital and stock of the farm. 3, The most approved methods of keeping farming accounts. 4, The construction of farm-buildings, roads, and implements used in husbandry. 5, Vegetable physiology and botany. 6, Horticulture. 7, Forest science. 8, The general principles of the veterinary art. 9, The laws relating to property. 10, Geometry applied to the measurement and surveying of land. 11, Geometrical drawing of farming implements. 12, Physics as applied to agriculture. 13, Chemistry, as applied to the analysis of soils, manures, &c. 14, Certain general notions of mineralogy and geology. 15, Domestic medicine, applied to the uses of husbandmen. The practical part of the education is conducted on the following system:—The pupils are instructed in succession in all the different labours of the farm. Some, for instance, under the direction of the professor of the veterinary art, perform the operations required by the casualties which are continually occurring in a numerous stock of cattle. Others are appointed to attend to the gardens, and to the following departments: woods and plantations; inspection of repairs taking place on the premises; making of starch, cheese, and other articles; the pharmaceutical department; book-keeping and the accounts. A daily register is kept of the amount of the manure obtained from the cattle of every kind. A pupil newly entered is appointed to act with one of two years' standing; and at the end of each week all are expected to make a report, in the presence of their comrades, of whatever has been done during the week in their respective departments. The professor, who presides over the practical part of their education, explains on the spot the proper manner of executing the various field operations; and he also gives his lectures on these different processes at the time when they are in actual progress. The professors in each department render their courses as practical as possible;—the professor of botany by herborizations; the professor of chemistry by geological excursions; the professor of mathematics, by executing, on the plan he has pointed out, the survey and measurement of certain portions of land. After two years' training in the theory and practice of rural economy, the pupils undergo an examination from the professors collectively, and, if satisfactory, a diploma is granted, which certifies to the capacity of the pupil for fulfilling the duties of what may be styled an 'Agricultural Engineer.'

Institutions designed for the improvement of agriculture, and supported by the state, have been established in most parts of Germany. In Prussia there is a public model farm and agricultural academy in nearly every province. The most important of these institutions is the one at Mögelin, in Brandenburg, about forty miles from Berlin, which was founded by the late king. Von Thaer was at one period the director. The establishment consists of a college and a model farm of 1200 acres. When visited by Mr. Jacob, in 1820 ('Agriculture, &c. of Germany'), there were three professors, who resided upon the premises: one for mathematics, chemistry, and geology; one for the veterinary art; and the third for botany and the use of the various vegetable productions in the Materia Medica, as well as for entomology. Attached to the institution there was a botanic garden, arranged on the Linnæan system; an herbarium; a museum containing skeletons of domestic animals, models of agricultural implements, specimens of soils, &c. The various implements were made in workshops upon the farm, and the pupils were expected to acquire a general notion of the modes of constructing them. The sum paid by each pupil was very high, not less than 80*l.* a year.

At Hohenheim, in the kingdom of Wirtemberg, two leagues from Stuttgard, an old palace has been appropriated as an agricultural college. The quantity of land attached to the institution is about 1000 acres. The pupils are of two grades, and those belonging to the superior class pay for their board 150 florins, and for their instruction 300 florins a year, or altogether 37*l.*, and extra expenses make the annual cost about 50*l.* Natives of Wirtemberg are admitted at a lower rate than the subjects of other states. The higher class of students do not, as at Grignon, take part in the actual labours of husbandry; but the means of theoretical instruction are very complete. Lectures are delivered by twelve professors on the following subjects:—Mathematics and physics, chemistry and botany, technology, tillage, and other departments of rural economy, forestry, and the veterinary art. The lectures are so arranged that they can be either attended in two half-years or three or four. In the former case much preliminary information must have been acquired. There is attached to the institution a small botanical garden; a museum of zoological, botanical, and mineralogical objects; skeletons of domestic animals; collections of seeds and woods; and a library of works on rural economy. The establishment also comprises a manufactory of beet-root sugar, a brewery, a distillery of potato-spirit, and there is an apartment devoted to the rearing of silkworms. A part of the farm is reserved for experiments. The second class of students do the manual labour, but they are nearly maintained at the expense of the institution, and, when they can be spared from field labour, they have the opportunity of attending the lectures at the college.

In Bavaria the king has given up the domain attached to the royal palace of Schleissheim for the purposes of a model farm; but a great mistake has been made in selecting land much below the average standard of fertility, which, as well as land of extraordinary productiveness, should be avoided. It is on a much inferior scale to the establishment at Hohenheim. In 1840 there were twenty-one scholars who paid about 15*l*. a year, and eleven who paid about 6*l*. The latter are merely field-labourers; and those who belong to the upper class are about the same grade as the second class at Hohenheim.

There are agricultural institutions supported by the state in several other countries of Europe.

(*On public Institutions for the Advancement of Agricultural Science*, by Dr. Daubeny; Dr. Daubeny's *Lecture on Institutions for the Better Education of the Farming Classes, especially with reference to the proposed Agricultural College at Cirencester*, delivered at Oxford, May 14, 1844; *Journals of Royal Agric. Soc. of England;* Dr. Lindley's *Gardener's Chron. and Agric. Gazette*, &c. &c.)

AGRICULTURE (from the Latin *Agricultura*). The economical relation of agriculture to other branches of industry is the subject of the following remarks.

The question has sometimes been propounded whether agriculture or manufactures are more useful to a state, or, in other words, whether agriculture or other branches of industry contribute most to the wealth of a state; and whether a state should give more encouragement to agriculture or manufactures. Such questions imply that there is something which essentially distinguishes manufactures from agriculture; and also that a state can and ought to give a direction to industry. Agriculture is the raising of vegetable products from the soil, which are either consumed in their raw state or used as materials on which labour is employed in order to fashion them to some useful purpose. Manufactures, in the ordinary sense of the term, comprise the various modes of working up the raw products of agriculture and mining. So far there is a distinction between agriculture and manufactures; agriculture is auxiliary and necessary to the other. In the popular notion, the difference in these two processes, the raising of a product from the ground and the working up of the product into another form, constitutes an essential difference between these two branches of industry; and accordingly agriculture and manufactures are often spoken of as two things that stand in opposition or contrast, and they are often viewed as standing in a hostile opposition to one another. But such a distinction between agriculture and manufactures has no real foundation. Those agricultural products which are articles of food—as bread, the chief of all—are essentials, and the industry of every country is directed to obtaining an adequate supply of such articles, either from the produce of the country or by foreign trade. Some of the various kinds of grain which are used as food are the prime and daily articles of demand in all countries. Agricultural articles which are employed as materials out of which other articles are made, such as cotton, are only in demand in those countries where they can be worked up into a new and profitable form. The varieties of soil and climate render some parts of the world more fit to produce grain, and others more suitable for cotton. Ever since the earliest records of history the people of one country have exchanged their products for the products of other countries: and if the matter were simply left to the wants and wishes of the great majority of mankind, no one would trouble himself with the question of the relative superiority of the process by which he produces grain or cotton, and the art by which his cotton is turned into an article of dress in some other country, and sent back to him in that new form to be exchanged for grain or more raw cotton. He might not perceive any essential difference in the process of turning the earth, committing the seed to it, and reaping the crop at maturity; and the process by which the raw material which he has produced, such as flax or cotton, is submitted to a variety of operations, the whole of which consist only in giving new forms to the material or combining it with other materials. In both cases man moves or causes motion; he changes the relative places of the particles of matter, and that is all. He creates nothing; he only fashions anew. The amount of his manual labour may be greatly reduced by mechanical contrivances, and perhaps more in what are called manufactures than in what is termed agriculture; so that if the amount of the direct labour of hand is to be the measure of the nature of the thing produced, agricultural products are more *manu*factures than manufactured articles are. Some branches of agriculture, such as wine-making, indeed belong as much to manufactures, in the ordinary sense of that term, as they belong to agriculture. The cultivation of the vine is an essential part of the process of wine-making; but the making of the wine is equally essential. Indeed there are few agricultural products which receive their complete value from what is termed agriculture. Corn must be carried to the market, it must be turned into flour, and the flour must be made into bread, before the corn is in that shape in which it is really useful. Agriculture therefore only does a part towards the process of making bread, though the making of bread is the end for which corn is raised. It is true that in agricultural countries the processes by which many raw products are fashioned to their ultimate purpose, are often carried on by agriculturists and on the land on which the products are raised. But agriculture, as such, only produces the raw material, corn, flax, grapes, sugar-cane, or cotton. If any agriculturist makes flour, linen, wine, sugar, or cotton-cloth, he does it because he cannot otherwise produce a saleable commodity; but the making of flour or wine or cloth is a manufacturing operation, as the word manufacture is understood.

Besides the manufacture of agricultural products, there is the manufacture of the products of mines. A mine cannot be classed altogether either with manufactures or agriculture, as these terms are vulgarly understood. Mining produces raw products, which have no value till they are subjected to the various processes by which an infinite variety of useful articles are made out of them. So far mining bears the same relation to certain branches of industry that agriculture does to other branches of industry which it supplies with raw materials. Fisheries produce a supply of food, and are therefore precisely like those branches of agriculture which are directed solely to the production of food.

Now if the question be, which of all these branches of industry adds most to wealth, or, in other words, is most useful to mankind, the answer must be,—they are all equally useful. If it be urged that some are of more intimate necessity than others, inasmuch as food is essential, and therefore its production is the chief branch of industry, it may be replied, that in the present condition of man it is not possible to assert that one branch of industry is more useful than another: each depends on every other. Further, if food is essential to all men in all countries, clothing and houses are equally essential even to the support of life in most countries; and the production of clothing and the building and furnishing of convenient houses comprehend almost every branch of manufacturing industry which now exists. It is an idle question to discuss the relative value of any branches of industry, when we found the comparison upon a classification of them which rests on no real difference, and leave out of the question their aptitude to minister to our wants. One might discuss the relative value of the manufacture of scents and perfumes, and the manufacture of wine and beer; and the foundation of the comparison of value might be the number of persons who use or wish to use the two things, and the effect which the consumption of scents and perfumes on the one hand, and of wine and beer on the other, will have on the consumers and the condition of those who produce them.

But though it is an idle question to discuss the relative value of the variety of processes included in the term agriculture, and of the infinite variety of processes included in the term manufactures, it is not an idle labour if we can show that such a discussion is worthless and can lead to no valuable results. It is not an idle labour to attempt to dissipate an error which affects the commercial policy of most nations, and is a deeply rooted error in the minds of the ill-instructed, both rich and poor. It was the opinion of a set of persons who have been called the Economists, that agriculture was the source of all wealth, and therefore the most important branch of industry. This doctrine was founded on the assumption that all tho materials that we use are ultimately derived from the earth. This, however, is not true: the products of the sea, of hunting, of mining, are not due to agriculture, even in the sense in which the advocates of this theory understood the term agriculture: and further, a large part of agricultural products receive most of their value from other labour besides agricultural labour. Even corn, the material of bread, as already observed, must undergo a manufacturing process before it becomes bread. But the greatest part of the corn that is produced has little value in the place where it is produced: it obtains its value by being transported to another place where it is wanted, and at a cost which forms a considerable part of its selling price. Lastly, the corn is of no value even when it has thus been removed from one place to another, unless it has been removed to a place where it is wanted by those who are not raising corn, but are producing something to give in exchange for it. The value, then, of the corn depends ultimately on the labour and the wants of those who do not concern themselves about its production.

If those who possess political power were free from all prejudices and all motives of self-interest, or what they suppose to be their interest, there would neither be encouragement nor discouragement given to any branch of industry, and least of all to agriculture. If taxes must be raised, they would be raised in such way as would least interfere with the free exercise of all branches of industry; and they would not be raised upon raw products of any kind. It is the business of a State to find sufficient means, at the least possible cost to the whole community, for defence against foreign aggression, for the administration of justice, and for all such matters of public interest as require its direction and superintendence. To ascertain what these matters may be and how they are to be effected, belongs to the subject of government; and the sphere to which the State should limit its activity cannot be exactly defined. But there is one principle which excludes its interference from many matters; which is this:—If men are not interfered with, they will employ their labour and capital in the way which is most profitable to themselves; and each man knows better how he can employ himself profitably than anybody else can, or any government can, whether such government is of one or many. Agriculture is no exception to this general principle; and there is no reason of public interest why a government should either encourage it or discourage it. In order that the agriculture of a country may attain its utmost development, it is necessary that it be free from all restraint, and that it be also free from the equally injurious influence of special favour or protection.

But no governments have ever let the things alone which they ought not to have meddled with; and agriculture has been subject perhaps to more restrictions than any other branch of industry. The interference with agricultural industry lies deeper than at first sight appears. Land is an essential element of a state: it is the basis on which the structure is raised. Now the political constitution of every country is intimately connected with the nature of the landed property; and if we would really trace the history of any nation from the earliest records to the present time, we must begin with the fundamental notions of the law of property in land. In this country for instance it is easily shown that the present mode in which land is held and occupied is the result of those feudal principles which were established, or confirmed and extended, by the Norman conquest of England. The various modes in which land is held by the owner and occupied by the cultivator, the modes in which it may be alienated or transmitted by will or by descent, the burdens to which it is liable either on any change of owner or in any other way, are all important elements in estimating the degree of freedom which agriculture enjoys. The political constitution of a country also materially determines whether the land shall be cultivated in large or in small portions, whether owned by a numerous body or owned by a few; there may also be positive laws which affect the power of acquiring land or disposing of it; and these circumstances materially affect the freedom of agriculture and its condition. The political constitutions of countries, so far as we know them, have not been the result of design. We of the present generation find something transmitted to us which our predecessors have been labouring to amend or deteriorate; they in like manner received it from their predecessors; but the beginning of the series we cannot ascend to. Still every existing generation can do something towards altering that which has been transmitted to it; and every act of legislation which interferes with the mode in which land is acquired or enjoyed materially affects the condition of agriculture. No sufficient reason has ever yet been shown why a man should not, as a general rule, acquire as much land as he can, and dispose of it as he pleases either during his lifetime or at his death. Though this general principle must be admitted, it may still be laid down as a safe rule that there are limits within which a man's power over his property in land ought to be circumscribed. He should not be allowed, for instance, to determine for generations to come what persons or class of persons shall enjoy his land, and to limit the power of alienating it: unless it may be when his property is given for public purposes of unquestionable utility. For with this limitation, it follows that when the purposes cease to be of unquestionable utility, the State ought to apply the property to new and useful purposes. There are therefore limits which ought to be placed to a man's power over his land. But such limits should not in any way limit the productive use that can be made of the land; one object of fixing such limits, whatever they may be, is to prevent any large amount of land from being withdrawn permanently out of the market. In a rich country, where great fortunes are acquired by commerce and manufacturing industry, there are always men who wish to invest money in land, and it is for the public interest that there should be opportunities of making such investments.

The tenure of land in any country may be unfavourable to the improvement of its agriculture. If the object is to encourage agriculture in the only way in which a State can profitably encourage it, all restrictions that arise from the peculiar tenure of land should be removed. But the mode in which land is held may have a political character, and this may be an obstacle to the giving to agriculture that freedom which is necessary for its improvement. It might be considered that in this country it would be politically useful to forbid those large accumulations of land in the hands of individuals, a condition which is accompanied with a diminution in the number of small landowners. But if it were wise in some points of view to enact a law that should limit the quantity of land that a man may hold, it would be very unwise in other points of view; and such a law would also easily be evaded. The Agrarian laws of Rome only applied to the Public Land, but among other matters they limited the amount of such land that a man could occupy and use. These laws were continually evaded. But besides this, an injury was done to agriculture, that is, the amount of useful produce was diminished by preventing large capitalists from occupying as much of the land as they pleased, subject to the rent which was due to the State. The specious object of the Agrarian laws was to give small cultivators the use or ownership of a portion of the public land, and thus to rear up a body of independent free agriculturists; for the larger farms were cultivated by slaves. Though these laws were not an interference with private property, as the term is properly understood, they interfered with the profitable employment of capital; and they failed in accomplishing their professed object. Some instances are given under the article Allotments, P. C. S., of the gradual decrease of small farms in England and their consolidation into large farms, a process which will certainly take place in all countries where there is no positive obstacle, whenever capital is become abundant.

The political constitution of a State may therefore encourage or discourage agriculture; and laws may be from time to time enacted which shall have the same effect. Such laws have sometimes an object purely political, that is to say, a law may be passed which shall have a direct object, not agricultural, and yet it shall indirectly affect agriculture. Any institution or law which in any way either prevents large masses of land from being owned or cultivated by individuals, or which results in a great subdivision of land among owners and occupiers, has an indirect effect on agriculture. Those who cultivate on a small scale cannot enter into the market in competition with those who cultivate on a large scale. A State which consists solely of small landowners must be a feeble political body, and the amount of surplus produce which can be raised will be small. Such a community, if it has not the resources of foreign commerce, will in seasons of scarcity run the risk of famine. The most profitable size of farms depends on a variety of considerations, but whatever it may be, the profitable measure will be practically determined in a country where land can be freely bought or hired, and where capital and labour are abundant. In such a country, and where there is a considerable extent and variety of surface, it is probable that circumstances will produce farms of every size from the smallest unprofitable holdings to the largest farms which can be managed with profit.

Where land is hired by the cultivator, it is an essential condition to good agriculture that there should be farms to hire which permit and require the employment of large capitals. It is also necessary that he who hires the land shall be able to secure the use of it for a period long enough to induce him to cultivate it in the best way, and to make those improvements the fruit of which cannot be reaped all at once. It is a last and equally important condition that he should not be restrained in his mode of cultivation. Small farms, short leases, or uncertain terms of years, and conditions which prescribe or limit the mode of cultivation, will infallibly produce bad agriculture.

The productive power of agriculture is not free in any country when the agriculturist is fettered by restrictions upon the sale of his produce; whether the restrictions are imposed by his own State and exclude him from selling his produce where he can, or whether they are imposed by another State which refuses to receive his surplus produce. In neither case will agriculture attain the development of which it is capable. In France the free intercourse between the different provinces of the kingdom was once impeded by many restrictions, and corn could not be taken even from one province to another. [France, P. C., p. 431.] The consequence was that agriculture was in a wretched condition, but it improved when the restrictions were removed. The history of all countries shows that the interference with the power of disposing of agricultural produce has been unfavourable to agriculture, and consequently injurious to the whole community. Nor is the agriculture of a country free when the land or its products are subject to heavy taxes, direct or indirect. Such taxes raise the price of agricultural produce, and so far diminish the power of persons to buy it; they also increase the amount of capital requisite for cultivating a piece of land, for the payment of the taxes is not always made to depend on the amount of produce raised, or on the time when the produce is by sale converted into money. Payments the amount of which is fixed with reference to the productive powers of the land or which depends on the actual amount of produce, may either be in the nature of rent, that is, the amount which a cultivator agrees to give to the owner of the land for the use of it; or they may be payments which the land owes to some person or persons not the owner or owners, and quite independent of the payment due to the landholder: to this second class of payments belong Tithes. The cultivator of the Roman Public Land paid the State a tenth of the produce of arable land, and a fifth of the produce of land planted with productive trees. But this second class of payments is an obstacle to improvement, for the occupier must lay out capital in order to increase the produce of the land; and it will often happen that he pays the tenth of the produce before he has got back his capital, and long before the outlay brings him a profit. The money payment which a man makes to the owner of land for the use of it, is or ought to be the value of the produce which remains after all expenses of cultivation and all costs and charges incident to the cultivation are paid, and the average rate of profit also is returned to the cultivator; at least this is the general mode in which the amount of rent under ordinary circumstances will be determined. It may therefore be as low as nothing. How high it may be depends on various circumstances.

If the agriculture of a country is free from all restrictions, it may in a given time reach the limit of its productive powers. In a country which has a considerable extent of surface and variety of soil, this limit may not be reached for many centuries, because improvement in agriculture is slower than in almost every other branch of industry. The best lands will be first occupied, and carelessly cultivated, as in America; the inferior lands will in course of time be resorted to, and finally the results of modern science will be applied to improve the methods of cultivation. An agricultural country, or a country which produces only raw products, and has no manufactures, will have reached the limit of its productive powers when it has raised from the soil all that can be profitably raised. Whether it will have a large surplus agricultural produce or not, will in a great degree depend on the size of the farms; but in either case the country will have attained the limit of its productive powers under the actual circumstances in which the agriculture is carried on.

But a country which also abounds in manufacturing industry may continue to extend its productive powers far beyond the limits of its agricultural produce. Part of the agricultural produce will be food, but when the producible amount of food has reached its limit, the productive power of manufactures has not reached its limit also; and this makes a real distinction between agriculture and manufactures. Great Britain, for instance, might not be able to raise more food than is sufficient for its actual population, but Great Britain could supply the world with cotton-cloth and hardware. A country of any considerable extent with a fair proportion of good soil will always be to a considerable extent an agricultural country, for, under equal circumstances of taxation with other countries, it will always be as profitable to cultivate the good lands of such country as to import foreign grain, the price of which is increased by the cost of carriage and contingent expenses. But a time will come in all countries which contain a large population not employed in agriculture, when foreign grain can be imported and sold at a lower price than grain can be produced on poor soils; and if there is no restriction placed on the importation of grain, experience will soon show when it is more profitable to buy what is wanted to supply the deficiency of the home produce than to attempt to raise the whole that is wanted by cultivating poor soils. No country of large extent with a great population could obtain the whole supply of corn by foreign commerce; such an instance is not on record. But a manufacturing country which has up to a certain point produced all the food that is required for its population, will be stopped short in the development of its manufacturing power, if from any cause whatever it cannot obtain an increased supply of food. An increased supply of food and an increased supply of raw produce are the two essential conditions, without which the manufacturing industry of a country must ultimately be limited by its own power to produce food. If the increased supply of food can be obtained from foreign countries, it is a matter of indifference to all who consume the food where it comes from; and the agriculturist himself, as far as he is a consumer of food, is benefited with the rest of the community by the greater abundance of food caused by the foreign supply and by the increased productive powers of the manufacturer. It is not necessary to determine how the increased supply of food will operate on wages or on profits, or on both: it is enough to show, that a time must come when there can be no increase in manufacturing power, if the supply of food is limited to what the country produces; and that by an addition to the supply of food an additional power is given towards the production of those articles which have reached their limit because the supply of food cannot be increased.

A country which has already produced from its best and its second-rate soils as much as these soils can produce in the actual state of agriculture, will begin to import grain from other countries, if there are no restrictions on importation. For capital will be more profitably employed in buying and importing foreign corn from countries where it is abundant than in raising it at great cost from inferior soils at home. It is generally assumed that the country which exports grain will take manufactured articles in exchange, and if there are no restrictions on either side this must be the case; for the manufacturing country does not want the grain more than the agricultural country wants the manufactures. But it might happen that a country which had a very large internal and foreign trade would find it much cheaper to buy annually from grain-growing countries all the corn that is wanted to supply its deficient produce at home, than to attempt to supply the deficiency, or to add to the present stock of food, by cultivating very poor soils; and this, even if the grain-growing country should refuse to take a single article of manufactures. The only way, indeed, of actually testing the truth of such a case as this is by experiment; but if commerce were free from all restraint, the importation of grain would become a steady trade, the amount of which would be regulated by the condition of agriculture in the importing country. If the importing country had brought all the better soils into cultivation, the amount of foreign grain that could profitably be introduced would depend on the cost of production in the exporting country and on the cost of transport. Any improvement in the agriculture and internal communications of the importing country would tend to check importation by adding to the quantity of produce or cheapening the cost of production; increase of population would tend to increase importation. The limit of profitable corn cultivation in the importing country, under its actual circumstances, would be determined by the cost of production in the exporting country and the cost of transport. The agriculture of the importing country and of the exporting country would then both be free, so far as restrictions on their commerce are concerned, and the consequence of this competition would be favourable to agriculture in both, for the same reason that the importation of foreign manufactures into a manufacturing country is favourable to the industry of both countries: such importation encourages the industry of the foreign country, supplies the wants of the importing country, and stimulates its industry by competition and the contrast of the home and the foreign article. The profits of the agriculturists in both countries would be always the same or nearly the same as the average rate of all profits in the two several countries; and the profits of the agriculturist of the importing country would not be affected by the profits of the agriculturist of the exporting country, any more than the profits of any other class of persons would be affected.

The free development then of agriculture in a country requires the admission of foreign grain. If foreign grain is absolutely excluded, land is made to produce grain which would be better employed in some other way, as in pasturage or planting. Corn thus becomes dear; and agriculture is encouraged or protected, as it is termed, to the injury of the mass of the people, and to its own injury also, for experience shows that those branches of industry receive most improvements which are neither restrained nor encouraged, but are subjected to fair competition; in other words, industry to be most productive to a nation must have no other direction than what the hope of profit will make individuals give it. If foreign grain is not excluded, but admitted on paying certain dues, the evil is much less than in the case of absolute exclusion, provided the duties are not high, and provided they are uniform; for nothing except a uniform duty can regulate the foreign trade and give it that steadiness which is most particularly the interest of the agriculturist. A uniform duty, as compared with absolute exclusion, is equivalent, so far as concerns the foreign trade, to an addition to the productive powers of the soil of the importing country. If trade is free, the exporting country can send its grain whenever the cost of production and the cost of transport do not raise the cost-price of such grain above that of the grain raised in the importing country. A miraculous addition to the productive powers of the soil of the importing country, or a sudden improvement in its agriculture, without any corresponding change in the exporting country, would at once lower the selling price of grain in the importing country, and diminish the supply from the exporting country. The effect is just the same as to the supply from the foreign country if a duty is laid on foreign grain, for that duty will, in certain stages of the agriculture of both countries, just make the difference that prevents the foreign grain from being sold in the importing country at the same price as the native grain. In such case the foreign grain cannot enter the country till the price of the native grain has risen by an amount equal to such fixed duty: the mode in which this rise operates is considered in a subsequent part of this article. But there is this important difference between the supposed cases of miraculous addition to the fertility of the soil or a sudden improvement in agriculture and the case of a fixed duty, that in either of the first two cases the country has an increased supply of grain, in the other it has not. However, a fixed duty has the advantage of determining the precise terms on which foreign and native corn shall enter into competition; and if the duty is moderate, and is considered necessary for the purposes of revenue, some people argue that a country is not ill administered in which such a duty is raised, though, if it is a manufacturing country rich in capital, such a necessary tax is an obstacle to the full development of its manufacturing powers.

If the duty is variable the trade cannot be steady, and consequently the price of corn will vary to every degree within very wide limits, an assertion which is not a conjecture, but a fact ascertained by experience. [CORN TRADE, P. C.] If there is a duty, either variable or fixed, it gives to poor soils a value which they would not have if the trade in corn were free; for the demand for food calls poor soils into cultivation, and the price of food is regulated by the cost of producing food on the poor lands, and food is consequently dear. The cost of producing food on the rich lands is less, either owing to their absolute superior fertility, or the less labour and manure that they require, or owing to both causes. This superiority of rich lands over poor lands gives to them an increased value either as objects of sale or objects of hire; the selling price of such lands is raised, and the letting price is raised by a duty on corn; and other lands also acquire a value that they would not otherwise have.

In a rich country it matters little if a capitalist who wishes to have land gives for it more than its value; such must be the result of the competition for land when the amount is limited, and the desire and the power to purchase are constantly increasing. But the effect of a tax on foreign grain in a manufacturing country, when all the best soils are under cultivation, is directly to increase the value of land, and to add to the income of the landholder by making land capable of profitable production and of bearing a rent, which, without the tax, could not be profitably cultivated or give a rent to the owner. The price at which the cultivator must sell his grain in order to continue to cultivate includes his profit and the owner's rent, and the price is paid by him who consumes the grain.

It remains to consider the effect of taxation on the exporting and importing countries. If both are free from taxation, or if the taxation is equal in both, or nearly equal, no nation is well administered which does not allow the importation of grain to be as free as is consistent with raising the necessary amount of revenue. It is not however hereby admitted that a tax on the importation of foreign grain is like any other tax, for such a tax is doubly injurious; first, in raising the price of food; secondly, in impeding the full development of all branches of industry, agriculture included. But if the exporting and importing countries are unequally taxed, it might be said that the agriculturists cannot enter into fair competition, if we suppose their facilities for production are the same; for if the importing country is more highly taxed, the cost of producing grain is thereby increased, and the exporting country has an advantage over the importing country to the amount of the difference in taxation in the two countries. But agriculture is not the only branch of industry that is taxed in a highly taxed country; all other branches of industry are also highly taxed. There is nearly always a duty on all raw produce that is introduced into it for the purpose of supplying the manufactures, as well as a duty on grain; other taxes also affect directly and indirectly the cost of other manufactured articles. Now as taxes must by the supposition be raised in such a country, the question is—In what manner can they be raised with least injury to the general productive power of the nation? If a heavy tax is laid on any raw produce which is required in the country, whether it be corn which is required for bread, or cotton, or other raw articles which are required to supply the manufactories, the productive industry of the country will be checked; for the cost of production is increased, and therefore the selling price is increased; and increase of price checks consumption and excludes the producer of the article from those markets which he could command if he could offer his article at a lower price. Thus if any circumstances increase the cost of producing a given article, cotton-cloth for instance, in a manufacturing country, that country is unable to enter into fair competition in the markets of the world with other manufacturing countries which are not subject to such additional cost of production. If a manufacturing country is in such a condition that it does import foreign grain to some amount, notwithstanding heavy duties upon it, this is a sure indication that the importing country, in the present condition of its agriculture, has passed the limit of production which is profitable to the community. In like manner, if foreign manufactured articles of the same kind with those manufactured in this country should be imported to a considerable amount, notwithstanding the payment of heavy duties, it would at least be a clear indication that these branches of domestic industry could not supply the demand; and it might be that such branches of industry were wholly unprofitable to the community.

The operation of a tax on articles imported into a country seems to be this: the articles may either be articles of a kind which are not produced in the importing country, or which are produced there. If a tax or duty is laid upon articles not produced in the importing country, the direct effect is to raise the price of such articles and to diminish the consumption of them. The indirect effect is to diminish the demand of the exporting country for the goods which it receives from the importing country. If a tax or duty is laid upon articles imported from abroad, which are also produced in the importing country, the effect is to raise the price of all such articles, both those imported and those produced at home, and in this manner:—The producer does not immediately supply the public. Between the producer and the buyer there are the wholesale dealer and the retail dealer. The wholesale dealer regulates his purchases by the demand which he expects, and if he buys the foreign article he pays for it the price which the importer demands and the duty which the State demands. The whole mass of articles in the merchant's hands, foreign and native, must now be viewed as the produce of the importing country. Any tax which the State may have raised, directly or indirectly, on the native produce, raises its price;

and the tax which it imposes on the imported article raises the price of that article and also the price of the native product. The average price, therefore, at which the merchant can furnish the articles of foreign and domestic produce is raised, and the consumer must pay this price. The State derives no benefit from the tax or duty on the imported article beyond the bare amount of the tax; it may even be injured in other ways by the tax which the consumer is thus made to pay, for he could get the article cheaper if there were no tax, and his means of purchasing other things and paying other taxes are so far diminished. The effect on the producer of the domestic article, which comes into the market in competition with the foreign article, appears to be this:—The fact of the foreign article being introduced and sold to any considerable amount while there is a domestic article, shows either that the foreign article is wanted to supply the deficiency of the home production, or that it is preferred to it. In either case the producer of the domestic article can ask a higher price for it than he could if there were no duty on the imported article. The duty, therefore, gives something to the native producer, which he would not be able to get if there were no duty. This explanation applies to all articles of native produce which are not subject to an excise duty, if there are any such, and at least it applies to grain. Now the additional price which the producer of grain is enabled to get because there is an import duty on foreign grain does not ultimately go into his pocket: it goes to the owner of the land, whoever he may be, whether the occupier or another; for there is a competition among farmers for land to occupy, and they will offer rent up to that amount which will leave them the usual rate of profit, or even less: and if a man farms his own land, he will equally have the advantage of the tax; for he can either profitably farm his land when there is no duty on imported grain, or the duty on imported grain enables him to cultivate land which otherwise he could not cultivate, because the duty raises the price. The state raises a tax on the imported corn, which the consumer pays; and this tax enables the native producer of grain to demand of the consumer another sum of money, which to the consumer is just the same as the tax. All duties, therefore, on articles imported into a country, which are also the products of that country, and are not subject to an internal duty, are of the class called protective duties, whatever their amount may be. It is not the object of this article to discuss how far such protection may be equitably given to any class of producers or proprietors in a highly-taxed country. It is sufficient to show that all persons as consumers are injured by the tax, and that the only persons who receive any benefit from it are the owners of land. If the land is not so highly taxed in those countries in which there is a duty on imported grain as in other countries, the injustice of such a duty is the more flagrant. [LAND-TAX, P. C. and P. C. S.]

There is another mode of viewing the operation of a fixed duty upon corn (*Economist Newspaper*, Dec. 5, 1843). It is urged by those who maintain that such a duty cannot be other than a protective duty, that no supply of foreign corn can be obtained in the importing country until the price of corn in such country has risen high enough to pay the price of corn in the exporting country, with all the costs of transport, and the fixed duty also. It is further maintained, that the price of *all* the corn in the importing country must be so raised before foreign corn will come in; and consequently, that in any season when there is a deficiency of corn in the importing country, it is not merely the duty on the foreign grain imported that must be paid by the consumer, but he will have to pay an amount equal to the fixed duty on all the corn that is raised in the importing country for the consumption of a given period, for instance one year. Thus, if the consumption is 20,000,000 quarters, and the deficiency is 2,000,000 quarters, a fixed duty of 5*s*. per quarter on the 2,000,000 quarters will cause a rise of 5*s*. in the quarter on the 18,000,000 quarters also. Accordingly the State will get the duty on the 2,000,000 quarters, which the consumer will pay, and somebody else will get the 5*s*. per quarter on the 18,000,000, which the consumer also will have to pay. The truth of this proposition in its full extent may be questioned. The sum which the consumer will have to pay will certainly be more than the duty on the 2,000,000 quarters, but perhaps somewhat less than the 5*s*. per quarter on the remaining 18,000,000 quarters. For something must be allowed for the fact that all the 18,000,000 are not in the market for sale at once. Under a fixed duty, some of the 2,000,000 quarters of imported corn would be sold when the market price had risen to (say) 47*s*. the quarter; and an advance of a shilling or two in the price would induce other holders to sell their corn; but all holders might not do so. The market price might then turn, and others would dispose of their warehoused grain while the market was falling. The home market might then become depressed for a considerable period; and during this period it might be so low as to render it unprofitable to import foreign corn, even if the duty were only two or three shillings. In this case then the consumers would not be paying 5*s*. per quarter higher than they would have done if the trade were free. Something also must be allowed for the disposition of merchants to speculate; and both they and the producers are liable to be acted upon by the apprehension of falling markets, when, as sometimes happens, a real panic takes place, and prices are depressed beyond all reasonable calculation. We should be disposed, therefore, to qualify the assertion of the 'Economist' by the conclusion that, in the importing country, with a fixed duty of 5*s*., the average price of corn, in a series years, will be somewhere about 5*s*. a quarter higher than it would have been if the trade had been free; and perhaps this is all which the writer intended strictly to contend for. It may perchance turn out that the consumer will have to pay more than 5*s*. per quarter on the 18,000,000 quarters, or on some part of it; but it seems hardly safe to assert that he will have to pay exactly 5*s*., neither less nor more.

A chimerical difficulty is sometimes raised of this kind:—If a country does not produce all the grain that it requires, or if it is dependent for any considerable amount on foreign trade, it may suffer from scarcity in some seasons, and in time of war might be in danger of famine. As to the scarcity, experience shows that no dependence can be placed on a regular foreign supply, unless there is a regular trade in corn, that is, a trade into which a man can enter as he would into any other well regulated trade. If a scarcity should ever happen in the importing country, it will be remedied by the stores of grain on hand that are supplied by a steady trade. If the trade is unsteady and uncertain, the scarcity may be supplied or it may not: but it must be supplied at a higher cost, and sometimes it may be difficult to get a supply at all. Rome, both under the republic and the empire, was in part supplied with foreign grain, but the supply was uncertain, for it was not all furnished in the way of regular trade, but sometimes called for as a forced contribution, sometimes accepted as a gift, and it was often purchased by the State, for the purpose of distribution among the poor, either gratis or at a low price. All Italy imported grain largely under the early emperors. The scarcity with which Rome was sometimes threatened was not owing to the grain coming from foreign parts, but to the fact that there was not a steady trade founded on a regular demand by a body of persons able to pay for it. If a government shall regulate or attempt to regulate the foreign trade by scales of duties varying according to any law that the wisdom of a legislature may select, the result will be the same, great irregularity in price and sometimes scarcity. It makes little difference whether the State imports directly or regulates the importation of its subjects by a capricious rule. The direct importation of the State, if well managed, would obviously be the safer plan of the two. What is here said of the Roman system applies only to the importation of foreign grain into the city of Rome. The necessity which existed for the importation is a question that can only be discussed with the question of cultivation in ancient Italy, and the gratuitous distribution of grain at Rome. Dureau de la Malle has some valuable remarks on this subject (*Economie Politique des Romains*); but we do not assent to all his conclusions.

The fear that war might shut out the supplies of grain which are brought into a country under a regular corn-trade cannot enter into the minds of those who view the question without prejudice. War does not and cannot destroy all trade; it may impede it and render it difficult, but trade has existed in all wars. The supposition that a rich manufacturing country which abounds in all the useful products of industry cannot under any circumstances buy corn out of its superfluity, is a proposition which should be proved, not confuted. It belongs to those who maintain this proposition to give reasonable grounds for its truth.

For some remarks in this article the writer is indebted to Ganilh, *Dictionnaire d' Economie Politique*, art. 'Agriculture.

AGRICULTURE, STATISTICS OF. In several countries of Europe there is a department of government organized either for collecting the statistics of agriculture or superintending institutions which have immediate relation to that branch of industry. In France these duties devolve upon a department of the Minister of Commerce and Agriculture. The management of the royal flocks, veterinary schools, and the royal studs; the distribution of premiums in agriculture; the organization and presidency of the superior and special councils of agriculture, are comprised in the duties of this ministerial department. The councils-general of agriculture, &c. in each department of France collect the agricultural statistics from each commune; and the quantity of land sown with each description of grain, the produce, and the quantity of live stock for the whole of the kingdom, are accurately known and published by the Minister of Commerce and Agriculture. In Belgium these facts are ascertained periodically, but not every year. In the United States of North America, at the decennial census, an attempt is made to ascertain the number of each description of live stock, including poultry; the produce of cereal grains, and of various crops; the quantity of dairy, orchard, and garden produce, &c., in each State. There are twenty-nine heads of this branch of inquiry. The only countries in Europe which do not possess statistical accounts of their agriculture founded on official documents are England and the Netherlands. In England the quantities of corn and grain sold in nearly three hundred market-towns, the quantities imported and exported, and the quantities shipped coastways, are accurately known, but no steps are taken by any department of the government to ascertain the quantities produced. On the same principle that a census of the population of a country is useful, it must be useful to have an account of its productive resources. The absence of official information is supplied by estimates of a conjectural character, founded at best only on local and partial observation. In France it is positively ascertained that the average produce of wheat for the whole kingdom is under fourteen bushels per acre. In England it is known that the maximum produce of wheat per acre is about forty bushels, and that the minimum is about twenty bushels. The usual conjecture is that the average produce of the kingdom in years of fair crops is about twenty-eight bushels, but the total superficies sown with wheat or any other grain, and the total quantity of the produce, are matters simply of conjecture. The only statement the public or even the government are in possession of in respect to the quantity of land cultivated and uncultivated, and of land incapable of producing grain or hay, in Great Britain, rests upon the authority of private inquiry made by one person, Mr. Couling, a civil engineer and surveyor, who gave the details to the parliamentary committee on emigration in 1827, now seventeen years ago. As there is an account published weekly in the 'London Gazette' of the quantity of each description of grain sold in nearly three hundred market-towns in England, with the average prices, and the quantity of foreign corn and grain imported is also officially published, it would be putting into the hands of the community very important elements of calculation in reference to the supply of food, if they could also learn after each harvest what had been the breadth of land under cultivation for each species of produce respectively, and the amount of produce harvested. The result could not fail to be felt in greater steadiness of price, which is particularly desirable for the interests of the tenant farmer, and also highly advantageous to the public. For example, the harvest of 1837 was deficient to so great a degree, that before the produce of 1838 was secured the great superabundance of the two preceding harvests was all consumed, and the stock of grain was more nearly exhausted than it was ever known to have been in modern times. A reasonable advance of price would have checked consumption, which, as regards wheat, had been going on with unwonted profusion, but in August, September, and October, 1837, the markets fell from 60*s*. 1*d*. to 51*s*. per quarter, and it was not until the middle of the following May that the average was again as high as it had been just before the harvest of 1837. By the third week in August, 1838, the average had risen to upwards of 73*s*., and wheat was admissible at the lowest rate of duty. The buyers consequently resorted suddenly to nearly every corn-market in Europe, and prices, aided by a wild spirit of speculation, which subsequently was productive of great loss to importers, rose enormously. It is contended that these losses and the fluctuation of prices would not have occurred if the produce of the harvest of 1837 had been more accurately known. (*On the Collection of the Statistics of Agriculture*, by G. R. Porter, Esq., of the Board of Trade.) The probable operation which statistical facts officially collected would have upon agricultural improvement are thus adverted to by Mr. Porter:—'It has been stated that if all England were as well cultivated as the counties of Northumberland and Lincoln, it would produce more than double the quantity that is now obtained. . . . . If the cultivator of land where agricultural knowledge is the least advanced, could be brought to know, upon evidence that could not admit of doubt, that the farmer of Northumberland or Lincolnshire procured, from land of fertility not superior to his own, larger and more profitable crops than he is in the habit of raising, is it likely that he would be contented with his inferiority?' In 1836 the late Lord Sydenham, while president of the Board of Trade, in order to test the probability of success that might result from a more extended attempt, caused circular letters containing fifty-two simple but comprehensive queries relating to agriculture to be sent to each clergyman in the one hundred and twenty-six parishes of Bedfordshire. Out of this number only 27, or about one in five, replied, and further inquiry was abandoned. The tithe commissioners make returns of the crops in all parishes, but they do not do so simultaneously. There is however no insuperable difficulty in collecting the national statistics of agriculture, whenever government thinks fit to undertake such a duty. On the 18th of April, 1844, on a motion in the House of Commons for an address to the queen praying for the establishment of some method of collecting agricultural statistics, the vice-president of the Board of Trade, on the part of the government, concurred in the object of the motion, but from various causes he declined at that time giving the motion his support. The yearly expense of the inquiry would be from 20,000*l*. to 30,000*l*.; and probably not a long period will elapse before the appropriate machinery will be in operation. In this way can government advance the interests of agriculture and of the public at the same time. In a country like England, which abounds with men of rank, wealth, and intelligence, who engage in scientific agriculture as a favourite pursuit, it is quite unnecessary for the government to assume the superintendence of matters which relate to practical agriculture; but this may be done with propriety in other countries, which are placed in different circumstances.

AIR BEDS AND CUSHIONS. The mechanical application of common air, in respect to its pressure or elasticity, has been greatly extended within the last few years. The pressure of fourteen or fifteen pounds on the square inch, which the weight of the superincumbent atmosphere gives to the air at the surface of the earth, is a mechanical agent which, under certain arrangements, becomes a substitute for powers of a very different kind.

Provided a mass of air can be confined within a given receptacle, and that receptacle be of an elastic or yielding character, the air assumes many of the qualities of a soft stuffing or padding, when its quantity is small compared with the size of its envelope; but when the quantity is as great as can be introduced without bursting the envelope, the air becomes in fact nearly equivalent to a solid body. So long as the means were wanting for conveniently making air-tight cloth vessels, this principle was slenderly applied; but the use of caoutchouc or India-rubber, as a glutinous varnish, has developed many ingenious contrivances for this object.

Almost any textile fabric may be rendered impervious both to air and water by the use of some one or more of the caoutchouc compositions [WATER-PROOF CLOTH AND LEATHER, P. C.]; and when a bag has been made of such material, rendered also air-tight by somewhat similar means at the seams, air may be passed into it as a substitute for more solid materials. In practice there are some very neat arrangements adopted in effecting this. Temporary air-seats or cushions are made by forming a bag of air-tight cloth, perfectly enclosed at every part except one corner, where is inserted a small tube and stop-cock, capable of admitting or preventing communication from the interior to the exterior. The cock being opened, and the tube applied to the mouth, air is blown into the cushion, until it expands to the desired degree of fulness; the cock is then closed, and the air remains imprisoned. In this state the cushion is of a more equable kind than any one stuffed with solid materials; and if the envelope be well made, it will retain its efficacy for a long time. When not in use, such a cushion can have the air expressed from it, and may then be folded up into a small space.

It is obvious that seats, cushions, pillows, and beds of various kinds, having a similar object in view in respect to softness, fulness, and elasticity, may be made by similar means. When the quantity of air included in an envelope is greatly increased, it may be made the means of producing actual pressure in a more equable way than by any solid bodies. Thus, an air-tight bandage was invented a few years ago, of which many persons had an opportunity at the time of seeing a specimen at the Polytechnic Institution. The object of this arrangement is to form a wrapper to an arm or limb under surgical treatment. There is a bandage with straps, capable of being conveniently tied round the arm; and when so tied, air is breathed into an air-tight envelope to the bandage, through a small tube provided with a pipe: by increasing or lessening the quantity of air impelled, the pressure of the bandage on the limb may be made so small as to be scarcely perceptible, or may be even painfully close, and it will be equable in different parts.

About four years ago Mr. Walton took out a patent for certain modifications in the mode of preparing air-bags for beds and similar purposes. The plan seems as if it must necessarily be a costly one, and is thus described.—There are first made a number of globular air-vessels of India-rubber, in one of two modes. In the first mode, a metallic receiver is charged with compressed air by means of a condensing syringe; at the upper part of this receiver there is a pipe furnished with a stop-cock; a jointed lever, countersunk on the under side, is brought down upon the pipe, a small aperture being made through the lever opposite the centre of the pipe. India-rubber bottles are cut in half and soaked in water at 100° Fahr., and afterwards in cold to facilitate their separation into laminæ; the thin sheets thus obtained are placed over the pipe and held down upon it by the lever. Upon then turning the stop-cock, the condensed air pushes the India-rubber up through the aperture in the lever, expanding it into a ball; in other words, the force of the compressed air both makes the ball and fills it by the same action. When brought to the proper size and strength for the required purpose, the ball is tied round with thread close to the lever, the superfluous edges are cut off, and the joint secured with India-rubber cement. The second mode of making and filling the air-balls consists in the use of a pair of hemispherical cups hinged together, and both connected by tubes with a metal receiver furnished with a stop-cock. A piece of thin sheet India-rubber is stretched over each hemispherical cup; and the air being then extracted from within, the external air forces the thin membrane to conform to the interior of the cup. The two cups of India-rubber are then joined together, forming a ball. The balls, made and filled by either of these methods, are connected together, either externally, or by being enclosed within an external covering, forming a sheet of balls. Many such sheets may be laid one upon another, enclosed in an outer case, to form a bed or mattress of any thickness. The object of this complicated plan is stated to be, the limitation of an accidental injury or rupture to one small air-vessel.

AIR-VESSELS are the parts constituting a piece of machinery invented by Mr. Cubit to serve the purpose of a *fly* in regulating the motion of a wheel which, as a prison discipline, is turned by men.

Several vessels are employed, each of which is cylindrical, and consists, like a pair of bellows, of an upper and lower board, with sides of leather: the vessel has only one aperture, and the lower board is made fast to the floor, while the upper one is capable of being moved up and down by its connection with a crank which turns on the axle of the wheel. A sliding plate having holes pierced in it is capable, by wheel-work, of moving before the aperture, so as to diminish the latter to any required extent, and is connected with the governing balls of the machinery.

Thus, when the velocity becomes too great, the divergence of the balls causes the sliding-plate to pass more or less over the aperture and contract its dimensions; by which means less air enters into and is expelled from the vessel, and a resistance is created which diminishes the speed. Or, in the event of the velocity becoming too small, the balls descend, and the sliding-plate is drawn off from the aperture, by which means the air enters and issues more freely, and thus the resistance to the motion of the machine is diminished. (Transactions of the Society of Arts for 1827.)

An apparatus of the same or a like kind might be employed for other purposes: for example, in lowering heavy goods from a wharf, or from the upper part of a warehouse; and an ingenious machine, in which the resistance was produced by the passage of water or oil through an orifice, is or was in use at some of the warehouses belonging to the East India Company. It consisted of a cast-iron box immoveably attached to the ground, or floor, its interior forming the concave surfaces of two hollow cylinders, in vertical positions and of equal heights, separated from each other by a portion of the material. The two cylinders were capable of holding about a gallon of fluid, and they communicated with each other by openings left near the top and bottom of the material between them. In the larger cylinder was a solid piston which ascended and descended in consequence of its connection with a crank on the axle of the wheel by which, in general, goods were raised up to the place. In the middle of the smaller one was a circular plate capable of being turned about an axis in the direction of a diameter so as to allow a communication of any convenient magnitude to be made between the upper and lower part of the cylinder.

In use, the two cylinders were nearly filled with water or oil; and, the piston rising and falling alternately as the goods in descending turned, by the crane-rope, the axle of the wheel, the resistance created by the passage of the fluid through the communications between the two cylinders and through the opening at the circular plate, prevented them from descending too rapidly: at the same time the risk of the accidents to which a simple brake is liable was avoided.

AIX EN PROVENCE. In the fresh-water deposits of this locality many fossil insects have been detected. (Murchison.)

AIZA'NI or AZA'NI, Antiquities of, (Αἰζανοί, 'Αζανοί) or according to its modern name, Tchafter-Hissar, a city of Asia Minor, in the antient province of Phrygia, about nine hours' journey from Kutahia. It is mentioned by Strabo (p. 576) as one of the places of Phrygia Epictetus under the name of Azani; other authorities write the name Aizani (Stephan. Byzant. v. 'Αζανοί). Nothing is known of its history, and its existence had been almost forgotten until recently, when, owing to its having been visited by travellers and artists, the numerous remains of extensive edifices have given it archæological interest in the history of architecture. Lord St. Asaph was the first who communicated any intelligence respecting these ruins (1825), which were visited about the same time by Count de Laborde, and somewhat later by Major Keppel; but it is to Charles Texier, the architect, who, just after completing his studies in Italy, was sent out by the French government to Asia Minor, about 1834, that we are indebted for an accurate artistical description of them.

The first building that attracts notice on approaching the place is a temple, which, being raised on a considerable eminence, forms, like the Parthenon of Athens, a conspicuous object from a distance, and commands the rest of the town. Instead however of being, like the Athenian Acropolis, the natural rock, enclosed on its summit with walls, but otherwise quite unshaped, and having its buildings placed quite irregularly without any regard to symmetry of general arrangement, the eminence upon which this temple at Aizani stands, forms an elevated platform or terrace cut out of the hill and perfectly regular in its plan, which is a parallelogram and nearly a square, its measurements being 532 feet (English) on its north and south sides, and 480 on its east and west. From the remains of walls at the north-west angle it is conjectured that the platform of the terrace formed a peribolus or court to the temple, enclosed on three of its sides, while the east one (corresponding with the entrance end of the temple) was left open, and on that side the face of the terrace was decorated architecturally throughout its entire extent by a series of twenty-two arches with pilasters between them, *i. e.* eleven on each side of the central flight of steps (100 feet wide), forming the ascent to the upper level. Thus the terrace here formed a magnificent substructure that, together with the temple, must have produced an unusually striking and imposing effect. The temple itself stands exactly in the centre of the peribolus or platform, consequently exactly facing the ascent up to it. This edifice, which appears from inscriptions found among the ruins to have been dedicated to Jupiter of Aizani, is now more than half destroyed, little more remaining than the columns of the north and west sides and the corresponding portions of the cella; yet what is left affords sufficient data for determining with accuracy the particulars in regard to its plan and the peculiar character of its order. Referring to the article TEMPLE in the 'Penny Cyclopædia' for an explanation of the respective terms, we may briefly describe it technically as being Ionic, octastyle, pseudodipteral with fifteen columns on its flanks, therefore exactly corresponding with the cut which is there given (p. 182) as an example of a pseudodipteral plan. Its general dimensions do not exceed 104 feet by 53, or including the broad socle on which it is raised, 121 by 72, and therefore in point of magnitude it is much smaller than some of the structures noticed in the 'Table' of them in the 'Penny Cyclopædia,' nevertheless considerably larger than some of the most celebrated of them—for instance, than the Maison Carrée at Nismes, which is only 38 by 77 feet. The whole is constructed of white marble, and the columns, 31 feet high, are each of them wrought out of a single block; but what gives such interest to this monument is that it affords a very remarkable example of the Asiatic Ionic, decidedly differing, at least in its entablature, from any specimens heretofore edited. The columns have the peculiar Asiatic Ionic base, but are not otherwise remarkable, except for the singularity of there being a small vase or urn carved in the upper part of each channel of the fluting: these are of course so very diminutive that they could hardly have been distinguishable at that height, and therefore were probably intended only to produce the effect of an enriched *collarino* or necking to the capital with the fluting continued through it. Far more remarkable is the entablature, both for its proportions and decorations: the architrave, which is divided into three fașias with carved bead mouldings, is considerably deeper than the frieze, which excess is caused by the unusual breadth of its coping, consisting of a large ovolo and cavetto above it, both enriched. The frieze is still more remarkable—even unique in its design, which is such as to render it most difficult to describe: large upright acanthus-leaves placed singly at intervals after the manner of triglyphs, are placed beneath a sort of consoles formed by the junction of two scroll-like volutes meeting each other in front like those at the angle of a Corinthian capital, to which they bear a very strong resemblance; therefore taken with the acanthus-leaves beneath them, they give the frieze a certain Corinthianism of character. The cornice again differs both from Greek and Asiatic-Greek examples of the order, inasmuch as, in addition to the dentils of the latter, it has small modillions: the corona is narrow; the cymatium above it, on the contrary, very deep, and enriched with a flower pattern. Taken altogether this specimen of the Ionic style is an interesting and valuable acquisition to our studies of the antient orders, and serves as another striking proof of the freedom and diversity with which they were treated, wherefore this account of it may be acceptable, more especially as this is almost the first that has yet been given in any English publication. Beneath the cella is a subterraneous chamber or crypt, 52 feet by 29 feet 6 inches, with a vaulted ceiling; light was admitted into it by means of *abat-jours*, or apertures in the pavement of the colonnades next the walls of the cella, and the steps leading to it were within the posticum. Several columns now lying on the ground within the peribolus indicate that that enclosure must have been adorned with them, since they evidently do not belong to the temple itself, being not much above half the size of the others, and besides the lower part of their flutings are cabled.

After this temple the chief other monuments discovered at Aizani are a theatre, stadium, and gymnasium: the first of these, which is in better preservation than almost any other antient structure of its kind, is 185 feet in its greatest diameter, and the spectatory had sixteen rows of marble seats, but those of the upper or second tier are nearly all destroyed: the podium however of that tier, or the wall of the præcinction separating it from the lower one [Theatre, P. C., p. 294], is for the greater part remaining, and shows one peculiarity, namely, niches placed at intervals in pairs, of which there were altogether 24. The orchestra forms more than a semicircle with a radius of 66 feet. The scena was decorated with six pairs of coupled Ionic columns, but these have fallen down, and are lying with a mass of other ruins and fragments in the orchestra.

The stadium, which is a little to the south-east of the theatre, measures 725 feet in its extreme length and 152 in its extreme breadth. There were two pulvinaria or loggias, one for the magistrates, the other for the directors of the games; and ten rows of seats along each side, capable of accommodating between 12,000 and 13,000 persons.

Of the gymnasium, or what is supposed to have been such, and which is situated to the south of the peribolus of the great temple, little more remains than a Doric colonnade extending upwards of 200 feet, whose pillars are all of white marble and of a single piece. To the north-west of the temple are also some ruins of what is supposed to have been a basilica. The river Rhyndacus, which passed through the city, was crossed by two bridges of white marble, each consisting of five semicircular arches. Both are remaining, as also the parapets of the quays along the river, which, like the bridges, are constructed of white marble and ornamented with sculptures. There are besides many tombs, whose doors and portals (represented in Texier's work) afford valuable architectural hints and studies.

ALA'NI ('Αλάνοι) is the collective name of different nomadic nations that lived in the countries north of the Euxine and the Caspian, and may be divided into European and Asiatic Alani. They became early known to the Romans, if the Alani mentioned by Suetonius (*Domitian*, 2) were the same as those of whom we speak, and not the Albani, who lived in the southern part of the present country of Daghistán and in Shirwán, and are mentioned by Strabo (p. 499, Cas.), Ptolemy, and many other antient writers. Ammianus Marcellinus (xxxi. 2) says that the Alani were the same as the antient Massagetae, which is probable if we take the name in its collective meaning, for the same author says (xxii. 19) that the Alani lived north of the Maeotis, a country of which the Massagetae, in all probability, have never occupied any part. The name appears to have originally belonged to a Caucasian tribe which lived between the chief range of the Caucasus and the Portae Caspiae, now the Iron Gate, near Derbend, and as far north as the great steppe between the Kuma and the Volga; and it is probably this tribe which subdued the neighbouring nations, and to which we must refer the words of Ammianus Marcellinus (xxxi. 2), who gives the best description of the Alani; he says that the nobles among them were a very handsome set of men, with fair hair, and eyes of a terrible expression. The Alani showed some traces of civilization, but they liked warfare above all other occupations, and made frequent incursions into the Roman provinces. Their horses were excellent and very swift, and the armour and arms of the men were light, and well suited for a predatory mode of warfare. The Romans fought many battles with them, but not always to their advantage. The Emperor Gordian was defeated by them near Philippopolis, A.D. 242; and they took a decisive part in the victory which they and the Goths obtained in A.D. 378, near Adrianople, over the Emperor Valens, who was killed in or after the battle. (Amm. Marcell. xxxi. 13.) In A.D. 406 and 407 the Alani became still more conspicuous by invading Gaul with the Vandals, Suevi, Burgundians, and other barbarians. After having lived some years in that country they joined the West Goths and Vandals for the purpose of invading Spain, which soon yielded to their arms (A.D. 411). The Alani now settled in Lusitania and the province of Carthagena, and lived for some time under their kings till they quarrelled with the West Goths, whose king, Wallia, defeated them in A.D. 440 in a pitched battle, where the Alanian king Atax lost his life. Upon this the Alani joined the Vandals, and shared their fate in Spain as well as in Africa. After A.D. 440 they ceased to be an independent nation. The later part of their history can only be traced in the dry and short chronicles of Prosper, Idatius, and Isidorus. Part of the Alani did not join the Spanish expedition in A.D. 411, but remained in Gaul under their king Goar. In A.D. 440 Aëtius, the Roman governor of Gaul, allotted them settlements in the environs of Valence, with a view of making them serve as a barrier against the Goths. Their king Sambida, or Sangipanus, was intrusted by Aëtius with the command of Orléans, which Attila was besieging in A.D. 451; and it appears that he was bribed by the Hunnic king, to whom he would have surrendered the town if he had not been closely watched by the Romans and the West Goths, who trusted him so little, that in the great battle on the Campi Catalaunici they put the Alani between their most faithful troops, and thus compelled them to fight. The second expedition of Attila into Gaul, which seems to be an historical fact, although Jornandes is the sole author who mentions it, was undertaken under the pretext of subduing those Alani of Valence. Gregorius Turonensis states (*Hist. Franc.* ii. 7) that they were deprived of their independence by Thorismund, king of the West Goths. The name of the Alani occurs in all the later historians, among whom, besides those quoted above, Zosimus, Procopius (in his 'Bellum Gothicum,' as well as in the 'Bellum Vandalicum'), and Priscus, are the best sources. All the passages of the antient writers referring to this nation are collected in Stritter, 'Memoriae Populorum.'

For many centuries after the destruction of the Alani in Spain and Gaul their name occurs in the later Byzantine writers, and we have many modern maps in which the Alani are put down as inhabiting the tract between Derbend and the Kuma. Eichwald, a most competent writer on these matters, shows that this arises from a mistake, the Byzantines having confounded the Alani with the Albani, a Turkish tribe, with which the Greek emperors were engaged in perpetual wars.

The Alani were undoubtedly a Circassian nation, and as the social state of the Caucasian tribes seems to be nearly the same as it was fourteen hundred years ago, a nearer acquaintance with these people will enable the student to form a pretty correct idea of the state of civilization of many of the barbarians who overthrew the Roman empire. The feudal system is a very old institution in Caucasia.

(Eichwald, *Alte Geographie des Kaspischen Meeres*; Mascou, *Hist. of the Antient Germans*, translated by Lediard; Papencordt, *Geschichte der Vandalen*.)

ALARIC II. (ALARI'CUS), king of the West Goths, succeeded his father Eudes in A.D. 484. Gothia, the then name of the West Gothic kingdom, had been considerably enlarged by Eudes, and extended over Hispania Tarraconensis and Baetica, and in Gaul as far as the Loire and the Rhône, by which rivers it was separated from the kingdoms of the Franks, the Burgundians, and the East Goths, who were masters of the province. If we can trust Isidorus, Alaric had spent his youth in idleness and luxury, though the truth seems to be that, preferring a peaceful reign to war, which in the eyes of the Goths was the only occupation worthy of kings, he incurred that reproach because he was not fond of bloodshed. He was an Arian, as most of his countrymen were; but he was a very tolerant man, as we see from the acts of the Council of Agde, which was held in A.D. 506, and by which many privileges were granted to the orthodox Catholics. His toleration was the cause of his ruin. Clovis, king of the Franks, having overthrown the last remnants of the Roman power in Gaul, coveted the fine countries west of the Loire; and there being still many Catholics in Gothia who were dissatisfied with their king because he was merely tolerant towards the Catholics, and did not adopt the Catholic faith, he declared war against Alaric. The old East Gothic king, Theodoric the Great, whose daughter Theudigotha was the wife of Alaric, foresaw the war, and tried to prevent it by conciliatory means: the letters which he wrote to that effect to the kings of the Franks, the West Goths, and the Burgundians, are given by Cassiodorus; but his endeavours were in vain, and the war broke out in A.D. 507. For twenty-three years the Goths had had no war of consequence (for that they should have had no feuds with their neighbours the Vandals and Suevi is not likely), and the warlike habits of his subjects were rather relaxed; while the Franks scarcely knew what peace was, and improved their discipline in continual contests with their neighbours. When the West Goths and Franks came to settle their difference in a pitched battle near Vouglé, in the environs of Poitiers, the result proved fatal to king Alaric, whose army was entirely defeated. Alaric fled, but was overtaken and killed. Gregorius Turonensis mentions his death in a few words, too vague to allow us to conclude that it was Clovis who slew his rival with his own hand, as several modern writers say. The Goths made a halt at Narbonne, and, unfortunately for them, quarrelled among themselves about the choice of a new king. One part of them chose Gesalic, or Gisolec, the elder but bastard son of Alaric; and another Amalaric, the lawful son of Alaric and Theudigotha. This prince being too young to rule, the regency over the West Gothic kingdom was intrusted to his grandfather, the East Gothic king Theodoric, who drove Gesalic out, and compelled the Franks to restore their conquests. A proof that Alaric was peaceful because he appreciated the blessings of peace, and that he was able to consolidate that peace by a regular system of legislation, is the code called BREVIARIUM ALARICIANUM, P. C. S.

(Cassiodorus, *Variar.* 3, ep. 1, &c.; Gregorius Turonensis, ii. 36; Procopius, *De Bell. Goth.* ii. 12; Jornandes, *De Reb. Goth.* p. 129, ed. Lindenbrog; Isidorus, *Chron. Goth.* ad an. erae 522; Mascou, *Hist. of the Antient Germans*, translated by Lediard; Aschbach, *Geschichte der Westgothen*.)

ALBA, *the Province of*, an administrative division of the Sardinian States, is bounded on the east by Acqui and Alessandria, north by Asti and Torino, west by Saluzzo, and south by Mondovi. The country is hilly, and it is intersected from south to north by the Tanaro, an affluent of the Po. The products are wine, corn, pulse, fruit, and silk. Truffles are dug up in many places, and are an article of export. A considerable quantity of horned cattle is bred in the country. The area of the province of Alba is about 300 square miles, and the population is 105,700 inhabitants. It is divided into eleven 'mandamenti' or districts, and seventy-seven communes. The head town, Alba, a bishop's see, is situated in a fertile plain near the banks of the Tanaro, and contains 8000 inhabitants. It has a cathedral, built in the fifteenth century, and several other churches; an hospital, a royal college, a clerical seminary, a literary and philharmonic academy, and several private collections of antient medals and other antiquities which have been found in the neighbourhood. Alba was a town of the Statielli, and it is said to have been restored by Pompeius Strabo, the father of Pompeius Magnus; in consequence of which it was called Alba Pompeia. The Emperor Pertinax was born at Villa Martis near Alba, where memorials of the splendid residence which he built himself have been found in a farm called La Martinenga, the owner of which has published an interesting account of the same: 'Della Villa di Marte, Casa, e Lari dell' Imperatore P. Elvio Pertinace ne' Celto-Liguri-Tanarei; Illustrazione del Conte Vincenzo Deabbate Patrizio d' Alba Pompea,' 4to. Alba, 1818. A sepulchral altar of marble, with a frieze of elegant workmanship, was found in the bed of the Tanaro in 1779, bearing the names of Caius Cornelius Germanus, aedilis, quaestor, duumvir, and sacerdos, and of his wife Marcella. This monument has been illustrated by the antiquarian Baron Vernazza: 'Germani et Marcellæ Ara Sepulcralis Commentario Illustrata.' The monument is deposited in the court of the town-house. In the middle ages Alba was one of the principal towns of the marquisate of Monferrato. It was annexed to the dominions of the house of Savoy by the treaty of Cherasco in 1631. The learned Vida was many years bishop of Alba.

The other towns of the province are: 1, Brà or Braida, a considerable place, of 10,000 inhabitants, in a district abounding with corn, wine, fruit, cattle, and silk. Brà is not far from Polenza, built on the site of the antient Pollentia, where Stilicho defeated the Goths, A.D. 403, and for a time saved Italy; 2, Sommariva del Bosco, a town of about 5000 inhabitants; 3, Canale, with about 4000, and other smaller places.

(Casalis, *Dizionario Geografico, Statistico, Commerciale, degli Stati di S. M. il Rè di Sardegna*; Denina, *Quadro dell' alta Italia*; *Calendario Sardo*; Serristori, *Statistica dell' Italia*.)

ALBATEGNIUS (Astronomer). D'Herbelot calls him Mohammed Ben Giaber, but Mr. Gayangos, who has given more particulars of him than any one else (in the *Biogr. Dict.* of the Society for D. U. K.), names him Mohammed Ibn Jábir Ibn Senán Abú Abdillah. The term Albategnius is the Latinized form of El Batani, or Al Bateni, from Baten in Mesopotamia, where he was born. He lived in parts of the ninth and tenth centuries, beginning his astronomical observations in A.D. 877, and continuing them till his death in 929. He generally resided at Rakkah (Aracta) or at Bagdad. His writings comprise abridgments of Ptolemy and Archimedes, with comments; a work on astronomy, chronology, and geography; a treatise on the rising of the constellations and various other points of astronomy; an elementary treatise on astronomy; and one on astrology; with minor works. The treatise on the rising of the constellations (Lalande *in verb.*, Delambre) was translated from Arabic by one Plato Tiburtinus, but badly (as was detected by Halley). This translation was twice printed: first as 'Alfragani Rudimenta Astronomiæ, et Albategnii Liber de Motu Stellarum . . . cum Joh. de Regiomonte Oratione Introductoria . . . Norimbergæ, 1537,' 4to.: next as 'Albategnii de Scientiâ Stellarum Liber, cum aliquot Additionibus J. Regiomontani . . . edidit Bernardinus Ugulottus, Bononiæ, 1645,' 4to. Both editions leave out the tables which the book was written to explain, from which it is difficult to form a very accurate idea of the labours of Albategnius; but there is enough to show that he was an astronomer of great merit, and a very independent turn of thought: it is likely that he was among the first, if not the very first, to find out that the data used by Ptolemy required correction. He seems to have had no other guide: the Indian numerals are not found in his work, so that it is difficult to suppose that he derived any astronomy from that quarter.

He was the first who rejected the chords, and substituted sines in their place, and of this apparently trifling improvement we are reaping the fruits to this day: he also used versed sines and (though without seeing the full extent of their utility) tangents. He determined the obliquity of the ecliptic with the parallactic instrument as described by Ptolemy, in such manner that his observation, compared with those of our time, gives 0″·505 for the annual diminution of that element: our modern tables give it, at this time, 0″·475. His sines gave trigonometry, even in his own hands, quite a new appearance and a new power; and he had a much greater number of methods in spherical trigonometry than the Greeks. It is most likely that he invented these himself, for he distinctly intimates himself to be the first who abandoned the chords: the rules for finding the third side from two sides and the included angle, and the angles from the sides, must be attributed to him; with great simplifications in the doctrine of right-angled triangles. He determined the length of the tropical year, making it only 2m. 26s. too short; a result much more exact than that of Ptolemy. The same may be said of his determinations of the precession of the equinoxes, of the place of the solar apogee, and of the excentricity of the earth's orbit. Looking at his determinations of the two latter, and seeing that he does not infer that they are changeable elements, we are left to conclude that he attributed the difference between himself and Ptolemy to errors of observation. But as it is by the research of Albategnius that succeeding astronomers were able to infer the variability in question, and as the only reason for his not inferring it was his well-grounded want of confidence in Ptolemy's results, he has the merit of the discovery. Several writers have affirmed that he did announce it; but incorrectly. The changes which he made in the lunar theory of Ptolemy are slight; and in his planetary theory he has very little success. For a fuller account of his work, see Delambre, 'Hist. de l'Astron. Moyenne,' p. 10-62. This learned and excellent historian, who rarely lets an author go without stripping a few leaves from his crown, shows Albategnius to great advantage in comparison with Ptolemy as an observer, and with his European follower Regiomontanus as a theorist: and the subject of our article may fairly take rank as the greatest of the Arabic school, which forms the link between that of the Greeks and our own.

ALBENGA, *the Province of*, an administrative division of the Sardinian States, forming part of the Duchy of Genoa, is situated on the southern slope of the Maritime Alps, which here become blended with the Apennines, and it stretches along the coast of the Mediterranean for about 30 miles. Its greatest breadth is about 18 miles. It is bounded on the north-east by the province of Savona, on the south-west by that of Oneglia, and on the north by the province of Mondovi in Piedmont. The country is intersected by offsets of the Maritime Alps which run to the coast, and form narrow intervening valleys through which rush rapid torrents in times of rain. The only river that does not dry up in summer is the Arocia, which rising in the province of Oneglia on the southern slope of the high ridge on the opposite side of which the Tanaro has its sources, flows in a south-east direction through the long valley of La Pieve, receives a number of mountain torrents, and afterwards entering the plain of Albenga about four miles above its mouth assumes the name of Centa, and then joins the sea to the west of the town of Albenga. The basin of the Arocia contains about 250 square miles. Formerly the river flowed to the eastward of Albenga, where a Roman bridge is still seen of ten arches, the piers of which are now buried in sand. In seasons of heavy rains the Arocia or Centa used to overflow its banks and inundate the plain and the town of Albenga, until the Cavaliere Somis, not long since Intendente or governor of the province for the king of Sardinia, caused the river to be embanked above the town, which was thus secured from the floods. He also filled up with sea-sand the marshes near the coast, which in summer infected the atmosphere. The malaria fevers have now almost entirely disappeared from the territory of Albenga. The plain of Albenga, one of the few plains in the Genoese territory, is celebrated for its great fertility. It produces corn, hemp, wine, oil, and fruit. Oil is the staple product of the country, but the oil of this province is inferior to that of the provinces of Oneglia and San Remo. A great number of the inhabitants of the coast lead a seafaring life. The province of Albenga contains 53 communes and 57,500 inhabitants. Albenga, the head town of the province, situated in a plain about a mile from the sea-coast, is a bishop's see; it has several churches, some lofty towers, a grammar-school, and about 4300 inhabitants, who live chiefly by agriculture. A small octagonal Roman temple adorned with eight granite columns serves as a baptistery to the adjoining church of St. Michael. The town existed in the Roman times under the name of Albingaunum, and it belonged to the tribe of the Ligures Ingauni, who fought strenuously against the Romans, and were finally subdued by the Proconsul L. Æmilius Paulus, B.C. 181 (Livy, xl. 25-29). Albingaunum was the birthplace of T. Ælius Proculus, who assumed for a time the imperial title in Gaul, until he was defeated and killed by Probus. (F. Vopiscus, *Historia Augusta*.) Several Roman inscriptions and other remains are scattered about the town. In the middle ages, Albenga governed itself as a municipal town under the supremacy of Genoa. The other towns of the province are:—1, Alassio, a town on the coast, south-west of Albenga; it has a collegiate church, a communal college, and 6800 inhabitants, mostly addicted to seafaring pursuits. At the end of the last century there were seventy merchant-brigs belonging to this place; they are now reduced to twenty. Boats from Alassio carry on the tunny and herring fishery on the coast of Sardinia, and the tunny fishery on that of Tunis. It is chiefly from Alassio that the inland country of Piedmont is supplied with sea-fish, both fresh and pickled. The sailors from Alassio and the neighbouring town of Laigueglia (2000 inhabitants) are among the best and most trustworthy in the Mediterranean. Many of them emigrate to America, and especially to Buenos Ayres, whilst others have founded respectable mercantile houses in various parts of the Mediterranean. Under the old Genoese republic the seamen of Laigueglia were among the few who ventured to trade under their own flag, and to brave the Barbary pirates who infested the sea, and especially the coast of Genoa. 2, Loano, eastward of Albenga, a town of 3500 inhabitants, was once a fief of the Fieschi and afterwards of the Doria family. The atmosphere of Loano is considered unhealthy. Loano has several churches, one of which is reckoned handsome. The maritime population of the Genoese Riviera take an especial pride in their churches. The church of the village of Garlenda, near Albenga, has several first-rate paintings, among others a Madonna and Child by Domenichino, which the inhabitants have refused to sell for 20,000 francs. 3, Finale, the name of three small contiguous towns, distinguished as Final Marina, Final Pia, and Final Borgo, the united population of which amounts to above 6000 inhabitants. Final Marina has a handsome collegiate church designed by Bernino, a college for boarders under the direction of the Barnabite fathers, and a good gallery of paintings in the house of Raimondi. Final Borgo has a collegiate church adorned with paintings and sculptures, and with the mausoleum of Andrea del Carretto, last Marquis of Finale, and a college for boarders kept by the fathers Scolopi. The valley of Finale is rich in orange-trees, some of which are said to bear from four to five thousand oranges. Finale and its territory was for centuries a marquisate held by the family del Carretto, under the suzerainship, however often disputed, of Genoa. In the latter part of the sixteenth century dissensions broke out between the marquis and the people; the marquis was repeatedly expelled, and after his death his heir, Andrea del Carretto, sold his rights to the court of Spain, which had long coveted a harbour on this coast, in order to have a direct communication by sea with its dominions in Lombardy. Finale was taken possession of in 1602 by the Spaniards, who lavished large sums in fortifying the place. Unlike the other Italian subjects of Spain, the inhabitants of Finale enjoyed for a century considerable commercial and other advantages under their Spanish masters. After the war of the Spanish succession, the Duchy of Milan having fallen to the share of the Emperor Charles VI., that sovereign, having no further necessity for the possession of Finale, sold it to the Genoese for 1,200,000 crowns. The Genoese took possession of Finale, and began demolishing some of the castles which the Spaniards had raised. In 1743 the Empress Maria Theresa ceded to the king of Sardinia what she styled her rights upon Finale, with the proviso that the king was to reimburse the purchase-money to Genoa. This led to a rupture between Genoa and the Empress, which was followed by the forced occupation of Genoa by the Austrians, and its memorable deliverance through the bravery of the people in 1746.

(Bertolotti, *Viaggio nella Liguria Marittima*; Chabrol, *Statistique du Département de Montenotte*; Ruiz da Laguna, *Discorso del Derecho que tiene Su Magestad para fabricar Puerto en el Final*, Milan, 1633; Acinelli, *Storia di Genova*.)

ALBERTINELLI, MARIOTTO, one of the best of the early Florentine painters, was born at Florence about 1475. He was the pupil of Cosimo Roselli, but he became eventually the friend and imitator of Fra Bartolomeo, whom he assisted in some of his works. In tone Albertinelli equalled, if he did not excel, Fra Bartolomeo; there are three of his works in the gallery of the academy at Florence, one of which, the Annunciation of the Virgin, is a masterpiece in tone: he excelled for his period also in design, and some of his works are drawn in a style worthy of the best of the *Cinquecentisti*, as the Italians term the painters of the sixteenth century. He drew from the antiques in the garden of Lorenzo de' Medici. His masterpiece is considered the Visitation of

Elizabeth to the Virgin, in the imperial gallery of Florence; it contains however only the two saints, but beneath it is a predella in three compartments, illustrating in small figures the Annunciation, the Nativity, and the Presentation in the Temple: it has been engraved by V. della Bruna.

Albertinelli was of a very singular disposition, and of dissipated habits. At one time he forsook painting, having taken offence at some criticisms upon his works, and turned publican, an occupation however which he soon exchanged for his original profession. He painted several works in partnership with his friend Fra Bartolomeo, and when that painter joined the order of the Dominicans, Albertinelli completed his unfinished works; among which was the Last Judgment, for the cemetery of Santa Maria Nuova, which, says Vasari, many suppose to have been the entire work of Bartolomeo. Albertinelli was so much distressed at losing the society of Bartolomeo, when the latter turned monk, that his friends had much difficulty in preventing him from following his example. Vasari says that he died about 1520, aged 45, the victim of his own debaucheries. He had some distinguished scholars; the best was Visino, who, according to Vasari, died in Hungary: others were, Giuliano Bugiardini; Franciabigio; and Innocenzio da Imola.

Albertinelli painted in fresco in Florence, in Viterbo, and in Rome. Vasari mentions a very excellent portrait by him of the mother of Lorenzo de' Medici, Donna Alfonsina Orsini, daughter of Roberto Orsini, the constable of Naples. A picture in the Louvre by him is inscribed—'Maricocti Debertinellis Opus. Ano. Dom. M.D.VI.' In the chapter-house of the Carthusians at Florence, a crucifixion in fresco, with the same date, is marked 'Mariotti Florentini Opus.'

(Vasari, *Vite de' Pittori*, &c.)

ALCA'MENES, (Ἀλκαμένης) a celebrated ancient sculptor, and a native of Athens. He was the pupil of Phidias, and lived therefore in the middle of the fifth century B.C., and later. Phidias, Alcamenes, and Polycletus were the three greatest sculptors of ancient Greece; Alcamenes survived Phidias some time, as he was still living in the 95th Olympiad, according to Pausanias, about 400 B.C., for he made two colossal statues of Minerva and Hercules, to commemorate the victory of Thrasybulus over the thirty tyrants, which he dedicated in the temple of Hercules at Thebes: this victory took place in the second year of the 94th Olympiad, or 403 B.C.

Alcamenes was sculptor in marble and statuary in bronze: his most celebrated work was a Venus, known as the Venus ἐν Κήποις or in the gardens; it was in the temple of Venus Urania at Athens. In the dialogue of the Portraits, Lucian makes Polystratus term this statue the noblest of all the works of Alcamenes, and he takes from it the face and hands to contribute towards his ideal portrait of the beautiful Panthea, the daughter (according to Wieland's conjecture) of the imperial fiscal-procurator in Asia, and the concubine of the emperor Marcus Aurelius: she succeeded the Augusta or empress Faustina, but was herself only a concubine (in the Roman sense). Many other ancient writers speak of this statue. Pliny says that Phidias finished it; by which must be understood that he made a few alterations on the finished statue of Alcamenes, which, according to his riper judgment, it required: mere technical finishing is not the work of a great master.

In another statue of Venus, Alcamenes contended with his fellow-pupil Agoracritus of Paros, and the Athenian judges awarded the prize to Alcamenes, not because it was the better work, says Pliny, but because it was the work of their own citizen. Agoracritus was so much hurt at the decision, that he changed his statue into a Nemesis, and sold it to the people of Rhamnus, on condition that it should not be set up in Athens: and as the Rhamnusian Nemesis it was long celebrated as one of the most famous works of antiquity, and was preferred to all other statues whatever by Varro. The statements about this work are various: according to some, it was made by Phidias for Agoracritus; a report which may have been spread by the Rhamnusians to give the statue more value in the opinion of the world. Pausanias, who saw it at Rhamnus, speaks of it as the work of Phidias, and does not mention the name of Agoracritus.

Alcamenes contended also, according to Tzetzes, with Phidias: the subject was a statue of Minerva; and the work of Alcamenes was at first, on account of its higher finish and proportions, preferred to the work of his master, but when fixed in their destined places, the superiority of the statue of Phidias was evident; the latter gained effect, the former lost it. In this instance, Phidias gave Alcamenes a lesson, from which modern artists might derive a benefit. The great majority of the statues and works of sculpture in the modern churches or other buildings of Europe, appear to have been made without any allowances for either the elevation or the distance from the eye, of the destined locality of the work: that a work in which this principle is carried fully out is unfitted for any but a similar situation, is not a sufficient apology for its neglect, though it may satisfy the artist's vanity.

Another celebrated statue by Alcamenes was one of Dionysus, of ivory and gold, placed in a temple to that god in the part of Athens called Λίμναι, the part in which the sculptor is said to have been born. The sculptures also of the posterior pediment of the temple of Jupiter at Olympia, representing the fight of the Lapithae and the Centaurs, were by Alcamenes. Pausanias mentions besides at Athens, a statue of Mars in the temple of Mars; a triple-bodied statue of Hecate on the Acropolis, the first in that form; and statues of Procne and Itys, in the same place. There was also a Vulcan or Hephaestus at Athens, in which the lameness was expressed without destroying the beauty of the statue: it is noticed by Cicero and by Valerius Maximus. Pausanias mentions also an Aesculapius at Mantinea, and Pliny speaks of a bronze figure of a pentathlete, or victor in the pentathlon, or five athletic exercises, which was called *encrinomenos*; these five games were—leaping, running, the discus or quoit, throwing the javelin, and wrestling.

(Pliny, *Hist. Nat.* xxxvi. 5, xxxiv. 8; Lucian, *Imagines*, 4, 6, and the note in Wieland's translation; Pausanias, i. 8, 19, 20, 24, 33; v. 10; viii. 9; ix. 11; Cicero, *Nat. Deor.* i. 30; Valerius Maximus, viii. 11; Tzetzes, *Chil.* viii. 193; Winckelmann, *Werke*, vol. vi.; Thiersch, *Epoche der bildenden Kunst*, &c.)

ALCOHOL, *Medical Properties of.* These are of a twofold kind: first, those in which it is employed on account of its solvent powers, it being, next to water, the most extensively employed solvent, to obtain, preserve, or facilitate the administration of a variety of active principles, vegetable, mineral, or animal; and secondly, those in which its own powers over the human frame lead to its use as a therapeutic agent. The former have been already treated of [Tinctures, P. C., p. 477]; and it is only necessary to observe here, that, besides for these, it is employed in many pharmaceutical processes in which it does not ultimately appear, either for its solvent or precipitating properties, such as in the preparation of many of the alkaloids, viz. aconitina, strychnia, &c., which, though the most potent medicinal agents we possess, are greatly restricted in their application by the high price charged for them. This arises partly from the minute quantity in which they exist in their original sources, the plants which produce them; but far more from the high duty on alcohol, which places our practical chemists at a great disadvantage compared with those of France and Germany.

The therapeutic properties of alcohol are therefore the only properties to be noticed here; and it is by no means intended to discuss points which have excited keen controversies in reference to the employment of alcoholic stimulants as ordinary beverages, but simply that employment of them which is conceded to be allowable by all parties—their use as medicinal agents. Besides, as many who do not require them are, in accordance with the usages of society, in the habit of taking them, it is proper to indicate which are the least hurtful. The excessive use of ardent spirits is deservedly reprobated, and every reasoning person will gladly lend his aid to root out this almost national vice; the evil effects of which are not limited to the individual, as the physical ailments engendered by habitual drinking have a great tendency to become hereditary. The mental powers of the offspring are also greatly influenced by the habits of the parent; and diseases of the brain, with derangement of the intellectual faculties, are the consequence. The extension of education and the better tone of feeling in the higher classes have done something to banish inebriety from the upper circles of society; and a more correct understanding of what is for their true interests has abated it among the labouring classes. Furnishing the operatives with the means of rational and healthful recreation, both mental and bodily, after the hours of toil, will aid this fortunate revolution. The refreshment of a bath will be found greater, more lasting, and more economical for the workman, than any artificial stimulant, and has been advocated by themselves. [Schools, P. C., p. 501.]

It is proper however that the mode of action of alcohol should be understood, to determine when it should be used.

A single moderate dose, suitable for the individual, produces effects which are entirely limited to the viscera of the abdomen. They extend themselves from the solar plexus of nerves to the organs upon which the splanchnic nerve is distributed, and excite in these a livelier action. A feeling of comfort in the abdomen, quicker and more powerful digestion, stronger peristaltic motions, increased desire for meat and drink, more abundant secretion, especially augmented secretion from the kidneys, are the common phenomena which result from the lowest degree of its action. A larger quantity, or several small doses repeated at short intervals, extend the action beyond the sphere of the splachnic nerve, even to the spinal chord, the brain, and entire nervous system. The feeling of comfort and warmth experienced in the praecordial region is diffused over the whole frame. The pulse is raised, becomes more powerful and quicker, all muscular actions take place with more ease, strength, and capacity of endurance, the tone of the nervous system is raised, the influence of the nervous energy upon the other organs is quicker and more powerful; but, above all, that part of the nervous system whose functions are executed by the brain is most perceptibly increased, as is seen in the greater cheerfulness, humour, and courage, as well as the more active and acute power of thinking. During this degree of action the sensibility to external impressions is unimpaired, or in even many instances augmented, as is manifested by a more eager participation in the incidents occurring or sentiments expressed, and in the expansion of the affections or passions.

Contemporaneously with these, all the functions of organic life are carried on more actively; of which we have proof in the increased secretions, especially of the cutaneous transpiration and secretion of urine.

From this view it is obvious that alcohol is an agent which, within certain limits, may be most beneficially employed when some portion of the system, particularly the stomach, brain, or kidneys, requires assistance. Hence under the influence of many sedative poisons, alcohol furnishes the readiest and most potent means of counteracting their effects, the prolonged action of which would prove fatal. Some poisons however, particularly those of ranunculaceous plants, such as monkshood, probably from their active principle being dissolved by the spirit, have their deleterious influence increased by alcohol. In the sinking stage of fevers, and many analogous states, alcohol furnishes the only means of warding off death. In malarious districts and in very humid regions, a moderate use of alcoholic drinks protects the frame against injurious impressions. Hence in Holland, and even in fenny districts of our own country, alcohol is useful. When cold is conjoined to humidity, it is still more serviceable. The Swiss peasant at great elevations on the Alps, and the shepherd in the Highlands, set the mists of their mountains at defiance; the former by his 'enziangeist,' or 'bitter-snaps,' the latter with whiskey. Such persons are rarely intoxicated. Many persons with feeble and slow digestion have the process expedited by a small portion of alcohol taken after their meals. Those also who suffer much from acidity in the stomach, or who are prone to calculous disorders, find great benefit from pure alcohol, in preference to either malt liquors or wines. (Prout, *On Diseases of the Stomach*, 3rd edit. p. 9.) The difference between pure alcohol and alcohol combined with other principles in wines has already been pointed out. [Wines, P. C., p. 465.] With persons very prone to acidity pure alcohol agrees better than any wines, especially than the sweet wines; and those disposed to the lithic acid diathesis find alcohol preferable to all wines except those of the Rhine, the employment of which however must be habitual, not occasional. Immense benefits would be conferred on the community in this country, if they could be introduced at a moderate price, as the quantity of alcohol in them is very small compared with other wines.

A reference to the chemical composition of alcohol will show that it is a highly carbonized compound. When taken to excess it produces exhaustion of the nervous power and an oppression of the circulation, almost apoplectic. Emetics or the stomach-pump, vegetable acids given freely, occasionally dashing cold water on the face or head, artificial respiration, and very cautious venesection, in some instances restore the sufferer. Liebig says alcohol has not been detected in the urine. When the quantity taken is not excessive, and can be all exhaled by the lungs, this may be true; but the presence of alcohol in the brain, blood, and urine has been proved by Dr. Percy. (Dr. Golding Bird, in *Medical Gazette*, vol. xxiv. p. 690.)

ALDEGREVER, HEINRICH, a celebrated German painter and engraver of the sixteenth century, was born at Soest in Westphalia in 1502. He became the pupil of Albert Dürer, being attracted to Nürnberg by the great fame of that artist, and he imitated his style so closely that he acquired the name of Albert or Albrecht of Westphalia, a circumstance which has misled some writers to call him Albert Aldegrever. There can be no doubt of his name having been Heinrich or Henry, as it is so engraved in two different portraits both executed by himself. As a painter Aldegrever executed little, he was chiefly occupied in engraving his own designs. His plates are generally small, and are executed in a very minute and laboured manner, whence he is reckoned among the so-called little masters, of whom he is one of the most distinguished. His prints are very numerous, exceeding three hundred, and they bear dates between 1522 and 1562, which is supposed to have been the year of his death; it is however a mere conjecture. His designs are conspicuous for the sharp and angular lines of the Gothic style; but though hard and wiry, many of his figures display good anatomical drawing. His subjects are sacred and profane. Thirteen plates of the labours of Hercules are among his very best works: they are very scarce. A print of the Count D'Archambaud, just before his death, killing his son lest he should leave the paths of virtue for those of vice, is also a remarkably good plate. Among the portraits engraved by Aldegrever are those of —Luther, dated 1540; Melanchthon; John of Leyden, king of the Anabaptists; and the fanatic Bernard Knipperdolling. He engraved also many designs for silversmiths and for booksellers.

His paintings are in the same style of design as his engravings, but they impress, still more than his prints, with the feeling of the pains they cost him: his colouring is very high. In the gallery of Berlin there is a small picture of the Last Judgment by him; in the gallery of Munich there is an excellent portrait of a man with a red beard; there are a few of his works at Schleissheim, at Vienna, and at Nürnberg, and at Soest, in some churches.

In a print of Titus Manlius ordering the execution of his son, Aldegrever has introduced an instrument, very similar to the guillotine used by the terrorists of the French revolution: it is dated 1533.

(Heineken, *Dictionnaire des Artistes dont nous avons des Estampes*; Bartsch, *Peintre-Graveur*.)

ALETHO'PTERIS (Sternberg), a genus of fossil Ferns, mostly from the coal formation. (Pecopteris of Brongniart.)

ALFE'NUS VARUS, one of the Roman jurists whose excerpts are contained in the Digest. [Justinian's Legislation, P. C.] He was one of the most distinguished pupils of the great jurist Servius Sulpicius, the friend of Cicero. Pomponius (*Dig.* i. tit. 2) states that he became consul, and it is generally assumed that he is the P. Alphinius who was consul A.D. 2, and the same person as the P. Alfinius or Alfenus Varus of Dion Cassius (lib. lv. Index). But as Sulpicius, the master of Varus, was born about B.C. 106 and died B.C. 43, it is not probable that Alfenus the jurist could be consul so late as A.D. 2.

Acron the scholiast (Horatius, *Sat.* i. 3. v. 130) has a story that Alfenus was a shoemaker at Cremona, who came to Rome, where he became the pupil of Servius Sulpicius, and attained such distinction for his legal knowledge that he was made consul and had a public funeral. The passage of Horace and the remark of the scholiast have occasioned much discussion (Wieland, *Horazens Satiren übersetzt*, note on *Sat.* i. 3. v. 130; Heindorf, *Des Q. Horatius Satiren erklärt*). It is very difficult to form any conclusion from the passage of Horace, though it may perhaps be assumed that he does refer to the jurist Alfenus; but this will not determine whether the story of his early life as given by Acron and alluded to by Horace is true.

Alfenus wrote a work entitled 'Digesta,' in forty books. He is often cited by other jurists; the excerpts in the Digest show that his style was clear. Gellius (vi. 5) quotes a passage from the thirty-fourth book of the Digesta of Alfenus and the second book of the Collectanea, or Conjectanea, as it stands in some editions of Gellius; from which expression one might infer either that the Collectanea was a part of the Digesta of Alfenus, or a different work by Alfenus. But it is not an improbable conjecture that the Collectanea was the compilation of Aufidius Namusa (*Dig.* i. tit. 2) in one hundred and forty books, which he made out of the writings of eight of the pupils of Servius. If so, Gellius referred to the passage both in the original Digesta of Alfenus, and to the same passage in the Collectanea of Namusa.

ALGÆ, FOSSIL. The remains of sea-weeds in a fossil state are less common than their probable abundance in the antient ocean and the generally marine origin of the strata might have led to suppose. This arises perhaps from the cellular texture and destructible nature of the marine plants. Traces however of several genera occur in Silurian, carboniferous, liassic, oolitic, and later deposits.

ALGARDI, ALESSANDRO, an Italian sculptor and architect, chiefly distinguished however as a sculptor. He was the son of a silk-mercer of Bologna, where he was born about 1600, or even earlier, but the dates given by the various writers who have written notices of him are so contradictory, that it is impossible to give a preference with any degree of certainty. He entered the celebrated school of the Carracci, but finding that sculpture was more suitable to his taste than painting, he became the pupil of Giulio Cesare Conventi, a sculptor of celebrity in his day. At the age of twenty, says Bellori, he accompanied Gabrielle Bertazzuoli, the architect, to Mantua, and was introduced to the duke Ferdinand, with whom he apparently became a favourite, as he received many small commissions from him for models, and was afterwards sent by him to Rome with an introduction to the pope's nephew Cardinal Ludovisi: he arrived in Rome in 1625. The cardinal employed him chiefly in the restoration of antient statues; and he received some employment from the Roman jewellers. His first original productions in Rome were two statues in stucco, for the Capella Bondini in the church of San Silvestro on Monte Cavallo. He obtained these commissions through the intercession of his friend Domenichino: they were a John Baptist, and a Magdalen, and obtained for Algardi a considerable reputation; he had however still to depend upon the jewellers for support. His patron Ferdinand, duke of Mantua, died shortly after his arrival in Rome, he quarrelled with Domenichino, and for many years he had no other occupation as a sculptor than that of restoring antient fragments. But about 1640 his prospects changed; he was chosen by Pietro Buoncompagni to execute the statue of San Filippo Neri for the sacristy of the Padri dell' Oratorio of Rome; he made a group in marble of two colossal figures, the saint, and an angel kneeling by his side presenting him a book; and he displayed so much judgment and taste in working the marble, that he raised himself to an equality with the most favoured of his contemporaries; and the Cardinal Bernardino Spada, in consequence of the success of this group, gave him a commission to execute a colossal group in marble of two figures representing the decapitation of St. Paul, for the church of the Padri Bernabiti at Bologna. St. Paul was represented kneeling, with his hands bound together before him; the executioner, entirely naked, was behind the saint, with his sword raised ready to strike. The success of this group was complete; it is technically a work of very great excellence, but in the attitudes it is forced or affected; it however established for Algardi the reputation of the greatest sculptor of his age. He now produced many works in rapid succession, chiefly in metal, both for Bologna and Rome. The principal of these were the monument of Leo XI. in Saint Peter's, and Attila checked by Saint Leo, an alto rilievo of enormous size, for one of the altars of the same church.

Algardi's better fortune commenced after the accession of Innocent X. in 1644, whose niece Costanza Panfili was married to Algardi's friend and patron, prince Nicolo Ludovisi, the nephew of Gregory XV., and himself a Bolognese. Don Camillo Panfili, another of the pope's nephews, entrusted to Algardi the erection of a villa without the gate of San Pancrazio, now well known as the Villa Panfili. As an architectural design it is a work of little merit, though it is Algardi's most successful effort in architecture: it is richly ornamented with sculpture.

Algardi executed also the bronze statue of Innocent X. which was decreed by the Roman people or senate in consideration of his having completed the Capitol. Innocent built the north-east wing, or Nuovo Palazzo de' Conservatori. The senate had voted the execution of the work to Francesco Mochi: why it was not executed by Mochi does not appear; Innocent probably interfered in Algardi's favour. The first casting failed; the second however was completely successful. Innocent is represented sitting, giving the papal benediction, and is placed in that part of the Capitol which was built by him. When the statue was completed, the pope was so well satisfied with it that he placed with his own hands a cross and chain of gold upon Algardi's neck, and created him a Cavaliere dell' Abito di Cristo.

The Attila, or La Fuga d'Attila, as it is called, is the largest alto rilievo in the world; the two principal figures of St. Leo and Attila are about 10 feet high. The design contains many other figures, and is treated pictorially, which treatment however involves many disagreeable effects, as the parts in high relief cast their shadows upon those in low relief, which are intended to be at a greater distance from the spectator, and destroy their effect entirely; the high light also of the principal figures coming in immediate contrast with their deep shadows, gives an insignificant and mottled effect to the accessory parts. In addition to these objections, there is another still more detrimental to pictorial effect, that is, the fact of the shadows being vertical as well as horizontal, for they fall upon the ground to which the figures are attached, as well as upon that on which they stand. This alto rilievo however, which is in marble, is of itself a work of great merit, though it may not deserve all the praises it has obtained; nor perhaps, on the other hand, is all the censure it has received merited: Count Cicognara has severely criticized it.

Algardi received for it 10,000 scudi, a sum probably equivalent at that time to 5000*l.* sterling now, and more than two hundred times as much as his old friend Domenichino received a few years before for his Communion of St. Jerome, one of the finest pictures in Rome. The rilievo was executed in great part by Domenico Guidi of Naples, and was finished in 1650.

Algardi died of a fever in 1654. His biographers speak of his character as generally good, though when he became rich he became also avaricious; he was never married, and in his youth he was very dissipated. The bulk of his property was inherited by a sister, whose marriage against Algardi's consent was partly or perhaps chiefly the cause of his death. Algardi's reputation is nearly exclusively that of a sculptor, and as such he ranks amongst the greatest of the moderns. His design is vigorous and natural, and his draperies are well studied; but his style, when compared with the antique, is somewhat vulgar and affected. He excelled in representing infants. His architectural designs, of which there are not many, are purely ornamental; the design itself is subservient to its ornaments; they want mass and feature.

(Passeri, *Vite de' Pittori*, &c.; Bellori, *Vite de' Pittori*, &c.; Cicognara, *Storia della Scultura*; Milizia, *Opere*.)

ALGEBRA. In the article on Algebra, P. C., we did not enter on the details of the science, in conformity with the plan of the work, which was to avoid methodical treatises on the great branches of human knowledge. Instead of attempting to make our work of reference supply the place of a school-book, we preferred to give those to whom the common elementary work was unnecessary some of the notions which were gradually enlarging the boundary of the science, and assisting, beyond what was once imagined possible, in clearing the difficulties which it presented to reflecting minds. No elementary work had been written on the subject of pure algebra, in its completely explicable form, except those, as Mr. Warren's, which rather belong to the state of transition than to that of complete development—or, as Dr. Peacock's,* which so far belong to the state of transition as to require Interpretation in explaining the meanings of some important symbols. In giving our readers from time to time such detached portions of the subject as are contained in Negative and Impossible Quantities, Operation, Relation, Interpretation, Sign, Root, in P. C., and a few others of less immediate connexion with the subject, we hardly hoped that the publication of any supplement could happen late enough to enable us to present the heads of a complete system, in which the previous explanation of every symbol is so general as to render subsequent interpretation, or collection of necessary meaning from deduced properties, altogether unnecessary. Still less did we imagine that, in our time, algebraists, sick of a system which has hardly any difficulties of principle left, would strive† to invent new systems to examine, and new symbols to interpret. Had there been any such hope, the articles in question might have assumed a different form. As it is, the best thing which can be done is to exhibit, under distinct heads of enunciation, the steps of the transition from common arithmetic to the complete *double algebra*, as it may be called, the subject matter of which is capable of representation in space of two dimensions. It is not within our limits to demonstrate every one of these heads; but much has been done in the articles already cited, and by dwelling a little upon the parts which are completely new (as far as this work is concerned), it is probable that the reader who has mastered those articles will be able to supply what is wanting for himself.

---

* We speak of the first edition: the second volume of the second edition is not (Dec. 1844) yet published, and the first refers only to arithmetical algebra. We regret not having seen this second volume before writing the present article.

† As Sir W. Hamilton, in his system of *Quaternions* (*Trans. Roy. Irish Acad.*, Nov. 1843, and *Phil. Mag.* 1844), the author of this article, in a paper on what he calls *triple algebra* (recently read before the Cambridge Philosophical Society), and perhaps others who have not yet promulgated their views.

1. In *pure arithmetic* the subject matter is simple number. Its symbols are 0, implying the absence of all number; 1 or unity; 2, the abbreviation of $1+1$; 3, that of $1+1+1$, &c. Also the symbols $+ - \times \div$ and those of powers and roots. All these symbols have specific meanings, and the symbols of operation are connected with known operations. There are also *general* symbols of number, a, b, c, &c., definite, but not specific, that is, each one stands for a definite number, known or unknown, throughout any one train of thought, though it need not represent the same number in all investigations.

2. The fundamental direct symbols of operation, seen in $a+b$, ab or $a\times b$, a^b, are connected with inverse operations, seen in $a-b$, $\frac{a}{b}$ or $a\div b$, $\sqrt[b]{a}$ or $a^{\frac{1}{b}}$. Each inverse operation offers certain difficulties: those of $a\div b$ are overcome by the introduction of the notion of fractions; those of $\sqrt[b]{a}$ by the considerations in LIMIT, P. C., applied to what is called the approximate extraction of roots. But $a-b$ presents cases of absolute impossibility, as in $3-7$; and this impossibility is incapable of being removed as long as the symbols are the symbols of pure arithmetic.

3. The rules by which operations of pure arithmetic are performed are found to be capable of classification under five heads: no step in any train of thought leads to anything but the use of one of these five simple rules, or of complex rules obtained by their combination. Of course these rules are understood as applied only when they give intelligible results.

I. *Rule of signs.*—Whenever two of the signs $+$ and $-$ both act upon any symbol, the result is that like signs give $+$, unlike signs give $-$.

II. *Convertibility of additions and subtractions*, as in $a+b-c=a-b+c=c+a-b$, &c.

III. *Convertibility of multiplications and divisions*, as in $\frac{a}{b}\times c=\frac{a\times c}{b}$, &c.

IV. *Distributiveness of multiplications and divisions*, as in $a(b+c-d)=ab+ac-ad$, and $\frac{c+d}{a}=\frac{c}{a}+\frac{d}{a}$.

V. *Rules of exponents.*—These are $a^b\times a^c=a^{b+c}$, $a^b\div a^c=a^{b-c}$, $a^b c^b=(ac)^b$, and $(a^b)^c=a^{bc}$.

Every master of the use of these rules can perform all the steps of an arithmetical operation, including all that is commonly called algebraical, but provided that no steps enter except those which are arithmetically intelligible. Even the common rules of computation, so far as they are not acts of mere memory or trial, consist in uses of the first four rules.

4. On examining problems into which the impossible subtraction enters, whether in process or result, whether from inconsistency in the problem or in the mode of solving it, the impossibility is always to be traced to a diametrically wrong sense put upon the meaning of some one quantity, as reading gain for loss, or ascent for descent, &c. And since the impossible subtraction can always be reduced to the form $0-a$, or $-a$ (thus $3-7$ is $3-3-4$, or -4), and since this is found always to require, as a correction, that a units should be taken of the sort *diametrically opposite to what was supposed when $0-a$ was being found*, it suggests itself to let $+1$ and -1 mean, not merely the addition and subtraction of 1, but any two opposite kinds of units whatever [NEGATIVE, &c., P. C.; SIGN, P. C.], addition and subtraction being only one of the infinite number of opposite meanings which may be signified.

5. Extensive induction shows [SIGN, P. C.] not only that the five rules remain true when the last augmentation of meaning is adopted, but that the want of symbolic distinction between the different meanings of $+$ and $-$ is of no consequence whatever. Complete opposition of character in $+$ and $-$ is all that is necessary to the permanence of the rules; and $+1$ may stand in the same problem for a unit of gain, a unit of ascent, a unit of future time, a unit of addition, &c.; while -1 stands for a unit of loss, a unit of descent, a unit of past time, a unit of subtraction, &c.

6. The algebra thus established, having all the processes of pure arithmetic, *and no more*, and completely containing pure arithmetic within its range of subjects (for $+1$ and -1 mean addition and subtraction of 1, as well as other things), may be called *single algebra*. Space of one dimension (length) is, so to speak, wide enough for it: if $+1$ signify a unit measured in one direction upon a straight line from a given point, then -1 signifies a unit measured in the opposite direction. Every positive and negative quantity may find its interpretation in this line.

7. On proceeding to ulterior results, it is found that the extension of meaning which is sufficient to admit such symbols as $3-7$ or $0-4$ within the range of intelligible quantities will not do the same for their roots of the second, or fourth, or any even order. Thus, even in the complete single algebra, $\sqrt{-1}$, $\sqrt[4]{-1}$, &c. are as void of meaning as $4-7$ in pure arithmetic: they are not positive quantities; they are not negative quantities; and there are no other sorts. Under the name of *impossible quantities* they were long used without being understood, because they were found to lead to true results. Some defended them on different theories, but the sentiment of Professor Woodhouse must have been the one which guided the class of mathematicians who think on first principles: 'since they lead to true results, they *must have a logic.*' The question was to find that logic: and till it was found, a great part of algebra was *art*, not *science*.

8. Since it has appeared that extension of meaning has succeeded in clearing away one class of difficulties, the means of removing the rest must probably be sought in further extension; but it will give a better idea of the subject to begin by throwing away all meanings, treating the symbols as symbols only, subject to certain five rules of operation. Let the only symbol which retains its meaning be $=$, denoting the identity of what precedes with what follows. We then stand thus:—Let it be granted that there are certain symbols, 0, 1, a, b, c, &c., and symbols of connexion, $+ - \times \div a^b$ (we cannot here dispense with the letters, since the symbol consists in the manner of placing the letters): let $0+a$ and a be synonymes, and also $0-a$ and $-a$, and $1\times a$ and a, and $a\div 1$ and a: let $1+1$ be abbreviated into 2, $2+1$ into 3, &c.: let $+a-a$ be 0, and let $\times a\div a$ be equivalent to $\times 1$: let the five rules in § 3 be perfectly and universally true, and let a, b, &c. be competent to represent (among other things, perhaps) 0, 1, 2, &c., or any formations from them or from one another. Let no idea of meaning be attached, for the present, to any symbol or to any of the words by which operations are described. Required all manner of methods of forming symbols which must be considered as identical. The collection of such methods is *symbolical algebra*, nothing but symbols and prescribed laws of use. For instance, required a necessary transformation for $(a+b)(c+d)$. By the fourth rule this is $(a+b)c+(a+b)d$, which, by the third rule, is $c(a+b)+d(a+b)$, which again, by the fourth rule, is $ac+bc+(ad+db)$, or $ac+bc+(+ad)+(+db)$, which, by the first rule, is $ac+bc+ad+db$. This symbolical algebra is not a science, but an art: it may be illustrated as follows:—Suppose a person to join the pieces of a boy's dissected map by the backs, without looking at the countries engraved on the fronts: he is then going through the dead and (by itself) uninstructive process of symbolical algebra; the pieces are his symbols, the forms of the edges are his rules for guidance. But another, who turns the map the right way, and puts the countries which he knows into their right places at once, and helps himself to the position of those which he does not know by trying to fit edges together, is going through the improving process of geographical acquirement, which corresponds to an algebra with meanings attached to the symbols. Symbolical algebras may be invented without end: how many of them would be worth anything for the value of their possible systems of meaning, is another question. We avowedly make a retrograde step when we introduce symbolical algebra; we throw away the arithmetic and single algebra which suggested the symbols and their rules, and retain for the moment only the unmeaning symbols and their laws of combination.

9. The next step is, given the symbols, rules, and consequent trains of legitimate transformation, of a system of symbolic algebra, how many and what systems of meanings may be attached to the symbols, so that all the fundamental rules may be true of those meanings, and all the symbolic identities which follow from those rules may be necessary consequences,

also with intelligible meanings. Every such system of meanings, superadded to the symbolical algebra, is a *logical algebra*, or one in which every process of transformation is a reasoning or a collection of reasonings. In all probability there is an infinite number of logical algebras to every self-consistent system of symbolical algebra: we merely note down the list of those which have hitherto been traced from the ordinary system, originally suggested by arithmetic.

I. *Pure arithmetic*, in which the subject matter is number. II. *Single algebra*, in which the symbols represent numbers derived from concrete magnitude, considered as being, in every case, of one or another of two diametrically opposite kinds. III. *Double algebra*, the main subject of this article, in which each symbol represents a line of definite length, and in some definite direction out of the infinite number which may be taken *in one plane*. IV. *Triple and quadruple** *algebra*, in which the directions are not confined to one plane (this subject is in its earliest infancy). V. The *geometry* of the second book of Euclid, and the corresponding solid geometry. Here AB actually means the area of the rectangle under the lines A and B, and ABC the content of the rectangular parallelopiped (or right solid) under the lines A, B, and C: the fundamental rules can be demonstrated, and propositions can rigorously be proved. The ordinary and incomplete mode of demonstrating the second book of Euclid might thus be rendered unobjectionable. VI. The *calculus of operations*, in which the symbols, or as many of them as we choose, are *not magnitudes at all*, but directions to perform certain operations on a variable quantity. [Operation, P. C.]

10. It does not follow that every species of logical algebra admits of explanation for every symbol or combination of symbols. Thus I. just mentioned rejects $0-1$; II. rejects $\sqrt{-1}$; III. is perfect; and IV. may perhaps be made so: in V., $AB+C$ means no more than AB, if it have meaning, and A^B is wholly inexplicable; and VI. is encumbered with difficulties of new and serious kinds as soon as its elements are passed. It may happen that the proper meaning of a symbol or formula cannot be assigned at the commencement of a logical algebra, but can afterwards be deduced from its symbolic consequences. When this is the case, the deduced meaning must not disturb any one of the five rules. This process is the *interpretation* to which we have alluded, and symbols of which the meaning is laid down from the commencement may be said to be *explained*.

11. It is impossible that a perfect algebra can be founded on ideas of time, loss and gain, or any in which only two directions can be imagined. Space, from the infinity of directions which it admits, is, as yet, the only perfect medium of explanation. Time before and time after a certain epoch may be represented by the positive and negative quantity, but what is there in the idea of time to which $\sqrt{-1}$ can possibly apply? Again, show us a commercial operation which, performed upon a gain, produces a sort of result which can neither be called gain nor loss, but which repeated *two* or more times upon a gain, turns it into a loss—and we can immediately construct a system of commercial algebra, in which $\sqrt{-1}$ shall be intelligible. But, as yet, the necessary ideas are found in geometry only, which causes some persons to object to the extension of algebra. But these surely forget that even common single algebra must derive its theory of oppositions from concrete quantity; -1, standing alone, is unintelligible in the science of pure number.

12. Remark the manner in which [Relation, P. C.] the definitions of $a+b$ and ab can be given, even in arithmetic, in terms of process, without mention of subject-matter: $a+b$ requires us to proceed from a as we proceed from 0 to form b; ab requires us to proceed with a as we should with 1 to form b.

13. Let the common symbol of algebra signify a length in a direction in a certain plane, change either of length or direction demanding change of symbol. Take a point O for the *zero point* or *origin*, and let 0 signify that we do not leave that point. From O draw any line at pleasure for the *axis of length*, and take a length OU upon it for 1: continue the unit axis both ways. Draw a perpendicular through O to the axis of length, and call it the *axis of direction*: the reasons for these terms will appear in the sequel.

14. Let $A+B$ denote the distance and direction from the origin which is gained by going over first A and then B; and let $A-B$ denote that gained by going over first A and then a line equal and contrary in direction to B. Let AB denote a line whose length has units equal to the product of the units in the lengths of A and B, and the sum of the angles which they make with the unit line for the angle it makes with the unit line. Similarly, let $A \div B$ have the quotient of the lengths of A and B for its length and the difference of the angles for its angle. These definitions are fully explained in Negative, &c., P.C., and Relation, P.C.

15. From the last it appears as an actual consequence of definition, that $-A$ means simply a line equal and opposite to A: and also that $+1+1$ or $+2$ can mean nothing but 2 units extended on the unit-side of the axis of length, and so on; while -2 means 2 units extended on the opposite side of the axis of length. It also appears that $A+B$ and $A-B$ are the operations of single algebra whenever the two lines are in the same direction. And if all lines be on the axis of length, all the four operations are those of single algebra: while, if they be all on the unit-side of the axis of length, there is nothing but pure arithmetic; except when an impossible subtraction obliges us either to reject the process, or to enlarge the definition and pass to the opposite side of the axis of length.

16. Make a positive and negative direction on the axis of direction, thus: Choose a direction of revolution in which a line revolving round the origin, and setting out from the axis of length shall be said to revolve positively. Let the unit revolve positively, and let the first side of the axis of direction which it meets be considered the positive side of that axis. Let the opposite direction of revolution be called negative. But if any difficulty arise about the use of negative angles, remember that this is merely matter of convenience, and can as well be dispensed with. Four right angles may be added to any angle of direction, without altering the direction indicated: and it is perfectly indifferent whether we speak of $-160°$ in the negative direction, or $+200°$ in the positive direction.

17. By $A=(a, \alpha)$, let us agree to mean that A signifies a line of a units of length, inclined at an angle α to the positive side of the axis of length. Use the theoretical mode [Angle, P. C.] of measuring angles. Then (a, α), $(a, \alpha \pm 2\pi)$, $(a, \alpha \pm 4\pi)$, &c., are all representations of the same line A. The peculiar symbols of the new algebra, as long as they are wanted, shall be capital letters; small letters denoting the symbols of the single algebra.

18. The first four of the fundamental rules in § 3 may be easily shown to be true. The geometrical propositions principally required are two. First, that any number of lengths being given and their directions, if we set off from a point through those lengths and in those directions, one after the other, we reach one and the same point in whatever order the lines of progress are taken. Secondly, that if any polygon revolve about one of its angular points, while at the same time the sides and diagonals which meet in that point are all changed in the same ratio, the figure always remains similar to what it was at the outset. With these propositions and the following—

$$(a, \alpha) \times (b, \beta) = (ab, \alpha+\beta) \qquad \frac{(a, \alpha)}{(b, \beta)} = \left(\frac{a}{b}, \alpha-\beta\right),$$

which are merely expressions of the definitions, there will not be much difficulty in establishing the first four of the rules.

19. Let the square, cube, fourth power, &c. of A, as yet, be denoted in full by AA, AAA, AAAA, &c., and their corresponding roots by $\sqrt{A}$, $\sqrt[3]{A}$, $\sqrt[4]{A}$, &c. There is then no difficulty in establishing, as in Negative, &c., P [illegible] that the mth power of the nth root of (a, α) is derived from

$$\left(\sqrt[n]{a^m}, \frac{m\alpha \pm 2k\pi}{n}\right).$$

k being any integer; that $\sqrt[n]{A}$ has n values and no more; that $\sqrt{-1}$ stands for a unit on one side (say on the positive side) of the axis of direction, and $-\sqrt{-1}$ for a unit on the negative side. Also, as in the article cited, that, if p and q be the projections of A, on the axis of length and direction, that A is identical in meaning with $p+q\sqrt{-1}$ and with $a\,(\cos \alpha + \sin \alpha \,.\, \sqrt{-1})$. Indeed, at this point it will be advisable for the student to review the imperfect system in Negative, P. C., &c., only reading exponents as is done just above, powers at full length, roots with the old radical sign.

20. Why do we not hitherto admit the exponent, and define A^2 to mean AA, &c.? Because we are not prepared with a definition which will include *all* exponents. In the article just cited, we get the meaning of $\varepsilon^{\theta\sqrt{-1}}$ by inter-

---

* By the quadruple algebra we mean Sir W. Hamilton's *quaternions*, which we call quadruple because its author calls it so; but inasmuch as it finds its complete interpretation in space of three dimensions, we consider it as *triple*. Its symbolic rules are not altogether those of ordinary algebra.

pretation, and it seems only a sort of accident that it should have an intelligible meaning. In order to provide beforehand a complete definition of the exponent, which shall make $(a+b\sqrt{-1})^{c+d\sqrt{-1}}$ as fully explained as any other symbol, *ab initio*, we must premise knowledge of the arithmetical theory of Naperian LOGARITHMS, P. C., and must lay down the definition of a line which answers to, and performs all the functions of, a *logarithm*. But as it is inconvenient to retain this name, let us substitute for it the word *logometer*, reserving the word *logarithm* for arithmetical use. By λA, the logometer of A or (a, α), is meant a line of which the projections on the axes[*] of length and direction are $\log a$ and α; a line, in fact, of the length $\sqrt{(\log^2 a+\alpha^2)}$ inclined to the unit-line at an angle whose tangent is $\alpha \div \log a$. Conversely, the line whose logometer is B or (b, β) has $b\cos\beta$ for the logarithm of its length, and $b\sin\beta$ for the angle (number of theoretical units in the angle). Every line has an infinite number of logometers: for the angle α may be read as $\alpha \pm 2m\pi$, where m is any integer; and thus we have an infinite number of logometers, hypothenuses to a set of right-angled triangles, whose common base is $\log a$ on the axis of length. But no logometer belongs to more than one primitive line.

21. The logometer has the fundamental properties of a logarithm: thus $\lambda A+\lambda B=\lambda(AB)$, meaning that any logometer of A added (bear in mind the extended meaning of all terms of operation) to any logometer of B gives one of the logometers of AB. We shall endeavour to give short heads of demonstration to this and the following propositions:—It is readily shown that the projections of two lines on either axis must be added (with their proper signs) to give the projection of the sum. Now in $\lambda A+\lambda B$, the sums of the projections are $\log a+\log b$ and $\alpha+\beta$: but the projections of $\lambda(AB)$ or $\lambda(ab, \alpha+\beta)$ are by definition $\log(ab)$ and $\alpha+\beta$; whence the proposition follows.

22. Denoting by ε, as usual, the base of Napier's logarithms, it is easy to see that $(\varepsilon, 0)$ has the simple unit line for one of its logometers, or $(1, 0)$, or 1; also that $\theta\sqrt{-1}$ is one of the logometers of a unit of length inclined at the angle θ, or of $(1, \theta)$, or of $\cos\theta+\sin\theta\,.\,\sqrt{-1}$.

23. Now let A^{B} be defined to mean the line which has for one of its logometers B multiplied into any one of the logometers of A: accordingly A^{B} has as many meanings as we can derive different lines by this process from the different logometers of A. And we shall show, first, that the fundamental rules are satisfied by this definition; secondly, that whenever B means a length of b units *in the axis of length*, the symbol A^{B} is exactly the A^{b} of common algebra. It is sufficiently obvious that A^{B} has meaning or meanings for all possible assigned lengths and directions of A and B.

24. Since ε^{A} means the line where logometer is $A\lambda\varepsilon$ or A, it follows that $\varepsilon^{\lambda A}$ is the same as A. Hence $\varepsilon^{B\lambda A}$ is the same as A^{B}, the line whose logometer is $B\lambda A$.

25. The sum of $B\lambda A$ and $C\lambda A$ (the logometers of A^{B} and A^{C}) is $(B+C)\lambda A$, which is, by definition, the logometer of A^{B+C}. Hence A^{B+C} and $A^{B}.A^{C}$, having the same logometers, are identical. Again, $A^{B}\,C^{B}$ has for its logometer $B\lambda A+B\lambda C$ or $B\lambda(AC)$, which is also the logometer of $(AC)^{B}$: hence $A^{B}\,C^{B}$ and $(AC)^{B}$ are identical. Thirdly, the logometer of $(A^{B})^{C}$ is $C\times\lambda\,(A^{B})$ or $C\times B\times\lambda A$, which is also the logometer of A^{BC}: hence $\left(A^{B}\right)^{C}$ and A^{BC} are identical. Consequently the fifth fundamental rule is true of A^{B} as here defined.

26. Let B be a line on the axis of length, represented by $(b, 0)$ or (b, π) according as it is positive or negative. Then $B\lambda A$ is made simply by multiplying the length of λA by b, and leaving it otherwise unaltered in the first case, or turning it through two right angles in the second. In the first case the projections of $B\lambda A$ are b times those of λA, in the second they have also their signs changed. In the first case then $b\log a$ and $b\alpha$ are the projections of the logometer of A^{B}, or A^{B} is $\left(a^{b}, b\alpha\right)$, agreeing with A^{b} in common algebra: in the second case A^{B} is $\left(a^{-b}, -b\alpha\right)$, agreeing with A^{-b}.

27. The meaning of $\varepsilon^{\theta\sqrt{-1}}$ is the line whose logometer is $\theta\sqrt{-1}\times\log(\varepsilon, 0)$, or $\theta\sqrt{-1}$. This line is $(1, \theta)$, or $\cos\theta+\sin\theta\,.\,\sqrt{-1}$, whence the equation

$$\varepsilon^{\theta\sqrt{-1}}=\cos\theta+\sin\theta\,.\,\sqrt{-1}\;\ldots\ldots\;(\theta)$$

is a necessary consequence of the various trains of definition. Now as all we know of these trains of definition is that the meanings of the symbols satisfy the five rules in § 3, it may seem to be too much that so remarkable an equation as the last should be actually involved in the definitions, instead of being the result of a long sequence of reasonings. And in truth it is too much in one point: for since all our preceding reasoning on the subject of A^{B} would apply equally to any base we might choose for logarithms, and any unit for measuring angles, what have we done but prove the preceding equation true for any base and any angular unit? And we reply that so far as the definition of A^{B} is concerned, our proof is perfectly general: bnt that, on looking back, we find a restrictive connexion between the logarithmic base and the angular unit, as follows:—It is very easy to see that in our prior definitions, the equation

$$\{(1, \theta)\,.\,(1, \theta)\,.\,(1, \theta)\ldots(m \text{ times})\}=(1, m\theta)$$

leads to the following

$$\{\cos\theta+\sin\theta\,.\,\sqrt{-1}\}^{m}=\cos m\theta+\sin m\theta\,.\,\sqrt{-1}$$

in which we may use m as an exponent, since for the simple integer, representing a line in the axis of length, the definition in § 23 gives $A^{m}=AAA\ldots(m \text{ times})$. Let θ be the angular unit; then we have

$$(\cos 1+\sin 1\,.\,\sqrt{-1})^{m}=\cos m+\sin m\,.\,\sqrt{-1}.$$

But the last is $\varepsilon^{m\sqrt{-1}}$, if we introduce the complete exponent from § 23; therefore it must be an equation of connexion between ε and the mode of assigning angle 1, that

$$\varepsilon^{m\sqrt{-1}} \text{ should be } (\cos 1+\sin 1\,.\,\sqrt{-1})^{m}$$

for all integer values of m: and this not merely from equation (θ), but from comparison of what $\cos 1+\sin 1\,.\,\sqrt{-1}$ must mean in the definitions prior to that of the exponent, with the complete exponential meaning of $\varepsilon^{\sqrt{-1}}$. Hence we must have ε, the base of the logarithms, connected with the angular unit by the equation

$$\varepsilon^{\sqrt{-1}}=\cos 1+\sin 1\,.\,\sqrt{-1}$$

and any base and angular unit which satisfy this condition will do. The most simple way of doing this is to take $\varepsilon=2{\cdot}71828\ldots$ as usual, and the angular unit such that there shall be π or $3{\cdot}14159\ldots.$ units in two right angles: but if any one should prefer $\sqrt[n]{(2{\cdot}71828\ldots)}$ for a base, and $n\times 3{\cdot}14159\ldots$ for the number of units in two right angles, he might get into trouble, but not into error.

28. Another difficulty, of the sort which arises when the result seems above the means employed in the demonstration, is that we have a complete system of trigonometry ready for demonstration by mere algebraical mechanism, without casting a further thought on the meaning of the symbols $\cos\theta$ and $\sin\theta$, or more on those of $\tan\theta$, $\cot\theta$, $\sec\theta$, $\operatorname{cosec}\theta$, than to make them, by definition, severally mean, $\sin\theta\div\cos\theta$, $\cos\theta\div\sin\theta$, $1\div\cos\theta$, and $1\div\sin\theta$. All we have done with $\cos\theta$ and $\sin\theta$ is to take them into our system as expressing the numerical values of the projections of a unit inclined at the angle θ upon the axes of length and direction. We have not even directly used $\sin^2\theta+\cos^2\theta=1$. But it should be remembered, that in proving generally $A\,(B+C)=AB+AC$, we have used the property of *similar figures*, an assumption which is quite sufficient to be the basis of the demonstration of Euclid I. 47, on which $\sin^2\theta+\cos^2\theta=1$ depends. And those who attentively read Euclid see that he does, in the sixth book, prove I. 47 over again, without any use of it, in showing that all similar figures described on the three sides of a right-angled triangle have the two smaller together equal to the greater. [HYPOTHENUSE, P. C.]

In the above definition of $\sin\theta$ and $\cos\theta$ it is clear that $\cos(-\theta)=\cos\theta$ and $\sin(-\theta)=-\sin\theta$, whence the first of the following, being universally true, gives the second:

$$\varepsilon^{\theta\sqrt{-1}}=\cos\theta+\sin\theta\,.\,\sqrt{-1}$$
$$\varepsilon^{-\theta\sqrt{-1}}=\cos\theta-\sin\theta\,.\,\sqrt{-1}$$

---

[*] Any two perpendicular lines would do; but to choose any other except the axis of length and direction would be a step precisely equivalent to preferring some other base to the Naperian in the logarithms of common algebra

Whence we have

$$(\cos\theta + \sin\theta\sqrt{-1})\,(\cos\theta - \sin\theta\,.\,\sqrt{-1}) = \varepsilon^{0}$$

Now ε^{0}, by definition, has $0\times\lambda\varepsilon$, or 0×1, or 0, for its logometer, and is therefore (1, 0) or 1. And the first side is, by common application of rules, $\cos^2\theta + \sin^2\theta$. If any one, instead of merely applying rules to the equation

$$(\cos\theta + \sin\theta\,.\,\sqrt{-1})\,(\cos\theta - \sin\theta\,.\,\sqrt{-1}) = 1,$$

should proceed to demonstrate the rules upon this instance, he would, in a circuitous way, be led to a perfect geometrical demonstration of $\sin^2\theta + \cos^2\theta = 1$.

29. No equation of this system, which hitherto admits of expression, presents any difficulty as to the meaning of its sides, or any combination of symbols for which the meaning is to be found by interpretation. Perhaps one of the most remarkable results of the antient system of algebra is the equation

$$\pi = \frac{\log(-1)}{\sqrt{-1}}$$

Some algebraical writers have stated that -1 has neither square root nor logarithm, and without further warning have afterwards made the non-existent logarithm, divided by the non-existent square root, give the ratio of the circumference of a circle to its diameter. Others have given fair warning that, in using what they called imaginary quantities, they were appealing, more or less, to experience; seeing that operations so conducted always led to truth, when, by the ultimate disappearance of $\sqrt{-1}$, the result could be interpreted, they were content to use such an equation as $\pi\sqrt{-1} = \log(-1)$ as an instrument of which the power was known, though its mechanism was concealed. In the complete system it is visibly obvious that $\pi\sqrt{-1}$ is *one* of the logometers of -1, or of $(1, \pi)$.

30. In ordinary working, there is no objection to dropping the distinction between the logometer and the logarithm, there being no difference between the two in operations.

That this system will finally be introduced into elementary instruction we entertain no doubt whatever. But how soon will this take place? The school-books hardly yet teach the interpretation of the negative quantity: so that there would be but little hope of the speedy success of the complete system, even if elementary works existed by which to make it known. But truth must conquer at last: and the respect with which the memory will be preserved of the mathematicians who were neither discouraged by the difficulties nor rendered incredulous by the mysteries of the antient system, will not protect from ridicule those who shall obstinately refuse to see light because there was once darkness, or shall wilfully continue in the imperfect system from which those who wish the exact sciences to be in all their parts the perfection of reason are most glad to be delivered. With respect to those parts of the doctrine of series, and of the integral calculus, which still present difficulties, though of a different character from those here treated, the lesson taught by the victory over what was rashly called *impossible*, which many heads have required many years to gain, is—Never refuse to examine, and to continue in the examination of, all consequences of the symbolic laws of algebra: there is every reason to hope that the symbols are always right, even though the views of their explanation may require correction.

ALGEBRAIC GEOMETRY. The regular treatises in this as in every other case, cannot be dispensed with by any of our readers who are desirous of acquiring it. But in this article, as in the last, we are led to write by the total want of elementary works to explain a new and useful modification of the mode of viewing a part of the subject. In the body of the Cyclopædia we avoided, as much as we could, articles which presumed, from their outset, a very ready acquaintance with the details of the branch on which they entered. Thus, though we might take for granted much algebra in treating the elements of the differential calculus, and much differential calculus in such an article as OPERATION, P. C., or TAYLOR'S THEOREM, P. C., yet we endeavoured to make every article to which a beginner was likely to refer, as elementary an exposition as we could. But it may be allowed, in a Supplement, to make some attempt at supplying the omissions which, during the progress of the Cyclopædia itself, we have observed in elementary works, so far as such defects are capable of being remedied within our limits of space: and the mere mention of those limits is a sufficient excuse for our assuming in the reader a reasonable knowledge of existing works.

In geometry of two dimensions, the number of co-ordinates is not so great as to make symmetrical disposition extremely necessary at the outset. We should not, for instance, gain much by forming the equation of the straight line thus:— $ay + bx + c = 0$ instead of $y = ax + b$; in fact, the writers who have preferred the symmetrical course have rather overloaded themselves with symbols, to an extent which makes the burden thus imposed on the memory greater than that from which symmetry relieves it. But it is not so in geometry of three dimensions. There are here three co-ordinates to every point; and, as it happens, symmetry, even when obtained by augmentation of the number of symbols, is found to be, on the whole, an assistance in the remembrance of formulæ. Accordingly, the equations of the plane and straight line, and formulæ connected with them, are expressed with great convenience in the manner of which the following is a summary: the first use of which, as far as we know, is found in the celebrated work of Malus, 'Théorie de la double Refraction,' Paris, 1810, 4to.

1. In arranging expressions containing three quantities or different sets of three, symmetry requires that no one letter shall ever appear at the beginning of one expression without appearing at the end of another; and that in every set of expressions which are formed by combination of pairs, an interchange of any two letters, or of the corresponding pairs taken out of different sets, shall reproduce the same set of expressions in another order, or at most with different signs. Thus, $a - b$, $b - c$, $c - a$, are symmetrical, and so are $ay - bx$, $bz - cy$, $cx - az$.

2. When there are two equations of the form $ax + by + cz = 0$, $a'x + b'y + c'z = 0$, the quantities are not given, but their proportions are: and x, y, and z are in the proportion of

$$bc' - cb',\ ca' - ac',\ ab' - ba'$$

3. An expression of the form

$$(ay - bx)^2 + (bz - cy)^2 + (cx - az)^2$$

is identical with

$$(a^2 + b^2 + c^2)\,(x^2 + y^2 + z^2) - (ax + by + cz)^2$$

4. The form of the equation of a plane is $Ax + By + Cz + D = 0$; the common form $z = Ax + By + C$ is unsymmetrical. The plane which passes through the point whose co-ordinates are p, q, r, which call the point $(p\,q\,r)$, is

$$A(x - p) + B(y - q) + C(z - r) = 0$$

The plane which passes through the three points $(p\,q\,r)$, $(p'\,q'\,r')$, $(p''\,q''\,r'')$, is

$$\{(q' - q)\,(r'' - r) - (r' - r)\,(q'' - q)\}\,(x - p) + \&c. = 0:$$

one term of which is enough; symmetry will point out the rest. Remember the order pq, qr, rp.

5. When such symmetrical expressions as $ab' - ba'$, $bc' - cb'$, $ca' - ac'$, are to be constructed, the best way is to write down a, b, c, a and a', b', c', a' under one another, and to calculate from the left to the end, without returning to the beginning. Thus from

$$\begin{array}{cccc} 8 & 1 & 3 & 8 \\ 2 & 4 & 6 & 2 \end{array}$$

we have

$$30,\ -6,\ -42$$

6. The most convenient form of the equations of a straight line is as follows. Let (abc) be a point on the straight line, and let A B C be any three quantities proportional to the cosines of the angles which the straight line makes with the directions of x, y, z. Then the equations of the straight line are

$$\frac{x - a}{A} = \frac{y - b}{B} = \frac{z - c}{C}$$

The following system is sometimes convenient:

$$x = a + Av,\ y = b + Bv,\ z = c + Cv$$

where $v\sqrt{(A^2 + B^2 + C^2)}$ is the distance between (abc) and (xyz).

7. The plane whose equation is $A(x - a) + \&c. = 0$ may be called the plane (ABC*abc*), and the straight line just mentioned may be called the straight line (ABC*abc*). Throughout this article capitals are generally proportional to cosines of angles, and small letters are co-ordinates of points. The order of co-ordinates is xyz, and all letters connected with co-ordinates run in consecutive triplets, as ABC, PQR, &c. Bnt when triplets of pairs are made, as AB, BC, CA, then AB particularly belongs to the co-ordinate to which C is attached, BC to that of A, and CA to that of B.

8. The angles made by the straight line (ABC &c.) with the axes have for their cosines $A \div \sqrt{(A^2 + B^2 + C^2)}$, &c.;

and the angle made by the two straight lines (ABC &c.), (A′B′C′ &c.) has for its cosine

$$\frac{AA' + BB' + CC'}{\sqrt{(A^2 + B^2 + C^2)}\,\sqrt{(A'^2 + B'^2 + C'^2)}}$$

When the lines are perpendicular, $AA' + BB' + CC' = 0$; and when they are parallel, A, B, C are in the same proportion as A′, B′, C′.

9. The angles made by the plane (ABC &c.) with the planes of *yz*, *zx*, and *xy*, are $A \div \sqrt{(A^2 + B^2 + C^2)}$, &c.; the cosine of the angle made by the planes (ABC &c.) and (A′B′C′ &c.) with one another is as in the last, and also the conditions of perpendicularity and parallelism.

10. The plane (ABC*abc*) is at right angles to the line (ABC*pqr*), whatever *a*, *b*, *c*, *p*, *q*, *r* may be. And the plane (ABC &c.) is at right angles to the line (A′B′C′ &c.) whenever A, B, C, are proportional to A′, B′, C′. But the plane (ABC &c.) is parallel to the line (A′B′C′ &c.) when $AA' + BB' + CC' = 0$.

11. The straight line (ABC*abc*) lies entirely in the plane (PQR*pqr*) when

$$P(a-p) + Q(b-q) + R(c-r) = 0$$
$$AP + BQ + CR = 0$$

12. The intersection of the two planes (PQR*pqr*) and (P′Q′R′*p′q′r′*) is the straight line (ABC*abc*), in which A, B, C, are proportional to $QR' - RQ'$, $RP' - PR'$, $PQ' - QP'$, and

$$P(a-p) + Q(b-q) + C(c-r) = 0$$
$$P'(a-p') + Q'(b-q') + C'(c-r') = 0$$

13. The intersection of the plane (PQR*pqr*) and the straight line (ABC*abc*) is at the point whose co-ordinates are $a + Av$, $b + Bv$, $c + Cv$, where

$$v = \frac{P(p-a) + Q(q-b) + R(r-c)}{AP + BQ + CR}$$

14. Two straight lines (ABC*abc*) and (A′B′C′*a′b′c′*) do not, generally speaking, intersect at all; their shortest distance is $(BC' - CB')(a - a') +$ &c. divided by $\sqrt{\{(BC' - CB')^2 + \&c.\}}$, and they meet when the numerator of this fraction is nothing. The plane (PQR*pqr*) is parallel to both straight lines when P, Q, R, are proportional to $BC' - CB'$, $CA' - AC'$, $AB' - BA'$.

15. The equation of a plane which passes through the straight line (ABC*abc*) and is perpendicular to the plane (PQR*pqr*) is

$$(BR - CQ)(x-a) + (CP - AR)(y-b)$$
$$+ (AQ - BP)(z-c) = 0$$

16. The perpendicular distance from the point (*abc*) to the plane (PQR*pqr*) is $P(a-p) + Q(b-q) + R(c-r)$ divided by $\sqrt{(P^2 + Q^2 + R^2)}$, independently of sign. And the perpendicular distance between the parallel planes (PQR*pqr*) and (PQR*p′q′r′*) is $P(p - p') +$ &c. divided by $\sqrt{(P^2 + \&c.)}$.

17. The perpendicular from the point (*lmn*) upon the straight line (ABC*abc*) meets it in a point of which the co-ordinates are $a + Av$, &c. where

$$v = \frac{A(l-a) + B(m-b) + C(n-c)}{A^2 + B^2 + C^2};$$

and the square of the length of that perpendicular is

$$(l-a)^2 + \&c. - \frac{\{A(l-a) + B(m-b) + C(n-c)\}^2}{A^2 + B^2 + C^2}$$

This is sufficient for a specimen of the method, and even for a summary of the most important propositions respecting the straight line and plane. On the good effect of symmetry it is hardly necessary to make much remark: not only are formulæ more easily remembered, since the whole can be formed from recollection of a part—and more easily used, since an unsymmetrical result is an indication of error—but the actual expression can be shortened in type, of which the above is a sufficient proof. It would have been impossible safely to write down as many results in twice the space, if the ordinary plan of notation had been adopted. The best mode of treating the ordinary forms for the straight line, such as $y = ax + \alpha$, $z = bx + \beta$, is to reduce them to the preceding, thus:

$$\frac{x-0}{1} = \frac{y-\alpha}{a} = \frac{z-\beta}{b}$$

ALGÉRIE, L' (pronounced *Algerée*; ALGERIA in English), is the name given by the French to their newly-acquired possessions in Northern Africa, which comprise the whole state formerly known as the Regency of Algiers. We have given under ALGIERS, P. C., a description of the country and its inhabitants, as they were at the time of the French invasion, which was the alleged consequence of a personal insult from the Dey to the consul of France. By the capitulation of the 4th of July, 1830, the French became possessed 'of the city of Algiers, and the forts and harbours depending on it.' No mention was made of the provinces, or of the native tribes, over which the authority of the Dey was little else than nominal. The Dey capitulated to the French more like the commander of a military garrison than as the sovereign of an extensive state. In truth, the Dey himself was, ostensibly at least, but an officer of the Turkish sultan. The native Arabs and Kabyles were told in the proclamations that the French had come to deliver them from the yoke of the Turks, who were, in reality, aliens to the country, pirates by sea, and usurpers and marauders by land. The Arab tribes in the neighbourhood of Algiers, Oran, and the other towns garrisoned by the Turks, were in the habit of paying a reluctant tribute to the Dey in order that they might graze their cattle in the plains without molestation, but the Kabyles who live in the mountains, as well as the more remote Beduin Arabs of the interior, seldom, if ever, entered into any such agreement, and the Turks only succeeded in extorting anything from them by sending armed detachments at harvest-time to seize by force what they could, or by surprising the Kabyle villages and kidnapping some of their young men, whom the parents were obliged to ransom. Such was the pretended sovereignty of the Turks over the greater part of the territory of the so-called Regency of Algiers.

The French became possessed by conquest of Algiers, Oran, Bona, and one or two more towns on or near the coast. The Moors and other mixed races who inhabit these places, became by conquest subjects of France. Of the three beys, or governors of provinces, Turkish officers subordinate to the Dey, that of Oran submitted to France; but Ahmed Bey of Constantina, being far off in a strong country, refused allegiance, and the Bey of Titteri, after having submitted at first, revolted soon after, and was joined by several tribes of Arabs and Kabyles. Thus it was that a course of hostilities was entered upon between the French and the natives, by which in the course of the last fourteen years the French conquest has spread from the frontiers of Tunis on the east, to those of Marocco on the west, and as far as the borders of the great Desert on the south. It is perhaps opportune for a knowledge of these complicated events, as well as for affording information on the present condition of the country, to recapitulate briefly, year after year, the progress of the French arms in Northern Africa.

Marshal Bourmont, after taking possession of the town of Algiers, gave occasion to the first hostilities with the Arabs, by marching a column of 2000 men to Bledah, where there was a meeting of Arab chiefs, who were consulting about their future relations with the French. On the approach of the troops the Arabs became alarmed, some dispersed, and others ran to arms and attacked the French, who were obliged to retire to Algiers with loss. In consequence of the revolution at Paris in July, 1830, and the change of dynasty which followed, Bourmont was recalled, and General Clausel was sent to succeed him. He arrived at Algiers in the beginning of September, 1830. In the following October he marched against the Bey of Titteri, crossed the Metidja plain, occupied Bledah at the foot of the Little Atlas, and then forcing the pass of Mount Teneah, entered the town of Medeyah, the residence of the Bey, about 45 miles south of Algiers. Clausel deposed the Bey, and appointed a Moor of Algiers in his place. In the mean time the Sheik Benzamoom, at the head of the Kabyles from the eastern mountains, attacked the French rear-guard at Bledah, and massacred 50 artillerymen whom he surprised on the road. General Clausel, having left a garrison at Medeyah, hastened back to Bledah, which the soldiers plundered out of revenge, as the inhabitants had shown themselves hostile to them.

General Clausel was the first to suggest the colonization of the territory of Algiers with settlers from Europe. Marshal Gerard, then minister-at-war, approved of the plan, and fixed on the Metidja plain, which lies between the table-land of Algiers and the ridge of the Little Atlas, for the first experiment. But neither the general nor the marshal seems to have thought of ascertaining first to whom the lands in the Metidja belonged. Baron Pichon, who was appointed, a year after, Civil Intendant of Algiers, having made inquiries, discovered that the lands in question belonged chiefly to Moorish proprietors, inhabitants of Algiers, the quiet subjects of France, whose property was solemnly guaranteed to them by the capitulation, and who let their lands to Arab or Kabyle cultivators or graziers. (Pichon, *Alger sous la Domination Française*, 8vo. 1833; a very interesting book for the history of the earlier period of the French occupation of Algiers.)

General Clausel entered into negotiations with the Bey of Tunis, by which the two provinces of Constantina and of Oran, the two great eastern and western divisions of the state of Algiers, were to be administered by two princes of the reigning Moorish dynasty of Tunis with the title of Beys, on their paying an annual tribute to France. The Tunisians were to assist the French in dispossessing the refractory Ahmed Bey of Constantina. The treaty was agreed on by the court of Tunis; but, when sent over to France, it was thrown out by the minister for foreign affairs. Meantime a nephew of the Emperor of Marocco at the head of a body of cavalry overran the country of Tlemsan, upon which Marocco had some antient claims, and he invited the tribes of the west to place themselves under the protection of a Moslem prince of the Arab race. Clausel sent reinforcements to Oran, and, notwithstanding the paucity of his means, was inclined to adopt hostile measures against Marocco, but he was prevented again by the minister for foreign affairs, General Sebastiani, who preferred resorting to diplomatic means to obtain the evacuation of the district of Tremecen or Tlemsan by the Prince of Marocco, who ultimately withdrew to his own country. General Clausel, dissatisfied with the repeated disappointments he had encountered from the French ministry, returned home in disgust, and published an apology of the acts of his administration. (*Observations du Général Clausel sur quelques Actes de son Commandement à Alger*, 8vo. Paris, 1831.)

General Berthezène remained in command at Algiers: although a distinguished officer of Napoleon's school, he was a temperate sober-headed man, who did not indulge in the sanguine aspirations of his predecessor. He resolved on contracting his line of posts within a narrower compass. He marched at the end of June, 1831, to relieve the garrison of Medeyah, which was closely blockaded by the Kabyles, and having evacuated the place, retraced his steps to Algiers, fighting his way through the pass of Teneah, harassed by swarms of Kabyles and Arabs, who followed him all the way across the Metidja plain to within a few miles from Algiers. He wrote in the following month of August a long but interesting report to the minister-at-war, in which he refuted some exaggerated notions of the partisans of conquest and colonization, which letter is given by Baron Pichon in the appendix to his work, p. 44. Berthezène applied himself to cultivate the friendship of the sheiks of the Arab tribes, who conceived a high opinion of his sense of justice. Unfortunately at the end of 1831, Berthezène was superseded by Savary, Duke of Rovigo, who on his arrival at Algiers found himself beset by a party who talked loudly of exterminating the natives, or driving them back to the Desert, taking possession of their property, and distributing the lands by lots to French colonists. General Berthezène after his return to France published a very interesting and impartial work: 'Dixhuit Mois à Alger, ou récit des évènemens qui s'y sont passés depuis le 14 Juin, 1830, jour du débarquement de l'armée Française jusqu'à la fin de Décembre, 1831,' Montpellier, 1834.

The administration of Savary lasted little more than a twelvemonth. Its character was harsh, prejudicial, and disorderly. It alienated the natives of all races and classes. Several Arabs and Moors of distinction were summarily executed. The Ouffias, a tribe of unoffending Arabs in the neighbourhood of Algiers, were wantonly exterminated; and sweeping confiscations of private property took place. The result was a general rise of all the tribes round Algiers and Oran, and the stoppage of all communication with the interior. Pichon, in his work already noticed, and General Brossard, in his 'Mémoire présenté au Duc de Dalmatie sur les moyens d'assurer la securité du territoire d'Alger,' give much information concerning the dismal period of 1832.

In 1833 Savary left Algiers on account of ill health, and returned to Paris, where he died in June of that year. General Voirol remained pro tempore 'commander-in-chief of the French possessions in North Africa.' During the session of that year in the Chamber of Deputies, Marshal Clausel, who continued to be a warm supporter of the system of colonization, after magnifying the importance of Algiers to France, which he compared to that of the East Indies to England, asked the ministers about their intentions concerning Algiers. The president of the council replied, that 'there was no intention of evacuating the country; that France was at liberty to act as she pleased, being untrammelled by any engagement with foreign powers respecting it; that for the present the government thought proper to confine itself to the possession of the three principal maritime stations, namely Algiers, Oran, and Bona, but that it might be thought advisable at a future time to occupy two or three more points on the coast, although there was nothing decided as yet on that subject. With regard to the plans for colonizing the country, the government was ready to favour them if carried on by private companies, but had no intention to pursue them on its own account, or by its own means.' These explanations seemed to give general satisfaction to the Chamber. The revenue derived from Algiers figured in the budget to the amount of only 1,500,000 francs, whilst the whole annual expenditure required to keep possession of and administer the country was stated in the Chamber to amount to 30,000,000 francs. The army employed in North Africa consisted of 30,000 men, of whom 4000 were turbulent characters, chiefly from Paris, who had been formed into a fighting corps. A corps of auxiliary native troops, by the name of Zouaves, was also formed, as well as a battalion of Turks, and a foreign legion consisting of men of all nations.

In May of that year, General Desmichels, governor of Oran, sent an expedition against a tribe of Gharabas or nomade Arabs, who had advanced to within 15 miles of Oran; the French surprised their camp, killed 300 Arabs, and carried away their women and children, and their cattle; but on their return to Oran the French were much harassed by the Arab horse. Shortly after Abd-el-Kader, the son of an influential Marabout, who in the year 1832, in the midst of the general confusion produced by the fall of the Turkish power, had attained the title of emir and bey of Mascara, and had gathered under his banner the Arab populations of the west, advanced with 9000 horse to within sight of Oran, and attacked the French outposts, but after some sharp fighting was obliged to retire with the loss of 800 men. The Gharabas then entered into negotiations with the French, who restored their women and children. In June the French occupied the maritime station of Arzew, east of Oran, and soon after the more important town of Mostagannem, on the opposite or eastern side of the Bay of Arzew. Abd-el-Kader made every effort to recover Mostagannem, but did not succeed. There was much fighting between the French and the Arabs in the province of Oran during the rest of the year. On the eastern coast an expedition sent from Toulon, in September of the same year, landed a body of troops at Boojeyah, and after several days' hard fighting against the Kabyles, who disputed every foot of ground, house after house, and garden after garden, the French obtained possession of the town, which formed an intermediate station on the coast between Algiers and Bona.

By an ordonnance of the month of August, 1834, General Count d'Erlon was appointed 'governor-general of the French possessions in North Africa,' under the direction and control of the minister-at-war. An intendant or head of the civil department was also appointed, as well as a commissary of justice at the head of the judicature. The military events of this year were of little importance. There was some desultory fighting with the Kabyles in the neighbourhood of Boojeyah, and with the troops of Ahmed Bey of Constantina, in the direction of Bona. The sheik of La Calle, a maritime station east of Bona, on the frontiers of Tunis, made his submission to the French. In the west, Abd-el-Kader, Bey of Mascara, whose authority was now acknowledged by all the Arab tribes from the river Shelif to the frontiers of Marocco, entered into an agreement with the French governor of Oran, by which he acknowledged the supremacy of France, and was acknowledged by the French as the emir of the province of Mascara, which included the whole western division of the state of Algiers, with the exception of Oran and its immediate territory, and the other points on the coast which were occupied by the French. The Shelif was to be his boundary on the east. A sort of commercial treaty was also concluded between the emir and the French. This convention was censured at Paris, as giving a political importance to the Arab chief, of which he would take advantage to consolidate his power, until a proper opportunity occurred to turn his arms against the French: and so it happened.

At the beginning of 1835 Abd-el-Kader crossed the Shelif, and excited the Hadjoutes and other tribes in the immediate neighbourhood of Algiers to rise against the French. He himself collected a force of 8000 horse and 4000 foot, of which 1200 had been trained as regular infantry, in the neighbourhood of Oran. General Trézel, the French governor of Oran, marched against him, and met him on the banks of the river Sig. The Arabs fought well, but gave way at last, and retreated a few miles. General Trézel having lost 240 men, thought it prudent next day to retire to Arzew on the sea-coast; but he was attacked by the Arabs at the Pass of Makta, where he lost his baggage, a howitzer, several caissons, and 500 men either killed or wounded. This disaster was the most serious which the French had yet encountered in Africa. Abd-el-Kader showed considerable military skill in these encounters.

Marshal Clausel, being appointed by the king to succeed Count d' Erlon, resolved on his arrival at Algiers to crush, if possible, the rising power of Abd-el-Kader. He began by appointing a native Bey of Oran, thus exciting a rival to the Emir in his own neighbourhood, He then prepared an expedition against Mascara, a town of about 10,000 inhabitants, and the capital of Abd-el-Kader, 18 leagues south-east of Oran. The Duke of Orleans sailed from France to Oran to accompany the expedition, which consisted of about 10,000 men. Abd-el-Kader tried to oppose the French on the banks of the Sig, and afterwards at the pass of the river Habrah, but his men were overcome by French tactics and discipline. He then withdrew into the interior, leaving Mascara to its fate. The French found Mascara deserted by its inhabitants, and plundered by the wild Arabs. Being unable to retain possession of it, Clausel ordered it to be set on fire on the 9th of December, 1835, after which he marched back to the sea-coast by way of Mostagannem, whence he returned to Algiers.

In the following January, 1836, Marshal Clausel undertook another inland expedition against the town of Tremecen or Tlemsan, situated about 100 miles south-west of Oran, near the frontiers of Marocco, and which was now the head-quarters of Abd-el-Kader. The Meshoar or citadel of Tlemsan was held by a body of Kooloolis, the sons of Turkish soldiers, formerly in the service of the Dey, who had retained possession of it ever since the fall of the regency. These men were on bad terms with the Arabs, who considered them as intruders, and they looked therefore up to the French for support. The French expedition set out from Oran, and after a march of five days entered Tlemsan, which Abd-el-Kader had evacuated with all the Moorish inhabitants. The Jews and Kooloolis received the French with acclamations. A body of troops then moved towards the mountains east of Tlemsan, where the Emir was encamped, and drove him away into the interior. Marshal Clausel next marched northward of Tlemsan to the confluence of the rivers Tafna and Isser, where he defeated another body of Abd-el-Kader's followers, among whom were several thousand horsemen from Marocco who had come to join in the Djehed or Holy war which the Emir had proclaimed against the infidels. Clausel, having returned to Tlemsan, found that the Moorish population had re-entered the town. He appointed a native Bey, distributed arms among the Kooloolis and other partisans of the French, and leaving a mixed garrison in the citadel, returned to Oran with the main body of his army. Unfortunately the Marshal, being misled by exaggerated reports of the wealth of the people of Tlemsan, imposed upon them an extraordinary contribution of half a million of francs, leaving three natives, one of whom was the well known Moorish colonel Jussuf, to collect it. It appears, that notwithstanding many acts of exaction and oppression said to have been committed by these men, they could only extract the value of 100,000 francs, chiefly in women's trinkets. The Marshal being now better informed, remitted the rest of the contribution, but the conduct of the agents at Tlemsan was the subject of severe censure in the Chamber of Deputies at Paris. In order to secure a nearer communication between Tlemsan and the sea-coast, Marshal Clauzel established a fortified camp at the mouth of the river Tafna, occupying at the same time the little island of Rasgoon, which lies before the æstuary.

On his return to Algiers the Marshal marched southward against the Kabyles, who had collected in the Little Atlas, and had interrupted the communication with the town of Medeyah. After an obstinate fight he forced the pass of Mount Teneah, and entered Medeyah, where he reinstated the Bey Mohammed who had been appointed by the French. Meantime the French engineers completed a military road from Algiers to Medeyah. Having performed all these things, Marshal Clausel, in the month of April, returned to France to take his seat in the Chamber of Deputies, and defend the system which he had pursued in his government of Algiers.

Soon after the Marshal's departure the French of the Tafna camp attempted to relieve the garrison of Tlemsan, but they were met on the way by Abd-el-Kader, who obliged them to retreat with considerable loss to their camp, where they were closely blockaded and suffered much from want of provisions.

This reverse induced the French government at home to send an expedition direct to the mouth of the Tafna, under General Bugeaud, who having learnt on his arrival that Abd-el-Kader had moved in the direction of Oran, marched in the same direction, by the coast road, and relieved the garrison of Oran, which had been closely blockaded for some time. From Oran, Bugeaud began his march to Tlemsan, but on arriving there he found the whole country around stripped of all provisions and cattle by Abd-el-Kader, and he was obliged to return to the camp of the Tafna, about forty miles distant, across the Telgoet Mountains, a road as yet untrod by the French. At the Tafna the French collected provisions from their transports, with which they loaded 500 camels and 300 mules, to supply the garrison of Tlemsan for four months. The convoy set off for Tlemsan escorted by 6000 men. Having crossed the mountains and the Isser, they found, on the 6th of July, Abd-el-Kader strongly posted on high ground above the steep banks of the Sikkak river. The Arab cavalry attacked the French as they crossed the ravine, and obtained a momentary advantage, but they were at last repulsed, when Abd-el-Kader advanced in good order with his reserve of regular infantry. This body of men fired with considerable precision, but being charged with the bayonet by the French, they were routed and driven in their flight down the precipice into the ravine below, where most of them were killed. The native auxiliaries of tho French were busy cutting off the heads of the fallen; the French however succeeded in saving the lives of 130 men, and this was the first instance of prisoners being taken in Africa. This was the first approach to a more humane system of warfare, and it led afterwards to an exchange of prisoners between Abd-el-Kader and the French. The defeat of Abd-el-Kader was complete. General Bugeaud entered Tlemsan, provisioned the garrison, and thence retraced his way back to Oran, from whence he embarked for France, where he was promoted to the rank of Lieutenant-General.

Meantime an expedition against Ahmed Bey of Constantina was resolved upon at Paris, and Marshal Clausel returned to Algiers to make his preparations. Troops were sent both from Algiers and from Toulon to Bona, where the Duke of Némours, Louis-Philippe's second son, arrived also to accompany the army. On the 13th of November the expedition, about 7000 strong, left Bona, and after two days arrived at Guelma, an old Roman station on the Seyboos river, where a depôt was established for the sick. The troops then crossed the defile of Ras-el-Akba, and attained the high land of Constantina, when they were assailed by a storm of hail and snow, followed by a sharp frost, which reminded some of the veterans of the retreat from Moscow. Many men died, and others had their feet frostbitten. On the 21st of November the army encamped before the walls of Constantina. Marshal Clausel had been told by Colonel Jussuf, whom he had prematurely appointed Bey of Constantina, that the population of the town would open the gates to him; but he found the garrison, consisting of Turks and Kabyles, determined upon defence, and the red flag of Algiers floating over the main battery. He had not the means of investing the place regularly, the snow continued to fall heavily, one-half of the men were ill or were left behind with most of the baggage; and the garrison of the town and the country-people kept the French outposts continually on the watch. After attempting to batter down with his guns the gate of Al-Cantar, Clausel made a desperate effort, on the night of the 23rd, to force that gate and that of Er Rahba, in which attempt a number of French officers and men lost their lives. On the morning of the 24th the French began their retreat in the direction of Bona, followed by the garrison of Constantina, and harassed by clouds of Arab horsemen, and thus they arrived at Guelma on the 28th, from whence they proceeded to Bona. The official statement of the loss of the French stated it at 453 dead and missing, and 304 wounded. The sick were in still greater number. The failure of this expedition produced a very unpleasant sensation in France. Marshal Clausel returned home, and was succeeded by General Danrémont. Upon the whole, this second period of General Clausel's administration was brilliant and bold in a military point of view, and notwithstanding some reverses, it paved the way for the ultimate occupation of the whole state of Algiers by the French.

In the spring of 1837 General Bugeaud was sent again to

Oran on a special mission to treat with Abd-el-Kader in order to prevent him from joining Ahmed Bey of Constantina, against whom a second expedition on a larger scale was being prepared. Fortunately for the French, Abd-el-Kader, an Arab and the representative of Arab nationality, had little sympathy for the Turkish Bey of Constantina, who was besides much inferior to him in character and abilities. Bugeaud, having collected about 10,000 men at Oran, moved forward with a strong escort to the banks of the Tafna, where he had a remarkable interview with Abd-el-Kader, which Bugeaud managed with considerable spirit and address, and at last a treaty was agreed upon and stamped with the seal of the Emir, dated 30th of May, 1837. Abd-el-Kader acknowledged the sovereignty of France, retaining the administration with the title of Emir of the two provinces of Oran and Titteri, with the exception of the towns of Oran, Mostagannem, Arzew, and one or two more points on the coast. Tlemsan was given up to him, on condition of his not molesting the Kooloolis and the other friends of France. On the side of Algiers the boundary-line of the Emir's territories was extended as far as the ridge of the Little Atlas which is nearest to the capital. Medeyah of course was given up to him, but Bledah and Coleah remained in possession of the French. The Emir on his part engaged not to cede any part of the coast-line to any foreign power, and he also engaged to furnish the French with a certain quantity of corn and 5000 bullocks. The treaty was very advantageous to the Emir, who gained a considerable extent of territory. But the French also obtained their object of being for a time relieved of anxiety from the west, so as to be able to turn all their strength towards the eastern province of Constantina, where 20,000 men were assembled at Bona and Guelma towards the beginning of October. General Danrémont took the direction of the expedition, and the Duke of Némours came from France to assume the command in chief. The army met with little opposition in its advance. They formed their batteries on the high grounds which command the town, and effected a breach in the wall. On the 12th of October, the Governor, General Danrémont, whilst surveying the operations, was killed by a cannon-shot, by the side of the Duke of Némours. General Valée assumed the direction of the besieging army, and the town was stormed, but the French encountered a stubborn resistance in the narrow streets; the natives sprung a mine, which killed a number of French soldiers, and a high wall which fell down buried many more under its ruins. At last all opposition was overcome, the surviving part of the garrison escaped or threw themselves down the walls of the town, and the Kasabah, or citadel, surrendered soon after. The Duke of Némours took up his quarters in the palace of the Bey. The soldiers at first committed many acts of violence, but by the exertions of the officers order was restored, the mosques were respected, and the inhabitants were assured of protection. Ahmed Bey had left the town previous to the arrival of the French, and retired into the interior, with a few followers. A native Kaïd, or civil magistrate, was appointed, and a French governor and garrison being left at Constantina, the army returned to Bona. The conquest of Constantina, followed by the submission of many tribes of the interior, was an important event. It established the French power in the centre of a vast inland region, the antient Numidia, extending to the borders of the Regency of Tunis on one side, and as far as the Sahara, or Great Desert, on the other.

In the following year, 1838, the French sent detachments from Constantina in several directions into the interior, to Milah, Djemilah, and Seteef, the antient Sitifis. The province of Constantina was divided for administrative purposes into two divisions, Constantina and Bona, and the former was subdivided into three Khalifats, or Lieutenancies, Sahhel, Ferdjouah, and Mejanah. Native officers were placed at the head of each, to administer justice and collect the tribute from the various tribes. The division of Bona was subdivided into four circles, Bona, Guelma, La Calle, and Edough. At the head of each circle a French military officer, and a native chief under his orders, were placed. The French occupied the maritime station of Stora, the antient Rusicada, the nearest landing-point to communicate with Constantina, and near it they built a town which they named Philippeville.

Meantime Abd-el-Kader was busy in subduing some remote tribes in the south of his province, which would not acknowledge his authority. After the ratification of the treaty, he sent an envoy to Paris, with presents to Louis-Philippe. He then proceeded to Aïn Madhi, about 200 miles inland, on the borders of the desert, the Marabout of which had refused obedience to him. He besieged the place for several months, and at last took it by capitulation, in January, 1839, and he sent to General Valée a journal of his expedition in French, which was written by M. Léon Roches, a young Frenchman who remained two years with the Emir in the capacity of his secretary. Abd-el-Kader was also forming a cordon of stations in the interior, upon which to fall in case of future reverses: at Boghar, about 40 miles south-east of Medeyah; at Thaza on Mount Matmata, on the left or south bank of the Shelif; at Saïda, south of Mascara; Tagdemt, south-east of Mascara; and Tefzra, south of Tlemsan.

In the spring of 1839 the French took possession of Jijeli, an intermediate station on the coast between Boojeyah and Stora, in the country of the Kabyles. Another expedition from Constantina occupied permanently Djemilah and Seteef, which last became the head town of the new khalifat of Medjana. In September of the same year the Duke of Orleans arrived at Algiers, and then proceeded by way of Philippeville to Constantina, where he received the homage of the various khalifas and sheiks of the province, as well as of the Ulemas with the Mufti at their head, and of the various corporations and trades of Constantina. He distributed to several native chiefs the decoration of the Legion of Honour. In October he proceeded with an exploratory expedition in the direction of Algiers, by way of Milah, Djemilah, Seteef, Sidi Embarak, and then through the Biban or Iron-gates, a remarkable defile in some places only eight feet wide, between perpendicular rocks from 800 to 900 feet high, a sort of Chedder cliffs on a more gigantic scale, which the Turks had never been able to pass without paying tribute to the neighbouring tribes. The French passed without opposition, and then by way of the Hamza and Wadi Zeitoon they returned to Algiers.

There is a well written report, published in 1839, by M. Blanqui, of the French Institute, who travelled through the French possessions in Algeria for the purpose of inquiring into the social and economical condition of the country: 'Rapport de M. Blanqui, Membre de l'Institut, à l'Académie des Sciences Morales et Politiques, sur la Situation économique de nos Possessions dans le Nord de l'Afrique.' He describes in lively terms the failure of the attempts at colonization in the Metidja plain, and the measures taken by the governor to save the towns of Bledah and Coleah, with their splendid orange, almond, and olive plantations, well irrigated, from the cupidity of the speculators and adventurers who had ruined a number of pretty country-houses and hamlets on the Sahel, or tableland round Algiers; he speaks of the alarming mortality among the French troops in the country; he censures the tariff of the customs; he seems pleased with the bustle and life which he perceived about the town of Algiers, which assumes rapidly the appearance of a European city, and he contrasts it with the stillness and solitariness which he found in the eastern province, at Stora, Philippeville, Bona, and Constantina. On the road from Stora to Constantina, a distance of 20 leagues, there is hardly a hamlet or an Arab douar to be found. For many a mile there is not a shrub, not a plant to be seen. The aspect of this undulating barren and deserted region reminds the traveller of the Campagna near Rome. 'The province of Constantina has been placed under a system of administration different from that of the rest of Algeria. The old civil constitution of the country has been respected, and European colonists are forbidden to enter the province. The French rule through the means of native authorities, khalifas, hakems, and sheiks, who have received the investiture of their office from the governor, and have sworn fidelity on the Koran. They retain their former authority, except the power of inflicting death. They raise the taxes and tributes, which they account for to the French treasury, retaining one-third of the gross amount for their trouble. The best understanding prevails between them and the French military, who on their part maintain the strictest discipline.' M. Blanqui accompanied the Duke of Orleans to Constantina, and saw all the principal native chiefs come to pay homage to the prince. He remarked that their appearance and manners were far superior to those of the Arabs of the province of Algiers. The whole population of the town he reckoned at about 10,000. But he thought little of the town itself, which was miserable, dirty, and decaying. He considers it important only as an advanced military post in the interior, but he doubts whether it is worth keeping. The whole report is very interesting, and is one of the best written papers we have seen on the state of the country; but as at the time M. Blanqui wrote, Abd-el-Kader ruled over one half of Algeria, several of the author's reflections and suggestions are now out of date, in consequence of the events that have happened since. This document has been inserted in the appendix at the end of Lesur's 'Annuaire Historique Universel' for 1839.

In October, 1839, the Arabs of Abd-el-Kader resumed hostilities against the French, without any previous declaration. They invaded the Metidja, and surprised and cut to pieces the French colonists, as well as several detachments of soldiers. A subsequent letter of Abd-el-Kader to Marshal Valée informed him that all the Moslem population had resolved to resume the Holy War against the French. In truth he had made peace at the Tafna two years before, merely to prepare for a fresh renewal of hostilities. All the colonists who could escape took refuge within Algiers, and the farms in the plain were plundered and burnt by the Arabs. On the news of these events the French government at home ordered reinforcements amounting to about 20,000 men, besides horses, to be sent to Africa. Meantime several affairs took place between the French and the Arabs in the neighbourhood of Algiers. The small garrison of Mazagran, east of Oran, attacked by several thousand Arabs, made a most brave defence. On the 31st of December a large body of the troops of Abd-el-Kader were defeated near Bledah, with considerable loss.

The war continued during the following year, 1840, but although the French army of occupation had been raised to 60,000 men, no definitive result was attained; the French, after some sharp engagements, recovered possession of Medeyah and Milianah, which had been given up to Abd-el-Kader by the treaty of the Tafna, and the maritime town of Shershel, west of Algiers, was also occupied. In the eastern province, several tribes friendly to Ahmed, the expelled Bey of Constantina, were defeated.

The French government at home resolved on carrying on the war against Abd-el-Kader with renewed energy, declaring that there could be no peace in Africa till that chief was destroyed, for experience had twice shown that no faith could be placed in him. With these views, General Bugeaud, who had formerly distinguished himself against Abd-el-Kader, was sent to Algiers to replace Marshal Valée as governor-general, in December, 1840.

Two seasons of the year are fit for European troops to keep the field in North Africa, the spring and the autumn. General Bugeaud opened the spring campaign of 1841 by marching against Mascara, which he took and garrisoned, driving Abd-el-Kader towards the south. Several remote tribes, having lost their confidence in the Emir, made their peace with the French. The campaign of the autumn consisted in provisioning Mascara, and obliging the powerful tribe of the Hashem, Abd-el-Kader's chief strength, to emigrate towards the Desert. The winter season put an end to hostilities. It was resolved to enclose the vast Metidja plain, an area of 40 square leagues, with a ditch, protected by military posts and blockhouses, in order to secure the colonists and their farms.

In the Chamber of Deputies, M. Guizot, the new minister for foreign affairs, emphatically refuted the insinuations of several journals, by stating that at no epoch since the revolution of July, 1830, France had entered into engagements to evacuate Algiers.

In the year 1842 the war continued to be carried on by General Bugeaud against Abd-el-Kader, who was defeated in person at Sikkak Sessef, and several more important tribes, the Moozaïa, the Sumata, the Shenua, Beni Massaoud, Beni Smala, &c., were induced to make peace with France. Tlemsan was again occupied, and a French garrison placed in it. Abd-el-Kader however, by his genius and activity, seemed to find fresh resources as he moved rapidly from place to place. The credit granted by the Chambers for the expenditure of the French possessions in North Africa, figured in the budget of 1842 to the sum of 47,050,984 francs. In November the Duke of Aumale, one of Louis-Philippe's younger sons, arrived at Algiers, and joined a new expedition against Abd-el-Kader. They obtained considerable successes against several Arab tribes. Ten thousand men were ordered from France to join the army of Algiers.

The campaign of the following spring, 1843, was marked by the Duke of Aumale surprising, at the head of a body of cavalry, the 'smala' or camp of Abd-el-Kader, whilst the great body of his Arabs were absent, on the border of the desert south of Tlemsan. Several thousand prisoners were taken and a large booty, including the Emir's papers. The Emir had barely time to escape. The French however lost several officers of rank in this campaign; among the rest General Mustapha Ben Ismail, a brave Arab auxiliary chief, 80 years old, whose head was taken to Abd-el-Kader, who proclaimed his death as a signal punishment of Heaven upon a traitor to his country. Meantime the French resorted freely to the African practice of making 'razzias,' *i. e.* predatory incursions into the grounds of hostile or disaffected tribes, carrying away their cattle, and often also their women and children. The cattle were sold, and the prisoners taken to Oran or Algiers, until the tribes made their submission. Colonel Jussuf distinguished himself in this kind of warfare. Attended by 1000 men mounted on camels and mules, he started from Medeyah, and plunging into the southern wilderness, he surprised the remote tribe of the Beni Yakoob, and seized an enormous quantity of cattle, which was afterwards distributed among the various garrisons of the division of Algiers. Abd-el-Kader wandered about with a small number of followers near the borders of Marocco. In the month of November his intimate friend and bravest lieutenant, the Khalifa Ben Allal, called Sidi Embarek, the One-eyed, at the head of about 1000 men, met a French division under General Tempoure, and a desperate affray ensued, in which the Arabs were cut to pieces, and Ben Allal, after killing or wounding three of his assailants, was shot dead by a fourth. His head was taken to Algiers, and his body was buried with military honours at Coleah, his native place. After this disaster Abd-el-Kader took refuge within the frontiers of Marocco.

In February, 1844, an expedition from Constantina, under the Duke of Aumale, set out for Biskara, seven days' march to the south, in the Belad-al-Jereed, where the Turks had once a station, and which was occupied by a detachment of Abd-el-Kader's. The French took possession of the district, the troops of Abd-el-Kader having fled, and left a native detachment in the fort. But after the return of the expedition, the friends of Abd-el-Kader surprised the detachment and massacred it. This excursion however made the French acquainted with the road to the great desert.

From his place of retirement within the frontiers of Marocco, Abd-el-Kader not only strove to keep alive disaffection against the French among the tribes of Algeria, but he likewise succeeded in exciting the fanatical population of Marocco itself to a holy war, for the purpose of driving away the infidels from Africa. Some of the emperor's family and court joined in the war-cry. The result has been a war between Marocco and the French. Marshal Bugeaud has added to his former successes that of defeating, at the battle of the Isli, the army of Marocco, which had advanced into that part of the territory of Algiers which lies west of the Tafna river; after which the French seized upon Ouchda, a frontier town of Marocco. These events, and the bombardment by sea of the towns of Tangier and Mogador, induced the emperor Abd-er-Rahman to sue for peace, the principal condition of which is that he will not permit Abd-el-Kader to annoy any more the French in their possession of Algeria. In the debates which took place, both in the British Parliament and in the French Chambers, it was elicited that the French dominion over Algeria has been acquiesced in by Great Britain; France, on its part, having engaged not to extend its conquests beyond the boundaries of the Algerine territories, either on the side of Tunis or on that of Marocco. Perhaps the best security for this is, as was frankly stated by the 'Journal des Débats,' that France will not conquer Marocco for the best of reasons, namely, that she cannot afford to do it. 'France,' observed the Journal, 'is already obliged, in order to retain possession of Algeria, to keep there an army of nearly 100,000 men, and to spend some 40,000,000 francs every year, and she would require double that contingent in order to effect the conquest of Marocco. It will take many years of peace before the revenue of Algeria can be raised so as to cover its expenditure, and it is even very doubtful whether it will ever be able to do that.' In a political point of view, however, the possession of Algeria is undoubtedly of considerable importance to France. Mankind at large, and the nations that border on the Mediterranean in particular, have derived one great advantage from the French conquest, namely, the extirpation of a nest of pirates and the final abolition of Christian slavery.

The high administration of the 'Algérie,' or State of Algiers, is by the king's ordonnances managed as follows:—A governor-general, who is a military officer of high rank, has the supreme command of the troops, and is also at the head of the civil and political administration. He is under the orders of the minister-at-war at Paris, where a department of the War Office is especially engaged with the affairs of Algiers. The governor-general is assisted in his functions by a council of administration, consisting of the director of the interior, the commandant of the naval force on the Algiers station, the military intendant, the attorney-general, and the director of the finances. A secretary-general of the government attends the sittings of the council.

The director of the interior has under him sub-directors at Oran, Bona, and Philippeville. Algiers, Oran, Bona, and Philippeville have municipal councils and maires. In the other towns, as at Constantina, there are civil commissaries, mostly natives, styled Hakhem.

The country is divided into three provinces. 1. Algiers Proper, which includes also the old division or province of Titteri. 2. Oran. 3. Constantina and Bona. The principal military stations are:—in the province of Algiers—Algiers and the neighbouring forts, Bledah, Medeyah, Milianah, Coleah, Shershel, and Boojeyah. In the province of Oran—Oran, Mostagannem, Arzew, Tenez, Mascara, El Esnam, Tlemsan, Mesergh'n, Mazagran, Tiaret. In the province of Constantina—Constantina, Seteef, Bona, Philippeville, Guelma, Jijeli, and La Calle. Algiers, Oran, Constantina, and Bona have each a considerable garrison and staff. The naval stations are —Algiers, Oran, with the fine bay of Marsa-el-Kebir, Bona, Shershel, and Stora.

For the department of justice, there are courts in the first instance at Algiers, Oran, Bona, and Philippeville. Appeals are made to the Royal Court, which sits at Algiers. There are justices of the peace at Algiers, Bledah, Bona, Oran, Philippeville, and Constantina. Algiers has a tribunal of commerce.

The public instruction is under an inspector. The establishments for instruction are—a college at Algiers with 15 professors; gratuitous courses of Arabic, both vulgar or oral, and written; communal schools; a museum, and a library. There is a Roman Catholic bishop of Algeria, and there are consistories for the Protestants at Algiers and Oran.

The European inhabitants, not military, settled in the various towns of Algeria, amounted in 1843 to about 60,000, and they are increasing rapidly by fresh arrivals. Since 1841 a number of villages have been built on the Sahel, or table-land round Algiers, each of which contains from fifty to sixty families of French colonists, chiefly emigrant farmers with a small capital. The government has granted them allotments of ground, on condition of their cultivating them and building their own houses. These villages have been surrounded by a ditch and towers, thus forming a chain of fortified outposts round the capital. Each village has its fountain, its church, a town-house, and a school. Similar villages have been built by private individuals near Bledah and in other places. At Tenez on the sea-coast, about 90 miles west of Algiers, a new European town has been constructed outside of the old Moorish town. From Tenez a road has been made to Orléansville, an inland colony of 500 or 600 inhabitants, with a military garrison. More to the east is Miliana, a town built on the declivity of Mount Zakar, more than 2000 feet above the sea, which was ruined in the war against Abd-el-Kader, but has been since restored on a much improved plan, and is become an important garrison town.

Marshal Bugeaud stated lately at a public dinner given to him by the merchants of Marseille on his return from Algiers, that tranquillity and security prevail over the greater part of Algeria, that the public revenue has risen to twenty millions of francs, and that the European population amounts to 75,000 individuals, and is daily increasing. It appears by the newspapers, that in the budget for 1845-6, just laid before the French Chambers, the receipts of Algeria are estimated at six millions and a half of francs, and the expenses of the war department are estimated at 74,465,527 francs, for 60,000 men and 13,896 horses. It appears that one half of the emigrants to Algeria are natives of France, and the rest are Spaniards, Germans, Italians, and Maltese. A regular communication by steam-boats has been established along the coast, between Algiers and Bona on one side, and Algiers and Oran on the other. A diligence runs between Algiers and Bledah in the interior.

(*Guide du Voyageur en Algérie, contenant l'Annuaire de* 1844 *et les Lois, Ordonnances, et Arrêtés concernant la Colonie*, a very well written and instructive compilation; Lesur, *Annuaire Historique*, 1830—43; Rozet, *Voyage dans la Régence d'Alger*, 3 vols. 1833; *Moniteur Algérien;* P. B. Lord, *Algiers and the other Barbary States*, 2 vols. 8vo. 1835; and the other works quoted in the course of this article.)

ALGORITHM, a corruption from the Arabic, the root being a word which means calculation, or at least refers to calculation or reckoning. When the Indian numerals were introduced from the East, this word came with them, and the new figures were denominated (by Chaucer, for example) *augrime* (or algorithm) figures. The word is tolerably well naturalized among the French mathematicians, as meaning the system of notation: thus there is an algorithm of functions, and an algorithm of the differential calculus, &c. It has also been used by English writers, but our language does not want it; the word *notation* does just as well. Hard words sometimes lead to misconception: those who attempt to interpret them find them not only spelt in different ways, but with very different meanings. Daniel Fenning (*Young Algebraist's Companion*, 1750) tells us that some writers are so short and intricate, that it is almost impossible to learn the *algorithm* from them, much less the *algorism*. In a note he informs us that the first of these hieroglyphics means the first principles, and the second their application to practice. Our old mathematical dictionaries define the word algorithm in probably its real imported sense, namely, as meaning the great rules of arithmetic.

ALIEN. On the 6th of August, 1844, an act was passed (7 & 8 Vict. c. 66) 'to amend the law relating to aliens.' It repeals the clause of 1 Geo. I. c. 4, which enacted that every Naturalization Bill should contain clauses to the effect that no person naturalized should be a member of the Privy Council, or of either House of Parliament, or hold any office, civil or military, or be capable of holding grants from the crown, of lands, tenements, or hereditaments, either in his own name or by any person in trust for him. By the 7 & 8 Vict. c. 66, a person born out of her majesty's dominions, of a mother who is a natural-born subject of the United Kingdom, is rendered capable of taking either real or personal estate by devise, purchase, or inheritance; and an alien who is the subject of a friendly state may take and hold every species of personal property, except chattels real, as fully and effectually as natural-born subjects. The subject of a friendly state may also, for the purpose of residence or occupation, either by himself or his servants, hold lands, houses, or tenements, for any term not exceeding twenty-one years; and may enjoy the same rights, remedies, exemptions, and privileges (except the right of voting at elections for members of parliament), as if he were a natural-born subject. An alien woman married to a natural-born British subject becomes naturalized by such marriage. The privileges conferred upon aliens by this act may be seen by referring to the former disabilities of aliens. [ALIEN, P. C.] Such of the provisions of the following acts which are inconsistent with the act 7 & 8 Vict. are repealed:—12 & 13 Will. III. c. 2; 1 Geo. I. sess. 2, c. 4; 14 Geo. III. c. 84.

The Alien Act of 1844 also contains a new provision for the naturalization of aliens. An alien who comes to reside in the United Kingdom with a view to settle here, may, by the following course, obtain nearly all the rights of a natural-born subject. He is required first to present a memorial to the secretary of state, containing a statement of his age, profession, trade, or other occupation; the length of time he has resided in this country, and the grounds on which he seeks to obtain any of the rights of a British subject; and praying for a certificate, which must be granted before further steps can be taken. The certificate granted by the secretary of state recites such parts of the memorial as, after due investigation, are found to be true and material, and it confers upon the applicant 'all the rights and privileges of a British subject, except the capacity of being a member of the Privy Council, or a member of either House of Parliament, and except the rights and capacities (if any) specially exempted in and by such certificate.' The certificate must be enrolled in the Court of Chancery, and within sixty days from its date the memorialist must take and subscribe an oath of allegiance.

The course of proceeding to be adopted by aliens wishing to become naturalized is to be regulated, so far as details are concerned, by the secretary of state, and the amount of fees is to be fixed by the lords of the treasury. Persons naturalized before the passing of 7 & 8 Vict. c. 66, and who have resided in this country for five successive years, are entitled to all the rights conferred by the new act.

The act at present in force for the registration of aliens is the 6 Will. IV. c. 11, which repealed an act of a similar kind (7 Geo. IV. c. 54). Masters of vessels arriving from foreign parts are to declare what aliens (mariners navigating the vessel excepted) are on board or have landed, under a penalty, for omission or for false declaration, of 20*l.*, and 10*l.* for each alien omitted. Every foreigner on landing is required immediately to exhibit any passport in his possession to the chief officer of customs at the port of debarkation, and to state to him, either verbally or in writing, his name, birth-place, and the country he has come from, under a penalty, for neglect or refusal, of 2*l.* The officer of customs is to register this declaration, dever a certificate to the alien, and transmit a copy of the declaration to the secretary of state. On leaving the country the alien is required to transmit to the secretary of state the certificate granted him on landing. The act does not affect foreign ministers or their servants, nor aliens under fourteen years. The proof of non-alienage lies on the person alleged to be an alien. Under 7 Geo. IV. c. 54, aliens were required to present themselves at the Alien-office; but this is no longer necessary.

The registration clause of 6 Will. IV. is generally disregarded by foreigners, and is never enforced, for there is no provision in the act for recovering the penalty. In 1842, out of 11,600 foreigners who were officially reported to have landed, 6084 only registered according to the act; but in the same year, out of 794 who landed at Hull, only one registered; at Southampton, out of 1174, not one; and of those who landed at London, not one-half. At Liverpool no return was kept of the number of foreigners who landed, and there was no instance of one who registered. There are two alien clerks at the port of London, and one at Dover, but at other ports the business is done by the officers of customs.

Under the act 7 Geo. IV. c. 54, the number of foreigners who arrived and departed during the year was ascertained; but it is said that the papers have been destroyed. The returns under the census of 1841 do not distinguish foreigners from British subjects born in foreign parts. The total number of foreigners and British subjects born abroad, and who were resident in Great Britain on the 6th of June, 1841, was 44,780, of whom 38,628 resided in England, and 19,931 of this number were returned in the counties of Middlesex and Surrey. The number of foreigners naturalized previous to the passing of 7 & 8 Vict. did not on an average exceed seven or eight a year, and the number who applied for letters of denization did not exceed twenty-five annually.

ALIMENTUS, CINCIUS. [CINCIUS ALIMENTUS, P. C. S.]

ALISON, REV. ARCHIBALD, was born in 1757, in Edinburgh, of which city his father, Andrew Alison, was a magistrate. In 1772 Archibald was sent to the University of Glasgow, whence he proceeded, with an exhibition, to Balliol College, Oxford, where he matriculated, Nov. 9, 1775. He took the degree of A.M., and that of LL.B., March 23, 1784, in which year he entered into holy orders, and married the daughter of Dr. John Gregory of Edinburgh; he was soon afterwards appointed to the curacy of Brancepeth, in the county of Durham. He obtained the perpetual curacy of Kenley in Shropshire in 1790, a prebendal stall in Salisbury Cathedral in 1791, the vicary of Ercall in Shropshire in 1794, and the living of Roddington in Shropshire in 1797, amounting altogether to about 800*l.* In 1800 he was invited to become senior minister of the episcopal chapel, Cowgate, Edinburgh. He accepted the invitation, and continued to officiate for the congregation, which afterwards removed to York Place, till 1831, when severe illness compelled him to withdraw from the performance of his public duties. He died in 1839, at the age of 82. He was much respected for his private character, was in habits of intercourse with the most distinguished literary men of Edinburgh, and was much admired as a preacher.

The Rev. Mr. Alison was the author of 'Essays on the Nature and Principles of Taste;' 'Sermons, chiefly on Particular Occasions,' 2 vols. 8vo., 1814, 1815, and several editions since; and 'A Memoir on the Life and Writings of the Hon. Alexander Fraser Tytler, Lord Woodhouslee,' in the 'Transactions' of the Royal Society of Edinburgh, 1818.

His literary reputation chiefly depends on his 'Essays on Taste,' which were first published in 1790, but which made little impression on the public till the second edition, with additions, came out in 1811, when the work became the subject of an encomiastic article by Jeffrey, in the 'Edinburgh Review,' and it then became popular; its popularity however has long been on the decline. The work consists of two essays: the first 'Of the Nature of the Emotions of Sublimity and Beauty;' the second 'Of the Sublimity and Beauty of the Material World;' the whole work is divided into chapters, sections, and parts, with much appearance of philosophical accuracy, but with little either of comprehensiveness or precision in the treatment of the subjects. His notion of sublimity is vague: sometimes he seems to understand the word in the common acceptation, as supereminent grandeur of any kind; sometimes in the sense in which it is used by Longinus, as anything calculated to produce a powerful emotion. The vagueness of his notion of beauty may be more easily excused, since, as the term is generally applied to any object of nature or art calculated to produce a pleasing feeling in the mind, the causes of the emotion of beauty are necessarily multifarious, and subject to no general rule: the forms, sounds, and colours of nature, for instance, having laws respectively appropriated to each, on which the feeling of delight depends, and which are applicable to all minds, while, in works of art, the causes of delight are perhaps still more varied, having reference not only to the invariable laws of nature, but to special circumstances connected with the art and artist. Alison does not treat of taste as an appreciating and discriminating faculty of the mind depending on the judgment, or as the judgment applied to the fine arts and to the objects and scenes of nature about which those arts are conversant, but as an emotion caused by objects or scenes calculated to excite certain associations of ideas and trains of thought, which, according to him, are the real causes of the emotion. His views are indeed little better than a series of opinions formed with little power of thought, and falsified in many parts by the application of the doctrine of association, which, however true as applied to particular cases, is not true when applied as the primary cause of the emotions of sublimity and beauty, and still less true as the leading principle of taste itself. His style is not unpleasing, but it is very diffuse, and deficient in distinctness and precision.

(*Biog. Dict.* of the Society for the Diffusion of Useful Knowledge; *Gent.'s Mag.*, Sept. 1839.)

ALKALIES—*Medical Properties of.* These bodies, once considered to be simple, are now known to be (with the exception of ammonia) combinations of oxygen with a metal. They have a great affinity for water, and very readily absorb watery vapour from the atmosphere. Their chief characteristic is the facility with which they unite with acids to form salts, compounds which are readily resolved by galvanism, when the acid goes to the positive pole, the alkali to the negative. They also change many vegetable infusions to a green colour, and restore to their primitive hue those which have been reddened by an acid. Their power in this respect was formerly held to be indicative of the presence of an alkali, but as it is shared by many other bodies, it is by no means conclusive. (Faraday.) Those combinations of an acid with an alkali which did not affect the colour of vegetable infusions were termed *neutral* salts; if they reddened infusions of a blue colour, this was attributed to the acid being in excess or larger proportion, and they were termed *acid* salts; while if they affected them as alkalies commonly do, they were termed *basic.* All these terms are objectionable, since the actions depend more on the power than the quantity of acid or the base, as the alkali was called. More accurate phraseology now prevails among chemists. Alkalies, strictly speaking, are only three in number, viz. soda, potassa, and ammonia. These are termed inorganic, to distinguish them from the organic substances, which are more properly called ALKALOIDS [P. C. S.], or Organic Alkalies. Strontian and barytes have sometimes been deemed alkalies, as well as magnesia and lime: these last are frequently termed alkaline earths. The alkalies are possessed of the alkaline attributes in the highest degree, are very acrid and caustic, readily soluble in water and alcohol, and form with carbonic acid salts very soluble in water: the alkaline earths are less caustic, sparingly soluble in water and alcohol, and form, with one proportion of carbonic acid, salts which are almost insoluble in water; but when carbonic acid is present in excess, the base is nearly completely dissolved, a circumstance which explains their presence in many mineral-waters when they first issue from the spring, but from which they are precipitated on exposure to the air. An imitation of this state in respect to magnesia has greatly facilitated the exhibition of it by forming a perfect solution of it. This is best done by putting a quantity of magnesia with water into a strong bottle, and introducing a sufficient amount of carbonic acid, when it is to be immediately corked and sealed.

It is impossible to exclude magnesia and lime from consideration when treating of alkalies, but the remarks which follow are chiefly intended to apply to soda, potassa, and ammonia. The two former are termed *fixed*, the latter *volatile:* soda is likewise termed the *mineral* or *fossil* alkali; while potassa is termed the *vegetable* alkali, or sometimes merely *kali.* The salts formed with alkalies are apt to *effloresce*, and resolve the crystals into the state of powder, or to absorb water from the air, and *deliquesce* or become liquid.

Alkalies in a pure state are extremely caustic, destroying the tissues with which they come in contact, and forming an escar which is deep if the alkali be confined, extensive and superficial if allowed to spread. This seems to depend on their strong affinity for water: hence they act as violent corrosive poisons, and are never used in a pure state, save in surgery to open abscesses or to form caustic issues. Diluted with oils they constitute rubefacients, particularly ammonia. Their causticity is also greatly lessened by combination with carbonic acid, and is more subdued by an excess of the acid; hence bi-carbonates are less caustic than sesqui-carbonates, and these last than carbonates. The carbonic acid is apt to fly off on exposure to the air, so that they regain their causticity. Carbonate of ammonia will altogether disappear if not kept in a well stopped bottle; this tendency is one source of its utility when used as smelling salts.

When suitably diluted with water or by combination with carbonic acid, so as to be safely applied to the tongue, alkalies have a taste peculiar, and to most persons unpleasant, which is designated *alkaline*, for want of anything similar to which to liken it. Ammonia and its carbonates are likewise pungent. They exercise an immediate influence on the fluids of the mouth and alimentary canal, as far as they pass unchanged. They neutralize all acids they meet with in their course, and render the mucus, and perhaps some other secretions, thinner and more watery. That they are readily absorbed into the circulating mass, on which they have a marked influence, is certain; but they are for the most part speedily eliminated, the kidneys appearing to be the channels by which they are thrown out of the system. Many alkaline compounds, as well as the uncombined but diluted alkalies, increase the secretion of urine, and change its nature if long persevered in, altering it from an acid to an alkaline state. This is particularly the case when the compound is one of carbonic acid, or of a *vegetable* acid with the base, all of which are decomposed in transitu, as first remarked by Sir Gilbert Blane, and produce on the urine and the system generally ultimately the same effects as the pure alkalies. The alkalies possess a power of rendering albumen soluble: unboiled white of egg is an albuminate of soda. The albumen of the blood is rendered more fluid by alkalies; hence in excess they impair the plastic power of that fluid.

These facts seem all that are requisite to form a correct estimate of their therapeutic powers and employment. Their caustic and rubefacient properties fit them for external use. Their internal employment is regulated by a variety of indications, but it is chiefly as antacids, or to counteract acidity in the stomach and primae viae, and as diuretics, and to dissolve calculi in the kidneys or bladder, and as refrigerant or cooling medicines in inflammatory diseases, that they are used. Many persons, soon after food has been taken into the stomach, are distressed with heartburn and other signs of indigestion, and either have the urinary secretion in an unhealthy state, or, if they be of a gouty disposition, have frequent attacks of gout. Such persons feel relief by taking some alkaline medicine after meals, or have recourse to them because others use them. When uric or lithic acid exists in the urine, such means may be proper; but this point should be ascertained before having recourse to measures which, when not appropriate, are far from being harmless. Some acid, either hydrochloric or acetic, is essential to sound digestion: to neutralize these is to retard and disturb that process. Other acids, especially lactic, in bilious persons and those who use sugar or saccharine fruits in excess, occur, and require to be obviated; but the proper time for taking, as well as the proper quantity to be taken, requires much judgment. Assuming that some alkali is proper, Sir B. Brodie thinks from three to four hours after each of the principal meals, especially dinner, the most suitable time. (*Lectures on the Urinary Organs*, 3rd ed. p. 203; and *Medical Gazette*, vol. xxiii. p. 151.) Dr. Prout makes a similar remark with respect to alkaline mineral-waters. A variety of circumstances regulate the alkali to be selected. From their greater causticity, the pure alkalies can rarely be persevered in sufficiently long, even when taken in such bland vehicles as veal-broth. The alkaline carbonates are better borne, and bi-carbonate of potass more easily than carbonate of soda. Their unpleasant taste constitutes an objection with many: this is in some degree obviated by giving them in the condensed form recently devised by Mr. Brockedon, or in an effervescing state with an excess of alkali, as recommended by Sir Gilbert Blane. If taken unnecessarily or persevered in too long, much evil is done: not only is an alkaline state of urine induced, with a deposition of the phosphates, as indicated by a white sabulous sediment, or an iridescent pellicle on the surface of the urine, but much general debility is caused.

'Other ill consequences follow the too liberal use of alkalies: they alter the quality of the blood. After some time the patient is liable to petechiæ; he perspires too easily, becomes low-spirited, and less capable than when in health of physical exertion.' (Brodie, *l. c.* p. 202.) As effervescing or saline draughts, made with a *vegetable* acid and some alkaline carbonate, are much used at the beginning of inflammatory diseases for their reducing and refrigerant effects, the same caution is requisite lest they be pushed too far. This is also needful in the case of soda-water (when it really contains soda, and not merely carbonic acid, as is frequently the case), citrated alkali, imperial and other drinks much used in warm weather. Scrofulous persons can least of all bear up against the abuse of these, yet for such are they unfortunately most employed. Weak vegetable acids will be found more beneficial.

ALKALOIDS—*Medical Properties of.* These substances, which modern chemistry has made known, are termed sometimes *vegetable* alkalies, as being hitherto found exclusively in vegetables, and also *organic* alkalies, from requiring a vital power to effect their formation; but the name given to them above is the most appropriate. They possess alkaline properties in the lowest degree, and are either tasteless or have a bitter acrid taste, existing generally in a solid, mostly crystalline form; some however are amorphous (Aconitinae), occasionally in a liquid state (Conia and Nicotina), the latter very volatile, and readily undergoing decomposition, with an evolution of ammonia, at a moderate temperature. The point in which they differ most from the common alkalies (except Ammonia) is in having nitrogen in their composition, one of them (Caffeina) being perhaps the most highly nitrogenized compound known. Sometimes one only exists in a plant, sometimes several in the same plant, *ex.* opium. Generally they are combined with an acid; most frequently it is a peculiar acid. Many of them are with difficulty soluble in water, more so in alcohol; they rarely completely neutralize acids, but the salts which they form are more soluble than the bases; hence various of their salts are used in medicine in preference to the primitive article.

Their great characteristic is the extraordinary action most of them have on the human system in a very small dose, and indeed several of them are, in very minute quantity, deadly poisons. 'No remedy, devoid of nitrogen, possesses a poisonous action in a similar dose; but it is certainly not in direct proportion to the quantity of nitrogen. Solania, and picrotoxia, which contain least nitrogen, are powerful poisons. Quinia contains more nitrogen than morphia. Caffeina and theobromina, the most highly nitrogenized of all vegetable principles, are not poisonous.' (Liebig, *Animal Physiology*, 1st ed. p. 177.) This author conjectures that they owe this great power to having a composition analogous to that of the nerves and brain; but points so hypothetical need not be discussed here.

Having been first detected in plants long used as medicines (Cinchona), it is chiefly among medicinal plants that they have been sought for and found. By many they are regarded as the active principle of these, and their extraction has had the great advantage of enabling medical men to administer their remedies in a smaller bulk and more convenient form. As the most important of them have been already treated of under the names of the plants which yield them, it is not necessary to notice any of them further here, except to state that chemists have recently rendered a great service in forming a neutral sulphate of quinine, which is much more soluble than the disulphate.

ALLAN, DAVID, called the Scottish Hogarth, was born at Alloa in Stirlingshire, in 1744, where his father was shoremaster. The choice of his profession was partly owing to an accident; he burnt his foot, and while he was being nursed at home, having nothing else to do, he amused himself with drawing with a piece of chalk upon the floor, an amusement he got so much attached to, that when he recovered he had a very great objection to going to school. But he soon obtained a happy release from this obligation, for his old schoolmaster turned him away from the school, for making a caricature of him punishing a refractory boy. The caricature seems to have had merit, and Mr. Stuart, collector of the customs at Alloa, was so much struck with it, that he recommended Allan's father to send him to the academy of Robert and Andrew Foulis at Glasgow, to learn to become a painter. He was according apprenticed in 1755, his eleventh year, to Robert Foulis, to learn drawing, painting, and engraving. Allan remained at this academy nine years, and when he returned home, he had the good fortune to be introduced by Lord Cathcart as a native prodigy to Erskine of Mar, on whose estate he was born, and by whom he was generously sent as a pensioner to prosecute his studies at Rome. At Rome he was introduced to Gavin Hamilton, who was of great assistance to him in his professional pursuits. Allan proved himself worthy of the generous patronage he enjoyed: he raised hopes however while at Rome which he never realized afterwards.

He obtained first a silver medal for a drawing in the Academy of St. Luke, and afterwards the gold medal for painting. The subject was the legend of the Corinthian maid who drew the profile of her lover around his shadow cast by a lamp upon the wall. The picture was well painted, and a good engraving of it by Cunego spread Allan's reputation throughout Italy; and his praises reached even his own countrymen; it was however the first and last good picture he ever painted. His subsequent works were distinguished for humour and feeling, but in execution, whether as paintings or engravings, they are very inferior.

He painted two other pictures at Rome, the Prodigal Son for Lord Cathcart, and Hercules and Omphale for Erskine of Mar; and he made also four humorous designs illustrating the Roman Carnival, which through Paul Sandby's prints of them became very popular, and they gained Allan a considerable reputation for broad humour. But he no more deserved the title of the 'Scottish Hogarth,' which for these and a few other similar designs he obtained in Scotland, than his historical pictures would warrant his being called the Scottish Raphael. 'He is among painters,' says Allan Cunningham, 'what Allan Ramsay is among poets—a fellow of infinite humour, and excelling in all manner of rustic drollery, but deficient in fine sensibility of conception, and little acquainted with lofty emotion or high imagination.'

In 1777 Allan visited London, which however he left for Edinburgh, after practising there for a short time as a portrait painter. After the death of Runciman in 1786, Allan succeeded him as master of the Trustees' Academy, which office he held for ten years, until his death in 1796. He left a son and daughter; the former went in 1806 as a cadet to India.

Allan's most popular designs are his Twelve Illustrations of Ramsay's Gentle Shepherd, which he engraved himself in aquatinta, and published with an edition of the poem, with some prefatory remarks, as a sort of apology for the humbleness of the style of his designs. He made also some designs for the lyric poems of Burns, who complimented the painter in his letters to his friend Thomson, on more than one occasion. Burns also found fault with Allan's 'stock and horn,' a rude musical instrument which he put into the hands of some of his characters. Burns offered to send him a real one, such as the shepherds used in the braes of Athol. 'If Mr. Allan chooses,' says Burns, 'I will send him a sight of mine, as I look on myself to be a kind of brother brush with him. "Pride in poets is nae sin;" and I will say it, that I look on Mr. Allan and Mr. Burns to be the only genuine and real painters of Scottish costume in the world.'

Allan however did not think that Burns's stock and horn were any improvement upon his own; he said it was only fit for 'routing and roaring.'

In another letter, Burns, speaking of Allan's illustrations of his works, says, 'Woo'd and married an' a' is admirable; the grouping is beyond all praise; the expression of the figures, conformable to the story of the ballad, is absolutely faultless perfection. I next admire Turnimspike.' Others of these designs which were successful were the 'Gaberlunzie Man,' 'Maggie Lauder,' and 'John Anderson my Jo.' Allan made also several designs of another description, as the Escape of Queen Mary from Lochleven Castle; several homely scenes, as the Scotch Wedding, the Highland Dance, the Repentance-Stool, &c., and some sketches of Scotch scenery.

(Cunningham, *Lives of British Painters*, &c.)

ALLEGATION, ECCLESIASTICAL, is the term applied to the first plea in testamentary causes: in criminal proceedings (ecclesiastical) the first plea is called Articles; in plenary or ordinary causes the first plea is called the Libel. This first plea is analogous to a declaration at common law or to a bill in equity. The term Allegation is also applied to every subsequent plea, in all causes. The first plea given in by a defendant is called a Responsive Allegation; the plaintiff's answer to that is called a Counter Allegation. The pleadings are not usually carried beyond this step. Besides these allegations, either party in the case is allowed to except to the credit of any witness upon matter contained in his deposition. These exceptive allegations, when admitted, are proceeded upon in the same manner as other pleas.

(Phillimore's ed. of Burn's *Eccl. Law.*)

ALLEN, JOHN, M.D., a writer on subjects connected with metaphysics, history, and physiology, was born in January, 1770, at Redford in the parish of Colinton, near Edinburgh. The small domain of Redford, situated on the slope of the Pentland hills, was his paternal property, and the mansion-house still attests the moderate but substantial wealth of his ancestors. He studied at Edinburgh, where he took a degree in medicine in 1791. He soon afterwards connected himself with those movements in Scotland for the furtherance of parliamentary reform, which called down the vengeance of the government. In 1795 he published 'Illustrations of Mr. Hume's Essay concerning Liberty and Necessity,' in answer to Dr. Gregory of Edinburgh, by a Necessitarian. This small tract is in many respects characteristic of his subsequent more distinguished works, in the felicity with which it adopts a broad and comprehensive view, as well as in the clearness with which it adheres to one unbroken line of reasoning, and keeps clear of divergencies and incidental questions. It is an exposure of the fallacious assumption that Hume's theory of cause and effect did not make allowance for unseen causes. This celebrated theory had been held to contain a principle not realized in nature, that in all cases the same apparent cause is followed by the same apparent effect. Gregory's attack was made in diagrams, and Dr. Allen's answer was in the same form, showing that Gregory's reasoning was accurate, but his description of Hume's opinion erroneous. In 1801 he translated from Cuvier, whose friendship he enjoyed, 'An Introduction to the Study of the Animal Economy.' It appears to have been about the commencement of this century that he formed an intimacy with Lord Holland, with whom he continued to reside until that nobleman's death. The connection between them appears to have rested on the foundation of common tastes and opinions and mutual esteem, not on patronage on the one hand and servility on the other. After the peace of Amiens Dr. Allen accompanied Lord and Lady Holland through France and Spain, and resided with them in the latter country until the year 1805. He made large collections relating to the past history of Spain, and to its social and political position. He had formed high hopes of the prospects of the Spanish people—hopes destined to be bitterly disappointed, as each effort to regenerate them sunk under anarchy or despotism, and the mortifications to which his zealous feelings in their favour were exposed, appear to have in his latter days damped his ardent admiration of free institutions. He became an extensive contributor to the 'Edinburgh Review,' on subjects chiefly connected with the British constitution, and with French and Spanish history. Forty-one articles in that periodical are attributed to him, and his researches in a great measure serve to establish and characterize its opinions on constitutional questions. His earliest papers were on Spanish and South American subjects, and among those attributed to him are—Bourgoing, 'Tableau de l'Espagne Moderne,' October, 1804; Helms' 'Travels from Buenos Ayres,' October, 1806; 'Mercurio Peruano de Historia,' &c., January, 1807; Molina's account of Chili, July, 1809; Laborde's View of Spain, October, 1809; Humboldt's 'Essay Politique sur la Nouvelle Espagne,' April, 1810, and November, 1811. The earliest article on constitutional subjects attributed to him is that on the Regency question, May, 1811. In the number for June, 1816, an elaborate essay on the constitution of parliament, full of original investigation, is believed to have been from his pen. He wrote in the same periodical some papers on the History of England by Lingard, which occasioned a pamphlet controversy with that author, chiefly relating to the massacre of St. Bartholomew, the authorities for which he charged Lingard with having referred to at second hand. The latest article which he is supposed to have contributed to the Review is that on Church Rates, October, 1839. He wrote the History of Europe in the Annual Register for 1806; and in 1820 a 'Biographical Sketch of Mr. Fox.' In 1830 he published a small but valuable constitutional work, called an 'Inquiry into the Rise and Growth of the Royal Prerogative in England.' He maintains that by the older constitution public acts were not performed by the English kings until after their coronation; and it is a remarkable circumstance of a general constitutional doctrine standing the test of minute chronological inquiries, that while Dr. Allen states the reign of Richard I. to be the only exception to this practice, Sir Harris Nicolas, in his 'Chronology of History' (p. 276), shows that in Rymer's 'Fœdera,' and other collections of documents, the regnal years of that reign are ante-dated by a year. Dr. Allen published several other pamphlets, some of them on subjects of comparatively temporary interest. He was a member of the Record Commission, and the only other office he ever held was that of under-secretary of the commissioners for treating with America in 1806. He died April 3, 1843. He left his medical books and MSS. to his early friend Dr. John Thomson, emeritus professor of pathology in the University of Edinburgh—and his other MSS. he bequeathed to Colonel Fox. We believe it is in contemplation to print a collected edition of his works. His character has been eloquently drawn by his friend Lord Brougham, in the third series of the 'Historical Sketches of the Statesmen of the time of George III.,' p. 342-348.

ALLEN, WILLIAM, was born on the 29th of August, 1770. His father, a silk-manufacturer in Spitalfields, and a member of the Society of Friends, intended to bring him up to his own business, but having at an early period shown a predilection for chemical and other pursuits connected with medicine, he was placed in the establishment of Mr. Joseph Gurney Bevan, in Plough-court, Lombard-street, London, where he acquired a practical knowledge of chemistry. He eventually succeeded to the business, which he carried on in connection with Mr. Luke Howard, and acquired great reputation as a pharmaceutical chemist. About the year 1804 Mr. Allen was appointed lecturer at Guy's Hospital on chemistry and experimental philosophy, and he did not wholly retire from this institution until 1827. He was elected a Fellow of the Royal Society in 1807, and the Society's 'Philosophical Transactions' contain accounts of several of the more important of his chemical investigations, which were carried on in conjunction with his friend Mr. Pepys. They established the proportion of carbon in carbonic acid, which was different from that adopted at the time in all systems of chemistry; and they also demonstrated that the diamond was pure carbon. The 'Philosophical Transactions' for 1829 contain a paper by Mr. Allen, based on elaborate experiments and calculations which he had made on the changes produced on atmospheric air and other gases by respiration. Mr. Allen was mainly instrumental in establishing the Pharmaceutical Society, and he was the president of this institution at the time of his death. Besides his public labours as a practical chemist, astronomy was a private study which he pursued with much delight in his hours of relaxation. Many years before his death, Mr. Allen purchased an estate near Lindfield, Sussex, and withdrew from business. Here, while still zealously engaging in public schemes of usefulness and benevolence, he carried out various philanthropic plans of his own, which reflect the highest honour on his character. The commodious cottages which he erected on his property, with their combination of comfort and convenience, were at once proofs of his kindness of heart and the enlightened benevolence which sought by this means to improve and elevate the character of the rural population. To each cottage an ample allotment of land was attached. He was if possible still more anxious to make provision for the education of the young. In 1825 he established day-schools at Lindfield, and in 1834 a department was added for boarders. The school-buildings and premises comprised a building for boarders, twenty of whom could be accommodated, school-rooms for boys and girls, an infant-school, workshops, outhouses, playgrounds, and there were about three acres of land cultivated on the most approved system by the boarders, who also took a part in household work. The subjects taught were land-surveying, mapping, the elements of botany, the use of the barometer, rain-gauge, &c., and to encourage the scholars to advance in their studies beyond the ordinary routine of common day-schools, there was a good library with various scientific and useful apparatus, including a galvanic battery, an electrical machine, an air-pump, a magic-lantern (used as a magnifier for illustrating vegetable physiology), and a representation of the solar system. Mr. Allen himself delivered lectures periodically to the boys on subjects connected with their probable future avocations. Soils and manures were analyzed, and models were exhibited showing the laws of friction on common roads, and the plans and mode of working various machines. This brief notice of the institution will be sufficient to show the intelligent spirit which directed Mr. Allen's benevolent efforts. He died at his house near Lindfield, December 30, 1843. (*Pharmaceutical Journal and Transactions* for February, 1844; *Minutes of Committee of Privy Council*, 1842-3, 'Lindfield School,' p. 551.)

ALLO'RI, the name of two distinguished Italian painters, father and son, though different in style.

The father, Alessandro Allori, was born at Florence in 1535, and was brought up by his uncle Angelo Bronzino, likewise a very distinguished painter. Allori, from his connection with his uncle, was also frequently called Bronzino, and he sometimes wrote the name upon his pictures. He was one of the most distinguished painters of the anatomical school, and was a devoted admirer of Michelangelo; but he appropriated nothing more of that great master than his affected display of anatomy, which Allori seems to have considered the greatest quality in art; in 1590 he published a treatise upon anatomy for the use of artists. He died in 1607, and his portrait by himself was placed in the Florentine gallery of painters' portraits.

Allori's works, both in oil and fresco, are numerous, and many on a large scale; his greatest work is the Montaguti Chapel in the church of the Annunciata, painted in oil in 1582. He has painted there, a Last Judgment, Christ disputing with the Doctors, and Christ driving the money-changers from the Temple. In the second he has introduced the portraits of Michelangelo and Giacomo da Pontormo in their own costume, besides several other portraits of his contemporaries. He was an excellent portrait-painter, and he constantly introduced portraits of his friends into his historical pieces.

The son, Cristofano Allori, born at Florence in 1577, was a better painter than his father, whose style he abominated; he used to call him a heretic. He studied with Gregorio Pagani, and rivalled that painter in richness of colour, and surpassed him in delicacy of execution. But he was idle and fastidious, and his works are scarce. In execution he was equal to anything, and he had of course a corresponding skill in copying. He is said to have made some copies of Correggio's Magdalen, with slight alterations in the background, which now pass as duplicates by Correggio; he generally made a slight variation in the background: the original of this work is at Dresden; that which the Roman government recently forced Vallati, an animal painter, to return to its former owner, from whom he had purchased it in a disfigured state some months before for 15 scudi, may be one of these copies by Allori. It seems it had been carefully but badly painted over, probably during the French revolution, to preserve it. The fact was forgotten by or unknown to its present possessor, a few years ago, and he sold it as a picture of no value. Vallati, who bought it, discovered in cleaning it, that there was another picture beneath, but as soon as he had recovered the original painting, it was reclaimed by the nobleman who sold it, and the Roman government forced Vallati to restore it; it is perhaps even more beautiful than the picture at Dresden, and is now valued at 5000*l.* sterling: the background differs slightly from that of the Dresden picture. Cristofano was an excellent landscape-painter. His masterpieces are considered the Miracle of San Giuliano, in the Pitti gallery; San Manetto, in the church de' Servi; Judith and Holophernes; and a Magdalen, which was the portrait of his own mistress, a very beautiful woman. The Judith is also her portrait, and the Holophernes was painted from himself: it was engraved by Gondolfi for the 'Musée Napoléon.' He died in 1621: his portrait is likewise in the Florentine portrait gallery.

(Baldinucci, *Notizie de' Professori del Disegno*, &c.; Lanzi, *Storia Pittorica*, &c.)

ALLOTMENT SYSTEM may be defined to be the cultivation of small portions of land by agricultural labourers and other classes of workmen at their leisure, and after they have performed their ordinary day's work. It is desirable that every country labourer should have a garden attached to his cottage for the growth of vegetables. In villages where the houses are not detached this cannot always be done, and the most convenient mode of giving them gardens is to divide a field near the village into small allotments. There are some instances of this plan having been resorted to about the close of last century, and the bishop of Bath and Wells commenced the letting of allotments in 1807; but it is only since 1830 that its adoption has become common. In 1830 the agricultural districts in the south of England were almost in a state of insurrection. The labourers went about in bands destroying thrashing-machines, and demanding higher wages; and at night the country was lighted up by incendiary fires.

Under the impulse of fear the farmers increased the wages of the labourers, but on the suppression of the disturbances they generally returned to the old rates. The season of alarm did not however pass away without some attempts being made to improve the condition of the agricultural labourer, and the extension of the allotment system was the most general mode by which an attempt was made to accomplish this object. A society, called the Labourers' Friend Society, was established in London, to promote the allotment system, and to circulate information respecting it. Allotments (garden-allotments, or field-gardens, as they are sometimes termed) are now common in all the agricultural counties in England; but they are nowhere universal. In East Somerset they are to be found in about 50 parishes; and the quantity of land devoted to allotments is said to be equal to the demand. At Farnley Tyas, Yorkshire, the tenantry of the Earl of Dartmouth have agreed to allot a rood of land to the cottage of each labourer employed on their farms, the rent to be charged at the average rent of the farm, with the addition of rates and taxes.

In several of the northern and midland counties the allotment system is promoted, and in some degree superintended, by a society called the Northern and Midland Counties Artisans' Labourers' Friend Society. The number of acres under allotment, according to the report of this society, in June, 1844, was 1082. There are several similar societies in the manufacturing districts; and the plans of some of them do not much differ from the social schemes of Mr. Owen. The Ruddington Land Allotment and Provident Fund Society, in December, 1844, purchased forty-two acres of freehold land, on which it is intended to erect 160 five-roomed cottages, but each member of the society will be invested by the trustees with the freehold of his cottage and garden, at the cost price. An industrial school is to be erected in the centre of the allotments. At Rotherham a Land Allotment Society has been established for the purpose of purchasing one rood of land for each of its members by payments of seven pence a week. The society has already obtained possession of four and a half acres, which, in the last week of December, 1844, was divided into fourteen allotments and balloted for. The cost of the land was 318*l.* In the case of these two societies the object is to become proprietors of land. It is scarcely necessary to remark that the members of these societies are not agricultural labourers. Allotments are also found in the neighbourhood of several large towns, and the proprietors of factories have in many instances granted allotments to their workmen; but in both these cases the land is more frequently cultivated rather as a recreation than with a view of adding to the means of subsistence. It has happened however, that in periods of manufacturing distress workmen employed in factories have been enabled to keep out of the workhouse with the aid of an allotment. At Nottingham land belonging to the corporation is divided into about 400 gardens, which are let at the rate of 1½*d.* a yard, or 25*l.* per acre: the greater number of these gardens have been cultivated for about 30 years. Where the tenant is an agricultural labourer, the main object is to increase his resources, and thus enable him to maintain himself without assistance from the poor's rate. There seems to be good authority for stating that the allotment system has been successful in this object; and that it has not only diminished the incentives to crime, but has encouraged habits of sobriety and industry, and led to a general improvement of character. Of 3000 heads of families holding allotments of land in West Kent, not one was committed for any offence during the years 1841 and 1842. In the parish of Hadlow, Kent, there were 35 commitments in 1835, and on the allotment system being introduced in 1836 the commitments were reduced in 1837 to one, and from 1837 to 1843 there had been only one. About 15 of those who were committed in 1835 became holders of allotments, and up to June, 1843, no cause of complaint had arisen against any of them. (Evidence of Mr. Martin: *Report on Allotments of Land.*) Of 443 tenants of allotments under Mrs. Davies Gilbert, in Sussex, there was only one person convicted in the course of 13 years. (*Communication from Mrs. Davies Gilbert*, April, 1844.) Mr. Wilmot, agent to the duke of Newcastle, who has laid out nearly 2000 garden allotments in Nottinghamshire, says, 'Numbers who, before they had gardens, were habitual drunkards, and reckless of every right feeling, have by degrees come round to a more steady course, and now spend their money in buying seed, manure, &c., instead of resorting to the beer-shop.' The tenants of these 2000 gardens consist of agricultural labourers, colliers, and mechanics. Similar testimony might be collected from various parts of the country where the allotment system prevails. The punctuality with which the rents are paid by the tenants proves how highly the labourers value their patches of land. Among Mrs. Davies Gilbert's numerous tenantry only three have failed to pay their rent in the course of 14 years; but in each case the size of the allotment (five acres) must be considered as taking it out of what may fairly be considered the allotment system. Captain Scobell, who was one of the earliest, and is now one of the most extensive, promoters of the system, estimates the loss from non-payment of rent as one-fourth, and certainly not more than one-half, per cent.

The great obstacle to the progress of the allotment system is the difficulty of obtaining land; but the landowners are much more favourable to it than the farmers, whose objections are—that the time which the allotment requires interferes with the labourer's ordinary employment; that it makes them too independent, and less anxious to obtain work; and, thirdly, they object that it affords a cloak for theft. These objections have frequently been entirely given up after the farmers have become practically acquainted with the operation of the system.

The principal rules which experience has shown to be best calculated to render the allotment system successful are the following:—As it is not intended that the tenant should look upon his plot of ground as a substitute for wages, but merely as a small addition to this main resource, its size should not be greater than can be cultivated during the leisure or spare time of the labourer or his family. The size of the allotment is determined by the number of the tenant's family, or the quality of the land, and in some cases by the quantity of manure which can be collected. The maximum size of allotments, according to Captain Scobell, should not exceed 50 or 60 rods, and 20 rods are sufficient for a person just settled and without a family. The size of Mrs. Davies Gilbert's allotments are as follows:—255 less than a quarter of an acre; 108 quarter-acres; two contain 60 rods each; 13 are half-acres; two are three-quarter acres; 22 are one-acres; 16 others contain two, four, and five acres; and one is of nine acres. Some persons state that a man in full employ can manage an allotment of a quarter of an acre, or 40 rods; but others are of opinion that 20 rods are quite enough. Lord Willoughby D'Eresby, in a letter which he published in November, 1844, proposes that every man of good character on an estate should have a quarter of an acre of garden-ground along with his cottage, which should be let to him by the landowner, and not by the farmer. To one-half of the whole number he would let additional allotments of three acres of pasture-land, or so much as would enable the cottager to keep a cow and three or four sheep; and further to carry out his views he would have farms on the estate of about 40 acres each, as an encouragement to the labourer to aspire to advancement in life. The diversity of views which are entertained as to the size of allotments may be explained by the fact that in one district the labourer may not be fully employed by the farmer, while in another, under a better system of farming, he may be employed at piece-work to the full extent of his powers. The allotment should be situated as near as possible to the tenant's cottage. Captain Scobell says that the distance should never exceed a mile, as the labourer will be fatigued by a longer walk, and it will be inconvenient to send so far for vegetables for daily use; and in fact this distance is far too great. In Kent there are allotments which are two or three miles from the labourer's dwelling, but this is a proof that employment is precarious, and that on the whole his condition is not good.

A much higher rent can be obtained for small allotments under garden tillage, than for land in undivided tenancy; and it is but reasonable that the owner of 100 acres divided into half-acre allotments, and having 200 tenants instead of one, should receive additional rent in respect of his additional trouble in collecting the rent, looking after his property, and other expenses that are incident to the division of the land. Those who are conversant with the system say that if the rent is one-third higher, the difference is not unreasonable; but as allotments are at present granted as a matter of favour, they are not always set at a rack-rent. Many persons recommend the landowner to take the cottages on each farm into his own hands, instead of allowing the farmer to let them. It is usual for the landlord to include tithes, parochial and other rates, in the rent, in order to save trouble, and to prevent the tenant being unexpectedly and frequently called upon for money payments. The rent of 137 acres belonging to Mrs. Davies Gilbert, divided into 419 allotments, is 428*l.* 8*s.* 5¼*d.*, or nearly three guineas per acre, which includes rates, tithes, and taxes, but is exclusive of houses and buildings, which are paid for separately. The rents vary from 6*s.* up to 8*l.* an acre. The rent of 15 acres of land belonging to Mrs. Walker Ferrand, near Bingley, which are divided into 59 allotments, is 32*l.* 9*s.*, or 11*s.* for each allotment, averaging as nearly as possible a quarter of an acre each. With the addition of rates and taxes, the cost of the 15 acres amounted to about 40*l.* per annum. The value of the crops for 1844 was estimated at between 400*l.* and 500*l.*, or between 7*l.* and 8*l.* each. The tenants are chiefly employed in the worsted factories. A form of agreement, which is usually signed by allotment tenants, embodies rules for the management of the land, and fixes other conditions for their observance. Spade-culture is insisted upon, and the use of the plough is prohibited; also underletting and working on Sunday. There are instances in which attendance at the parish church is enforced; and in other cases it is merely stipulated that there shall be attendance at some place of worship. The allotment is usually forfeited for non-payment of rent, gross misconduct, commitment for any crime, or wilful neglect of the land. Cottagers without families, those whose circumstances are considered tolerably comfortable, and those whose character is not good, are in some instances not allowed to have allotments. A particular rotation of crops is sometimes required in the agreement. The growth of wheat is not allowed in some cases. Where it is encouraged, it may probably be safely assumed that in that particular district the labourer is worse off than usual. Some recommend that on a half-acre one half should be in wheat and the other half in potatoes; and it is assumed that other vegetables are grown in the garden attached to the labourer's cottage. Captain Scobell thinks it unadvisable to exclude any one from holding an allotment on account of previous bad character, as there is a chance of his being reclaimed. Becoming permanently a pauper is a fit ground for exclusion; but when the tenant receives casual relief on account of sickness or accident, he is not excluded. So long as the tenant observes the conditions of his agreement, it is found useful to stipulate that he shall on no other account be ejected from his land.

There seems to be no doubt that the absolute produce of the soil when cultivated in small allotments is greater than the same land would produce under the ordinary course of tillage by farmers. A much larger quantity of manure is used; in some cases four times as much as farmers are enabled to put upon their land, and a single rod is frequently made to produce vegetables sufficient for the consumption of a labourer's family for six months; but if every labourer had an allotment, the quantity of manure collected could not be so great as it is at present. The disposable produce per acre of land in large farms is of course much greater than when the same quantity of land is divided into small holdings.

Captain Scobell estimates the average value of an allotment at 2*s.* per week, or about 5*l.* per year, and that during the year 20 days' labour is required. The profit is equal to 10 weeks' labour at wages of 10*s.* per week. According to another estimate, the gross profit of half an acre is calculated at 19*l.* The produce consists of 12 bushels of wheat at 7*s.*, and six hundredweight of bacon at 6*d.* per lb.; and something is set down as the value of the straw. The rent, seed, and other expenses, it is said, will amount to 3*l.* 10*s.*, leaving a profit (without deducting the cost of labour) of 15*l.* 10*s.*, which is equal to 6*s.* a week for a whole year. Such an allotment as the one here alluded to will require about 30 days' labour in the course of a year; but it is necessary that the chief part of this labour should be given between Ladyday and Michaelmas. One of Mr. Sutton's allotment tenants at Wiggington, near Tring, stated at the Michaelmas rent-day, 1844, that the value of the produce which he had raised on his quarter of an acre was between 5*l.* and 6*l.* Supposing that there are a million families in England and Wales who are in the same circumstances as the tenants of existing allotments, and that four families had an acre amongst them, the whole quantity of land in allotments would be 250,000 acres, or nearly 400 square miles, which is one-third more than the area of Middlesex, and about the 128th part of the area of England. This would be about one 43rd of all the arable land in England. At three guineas an acre the rent would amount to 787,500*l.*, and the value of the produce, according to Captain Scobell, would be about 5,000,000*l.*

From the Anglo-Saxon period to the reign of Henry VII., nearly the entire population of England derived their subsistence immediately from the land. The great landowner consumed the produce of his demesne, which was cultivated partly by prædial slaves and by the labour of the tenants and cottiers attached to the manor. These tenants were the occupiers of small farms, and paid their rent in kind or in services, or in both. The cottagers had each a small croft or parcel of land attached to his dwelling, and the right of turning out a cow or pigs, or a few sheep, into the woods, commons, and wastes of the manor. While working upon the lord's demesne, they generally received their food. [VILLEIN and VILLENAGE, P. C.] The occupation of the land on a farm of 160 acres, called Holt, in the parish of Clapham, Sussex, has been traced at various dates between the years 1200 and 1400. During the thirteenth and fourteenth centuries, this farm, which is now occupied by one tenant, was a hamlet, and there is a document in existence which contains 21 distinct conveyances of land in fee, described to be parcels of this hamlet. In 1400 the number of proprietors began to decrease; by the year 1520 it had been reduced to six; in the reign of James I. the six were reduced to two; and soon after the restoration of Charles II. the whole became the property of one owner, who let it as a farm to one occupier. (*Quarterly Review*, No. 81, p. 250.) The history of the parish of Hawsted in Suffolk, by Sir T. Cullum, shows a similar state of things with regard to the occupancy of land. In the reign of Edward I. (1272-1307) two-thirds of the land in the parish, which contains 1980 acres, were held by seven persons, and the remaining third, or 660 acres, was held by 26 persons, which would give rather more than 25 acres to each holder. The number of tenants who did suit and service in the manorial court at a somewhat later period was 32; and one tenant was an occupier of only three acres. In the reign of Edward I. there were 50 messuages in the parish; in 1784 there were 52; in 1831 there were 62, inhabited by 88 families; and in 1841 there were 100 inhabited houses, the increase of population being from 414 in 1831 to 476 in 1841. In 1831 there were nine occupiers of land who employed labourers, and two who did not hire labour.

The consolidation of small farms in the sixteenth century, and the altered social state of the country which took place at that period from a variety of causes, dissevered to a great extent the labouring classes from the soil which they cultivated. They had previously produced for their own consumption, and as domestic manufactures were common, each household possessed within itself the means of satisfying its principal wants. They now began more generally to work for money wages; and in vain did the legislature attempt to preserve them from dependence on this source of subsistence, by enacting penalties against building any cottage 'without laying four acres of land thereto.' (31 Eliz. c. 7.) There were still, however, large tracts of waste and common lands on which the cottager could turn a cow, a pig, a few sheep, or geese, and this right still gave him a portion of subsistence directly from the land. The division and inclosure of these commons and wastes completed the process by which the labourer was thrown for his sole dependence on money wages. From the reign of George I. to the close of the reign of George III., about four thousand inclosure bills were passed. Under these allotments were made, not to the occupier, but the owner of a cottage, and this compensation for the extinguished common right generally benefited only the large landholder; and when this was not the case, the cottager was tempted by a high price offered by his richer neighbours, or driven by the abuses of the old poor-law, to part with his patch of land.

So long as the labourer is paid fair wages, he can obtain the chief necessaries of life; yet it happens that in most parts of the country he would be unable to procure any other description of vegetables, except potatoes, unless he had a garden attached to his cottage. No agricultural labourer's cottage should be without a garden where it is practicable. The cottager's garden should be large enough to enable him to grow sufficient vegetables of all kinds for his own consumption; though if potatoes for winter storing can be purchased from his employer, or grown under the usual conditions on a patch of his employer's land, it will be as profitable as growing them himself, that is, if he is in full employment and obtains piece-work at good wages. The necessity for cultivating the land on his own account, further than for the purpose of raising sufficient vegetables for his own consumption, and of looking to the allotment system as a means of remedying the evil of low wages and insufficient employment, is, in proportion to its urgency, an indication of the low position of the agricultural labourer. If he has sunk to this inferior state, and there are no other means of increasing his resources, the allotment system is then an expedient deserving of attention, and at the present time great expectations are entertained of what it is capable of doing for the labourer; but it should be understood that, in an economical sense, it is a more satisfactory state of things when the improvement in the condition of the labourer arises from the prosperity of the farmer and his ability to give higher wages. The profits of the farmer and the wages of the labourer are derived from the same source, and if the latter are reduced to a very low point profits are usually low also. When improvement in the condition of the labourer springs from the allotment system, and not from the wages which he receives, it may generally be assumed either that the resources of the farmer are impaired, or that the labourers are so numerous that they cannot all obtain as much work as they are capable of performing. But if the allotment system be regarded as a means of improving the condition of the labouring class, its operation must necessarily be partial, since it cannot be rendered applicable to the non-agricultural labourers in the large towns, and as to the agricultural labourers there is nothing in their condition to prevent any pecuniary benefit from allotments being followed by a decline in their wages.

The question of the advantages of the allotment system may be reduced within narrow limits. If it be understood in the sense of the definition given of it at the head of this article, the object is rather moral than economical. The allotment system may also be intended, not to change the labourer into an independent cultivator, but to supply him with a means of making a living in those places where his ordinary wages are not sufficient. But, as already observed, this implies and admits that his condition is not so good as it ought to be for his own and the general benefit. There is a superabundance of agricultural labour, or a want of sufficient capital invested in agriculture, in the place of the labourers' residence, or both causes combine to depress his condition. Now it is possible that the allotment system, if carried to any great extent, might contribute to increase the superabundance of labour, by inviting to a district more labourers than are wanted, or by giving them an inducement to marry too soon, and so ultimately to depress the condition of the labourer still further. It is no answer to this, that plots of ground have been and are cultivated by the labourer advantageously to himself and profitably to the owner. It may be admitted that circumstances in any given place may be such, that the distribution of allotments among labourers who are not fully employed, may be of great temporary advantage to themselves and to the neighbourhood. But a continual extension of such allotments in the same neighbourhood, though it might be called for by the wants of the labourers, would be no benefit to that neighbourhood, nor ultimately to the labourers themselves; for the end would be that many of them would be reduced to get their entire means of subsistence out of a small plot of ground. The allotment system then, if carried to this extent, involves the question of the advantage of very small farms as compared with large ones; a question that cannot be discussed satisfactorily without a consideration of the general economic condition of each particular country. But it may be laid down as a sure principle that in a country where a large part of the population are employed in other pursuits than those of agriculture, the necessary supply of food and other agricultural produce, for those who are not agriculturists, cannot be raised so profitably in any way as by the well instructed farmer, who has a sufficient capital to cultivate a large farm; and if the whole country were divided into small farms, the necessary supply of produce for the wants of the non-agriculturists would ultimately fail altogether, For if the small-farm system were gradually extended in proportion to the demand, the result would be that each man must, in the course of this distribution, have just as much as would raise produce enough for himself and his family; and ultimately, he must be content with less than is sufficient, and he would be reduced to the condition of the Irishman who lives on his small plot of land.

There is a difference between small farms of a few acres which are let on lease, and small farms which are a man's property. If all farms were divided into small holdings, there could be little accumulation and little improvement. There is the same disadvantage in small farms compared with great, that there is in small manufacturing establishments compared with large ones. Profitable production is carried on better on a large farm when proper capital is employed (and indeed a large farm without proper capital would ruin any man), than if it were divided into a number of small farms and the same amount of capital were employed; for it is obvious that the amount of fixed capital in buildings, agricultural instruments, and animals must be greater on the small farms than on the large one. There are many other considerations also which show that, as a matter of public economy, the large farms are best for the public, and consequently for the holders of such farms. The small farms, if stocked sufficiently, would pay the farmer, not equally well with large farms, but still they might pay him sufficiently well to make his investment profitable. But such farms are generally understocked. In fact it is only in those cases where the cultivation is with the spade, and the land is managed like a garden, that such small holdings can be made profitable: the holder cannot, as a general rule, enter into competition with the large producer as a supplier of the market.

In some countries, where there are numerous small landholders, and it is usual for the estate to be divided on the death of the head of the family, the tendency must be, and is, to carry this division further than is profitable either to the community or to individuals. But in such case the evil may correct itself: a man can sell what it is not profitable to keep, and turn his hand to something else. The man who has been long attached to a small plot as a tenant, and mainly or entirely depends on it for his subsistence, will not leave it till he is turned out.

The allotment system, when limited to the giving a labourer a small plot of garden-ground, presents many advantages. But the object of making such allotments is moral rather than economic: the cultivation of a few vegetables and flowers is a pleasing occupation, and has a tendency to keep a man at home and from the alehouse. In many cases also, a small plot of ground can be cultivated by the labour of the wife and the young children, and a pig may be kept on the produce of the garden. The agricultural labour of young children is of very little value, but children may often be employed on a small plot of ground. Such employment is better than allowing the children to do nothing at all and to run about the lanes; and if their labour is well directed to a small garden, it cannot fail to be productive, and to add greatly to the supply of vegetables for the family.

Any extension of the allotment system beyond what a labourer can cultivate easily at his leisure hours, or with the assistance of his family, may be for a time a specious benefit, but in the end will be an injury to himself and to others. If a man is a labourer for hire, that is his vocation, and he cannot be anything else. If he becomes half labourer and half cultivator, he runs a risk of failing in both capacities; and if he becomes a cultivator on a small scale, and with insufficient capital, he must enter into competition in the market with those who can produce cheaper than himself; or he must confine himself to a bare subsistence from his ground, with little or nothing to give in exchange for those things which he wants and cannot produce himself.

The legislature has in several instances sanctioned the plan of allotting land to the poor for cultivation, in some cases for the paupers of the parish only, and in others for the independent cottager. The 22 Geo. III. c. 83, § 27, provides for the inclosure of land adjoining workhouses, not exceeding ten acres in extent, in order that the same may be cultivated and improved by the poor, that is, it may be inferred, by the paupers. Under 59 Geo. III. c. 12, parochial authorities were empowered to provide land not exceeding twenty acres in extent, on which the poor might be employed. The act 1 & 2 Wm. IV. c. 59, enabled churchwardens and overseers, with the consent of the Treasury, to enclose fifty acres from any forest or waste lands belonging to the crown. Another act was passed in the same session (1 & 2 Wm. IV. c. 42) to inclose fifty acres of waste land, and to cultivate and improve the same for the use and benefit of the parish, or to let any part of it to any poor or industrious inhabitant of the parish to be cultivated on his own account. The most important act on the subject of providing land for the poor is the 2 & 3 Wm. IV. c. 42, passed in 1832. It authorises (in parishes enclosed under any Act of Parliament) the letting of the land set apart by the Inclosure Act, generally with a view to provide fuel for the poor; and the rents are to be applied to the purchase of fuel. The preamble of the act alludes to the advantage of letting such land 'at a fair rent, and in small portions, to industrious cottagers of good character.' The act is to be carried into effect by the trustees appointed by the Act of Inclosure, and by the parish officers in vestry assembled. The allotments are to be not less than one-fourth of an acre, and they are not to exceed an acre, and the rent is to be the average rent of land of similar quality in the neighbourhood. It must be let to industrious cottagers of good character, being day-labourers or journeymen settled in the parish. The tenants must cultivate their allotments in such a manner as to preserve it in a due state of fertility; and non-payment of rent or improper cultivation subjects them to be ejected. In case the land which the vestry is authorised to let be inconveniently situated, it may be let, and other land for the cottagers may be hired. No habitation is allowed to be erected by the tenants. The provisions of this act are extended to the acts 1 & 2 Wm. IV. c. 42 and c. 49, already noticed. The 5 & 6 Wm. IV. c. 69, § 4, places the working of the various acts quoted above under the control of the Poor Law Commissioners. In the session of 1844 a bill for the promoting the letting of allotments to the labouring poor was introduced into the House of Commons, which contained regulations and provisions for superintendence of a very complicated nature. When a cottager has a garden attached to his dwelling, he may manage it as he pleases, and it may or may not be well cultivated, but his independence is not interfered with, and he is not placed in a state of tutelage under parish authorities. The bill in question, which is likely again to be brought forward, proposed to delegate the powers conferred upon parish officers by the acts already quoted to four 'wardens of field-gardens,' who are to be elected triennially by the parishioners in public meeting assembled, and who are to act in conjunction with the officiating minister of the parish. The wardens are to be authorised to take land belonging to the parish or to hire land to an extent not exceeding half an acre for every rate-payer assessed at not more than 10*l*. This land they are to let in field-gardens or small plots.

ALLSTON, WASHINGTON, a distinguished American historical and landscape painter, was born in South Carolina, in 1779, and was educated at Harvard College, which he entered in 1796, having spent a preparatory term, by the advice of his physicians, at Newport, Rhode Island. Having determined to follow painting as a profession, he resolved to visit England for that purpose; he accordingly set out in 1801 with another artist, for London, and entered the Royal Academy of Arts of London as a student, in which he remained three years, during the presidency of West.

In 1804 he went with a friend to Paris, and thence to Rome, where he remained four years. In 1806 he attracted considerable notice there by a picture of Jacob's Vision. He excelled chiefly in colouring, and is said to have created considerable sensation among the painters in Rome, by the peculiar effects which he accomplished, through a great use of asphaltum, after the manner of Rembrandt. Many of the German and Italian painters endeavoured to imitate his effects; they however failed, says the 'Morgenblatt' (1807), and spoilt several of their pictures.

He painted several pictures at Rome, which were admired for their colour and chiaroscuro; among them a portrait of himself, and several landscapes.

In 1809 Allston returned to America, and at Boston married the sister of Dr. Channing. In 1811 he again visited England, where he obtained the 200 guineas prize from the British Institution for a picture of 'The Dead Man raised by Elisha's Bones,' which was afterwards bought by the Pennsylvanian Academy of the Arts for 3500 dollars. In 1813 he had the misfortune to lose his wife, at a time when he was himself in a very weak state of health. In 1814 he published a book entitled 'Hints to Young Practitioners in the Study of Landscape Painting.' In 1817 he paid a second visit to Paris, with Leslie the Academician; and he returned in the following year to America, to Cambridge in Massachusetts, where he resided until his death in July, 1843. He was an Associate of the Royal Academy of London; his election took place in 1819. In 1830 he married a second wife, who survives him. Fiorillo, in his history of painting in England, speaks of a clever picture by Allston, of a French soldier recounting his deeds of heroism to a circle of listeners around him. Two pictures of Jeremiah and Uriel are noticed in Dr. Nagler's Dictionary of Artists, as having been painted by Allston in 1821. Shortly after his death a large unfinished picture of Balshazzar's feast by him was exhibited at Boston. He has left several other unfinished works. He is spoken of as having been a very accomplished man and an elegant writer.

(*Art Union*, 1843; Fiorillo, *Geschichte der Mahlerei*, vol. v.)

ALOES—*Medical Properties of.* Though known to the antients and largely used in modern times, the sources of this drug are not accurately determined. It seems better to follow the plan of the 'Edinburgh Pharmacopœia,' and assign it to an undetermined species of the genus Aloe, rather than restrict it, as done by the 'London Pharmacopœia,' to the A. spicata, which, though it may yield Socotorine and some Cape aloes, is not the source of Barbadoes aloes, which last would appear to be procured from the A. vulgaris, a plant native of Greece, and which furnished the aloes of the antients, and which is now cultivated in the West Indies, as well as Spain, Italy, and Sicily, from which latter countries France and other continental nations, but not Britain, are often supplied. This plan seems the more judicious, as the commercial varieties, however designated, or whencesoever derived, are to be found of nearly every degree of excellence or worthlessness, if care be not taken in the mode of obtaining the article. Dr. O'Shaughnesy, whose position in the East gives him good opportunities of observing, states, in his 'Bengal Dispensatory,' that 'the quality of the product is apparently more dependent on soil, climate, and preparation than on specific differences in the plant.' Not only has Barbadoes aloes become less valuable from changes in the mode of collection; but even the real Socotorine aloes has become deteriorated, from any person in the island of Socotra being at liberty to cut as many leaves of the now neglected plant as he pleases, and prepare it in any way he likes, instead of the care formerly bestowed on it. 'Formerly every part of the island produced the aloe; and the whole was farmed out to different individuals, the produce being monopolised at a fixed price by the Sultan. The boundaries however thus set up, which consisted of loose stone walls, and were carried with immense labour over hill and dale, though they still remain, under the present unsettled government no longer distinguish property. The descendants of the owners to whom the several fields were formerly allotted, have either withdrawn their claims or these are forgotten. At present, any one collects the aloe leaves who chooses to take the trouble, and nothing is levied on account of the Sultan.' (Lieut. Wellsted, 'Memoir on the Island of Socotra,' in *Journal of Royal Geogr. Society*, vol. v. p. 197.) In the language of the island the aloe is called Tayef; by the Arabs, Soobah. Though this island possesses plants sufficient to yield nearly all the aloes required in commerce, very little is now obtained from it; and what passes under the name of Socotorine aloes is almost entirely the best East Indian sort, as is rendered further evident by its being exported from Bombay. When one source of any article of commerce is dried up, it is the custom of the dealers to bestow the name of the sort in greatest repute on the best they possess; meaning, not that it is the produce of the place the name of which it bears, but that it possesses the qualities of the kind originally obtained from that part. Alterations in commerce, dependent on a variety of causes, are constantly rendering implicit reliance on names a very unsafe guide.

Attention to the mode of extracting the juice might render aloes, whencesoever procured, of excellent quality; but it will be seen presently how little the ordinary methods are calculated to ensure this end, quantity rather than quality being aimed at by the preparers. The aloe, like the hyacinth and many other liliaceous plants, contains a vast quantity of a mucilaginous matter (vegetable albumen?), more abundant towards the centre of the thick fleshy leaves than near the surface. The medicinal juice is altogether different from this, and is contained in a distinct set of vessels (Opangia, Link; Opophora, vasa laticifera), which are distributed chiefly under the thick cuticle of the leaves. Out of these vessels the juice sometimes exudes, either from turgescence or from the punctures of insects, and concretes into tears, forming that variety of aloes called Aloe lucida, seen occasionally as a curiosity, but not met with as a commercial article. (The term A. lucida is applied by Geiger and Theod. Martius to fine Cape aloes, but it is quite distinct from that now spoken of.) If transverse but not deep incisions were made at various points and at proper distances in the course of the leaves while yet attached to the stem, much fine aloes could be procured by scraping off the juice from time to time as it flows, or allowing it to become concrete and then picking it off. The general practice however is to cut off the leaves near the base, and put their open ends into a skin, into which the juice flows. This is afterwards inspissated, either by spontaneous evaporation in the sun, or promoted by a gentle heat. Pressure of the leaves is sometimes made to assist the flow, but by this means 'large quantities of viscid mucilage are forced out, and mix with the proper bitter juice, which is proportionately deteriorated.' (O'Shaughnesy.) Dipping the leaves into hot water, by which their vitality is lessened or destroyed, and their hygroscopicity diminished, is equally objectionable, as the viscid mucilage then flows out more freely. Worst of all is the plan now, but not formerly, pursued in Barbadoes. Barbadoes aloes of the present day is the extract of a decoction. 'It is made by immersing for ten minutes in boiling water the chopped leaves previously enclosed in cloths or wicker baskets, increasing the strength of the decoction with repeated supplies of chopped leaves till the water is fully charged; then allowing the liquor to cool and the sediment to settle; and finally evaporating the clear liquor with caution till it is concentrated sufficiently to become solid on cooling. The hot liquor is allowed to concrete in large gourd-shells, in which it is always transported to Europe.' (Christison.) From these different plans of collecting and inspissating the juice, results an article which differs considerably in appearance and greatly in value. Aloes is one of the few drugs in which adulteration is not extensively practised further than by substituting the inferior and low-priced kinds for the superior. When carelessly prepared, sand and fragments of leaves and skins are frequently found in the samples.

A few of the most important sorts found in commerce may be noticed. The finest sort, to which the term Socotorine aloes is given, can scarcely be regarded as one of daily occurrence, and is noticed merely as a standard of excellence by which to judge of others according to the degrees in which they approximate it. 'It consists of small angular fragments, possessing a deep garnet-red colour, altered somewhat by exposure to the air; a conchoidal fracture, a resinous lustre, much translucency in thin layers, a beautiful garnet-red hue by transmitted light, and a peculiarly fragrant odour. It is brittle, easily pulverisable, and of a fine golden-yellow tint when in powder. It is almost entirely soluble in spirit of the density of 950°, a very scanty light flocculent matter being left.' (Christison.) As specimens decline from this unusually high standard, the lustre diminishes, the fracture is rougher, the odour less pleasant, the solubility less, they are not so readily pulverisable, the powder is of a deeper colour, inclining to brown, the residuum greater, and consisting of more of the flocculent matter, as well as incidental impurities. In regard to the amount of insoluble matter, Barbadoes aloes contains the most, varying from 5 to 12 per cent.; and it is much more difficult to reduce to powder, as the mode of obtaining it explains.

The chief varieties go by the name of—Socotorine; East Indian, called also frequently *hepatic;* and Cape aloes (*Aloe lucida* of Geiger and Theod. Martius), also called *A. Cabo.* Innumerable subvarieties of these are found. Caballine, or *horse* aloes, has nearly disappeared from commerce, refinement or fashion in veterinary medicine deeming it not fit for horses.

Barbadoes aloes comes to this country in the gourds and calabashes into which it is poured when prepared. Each of these weighs from sixty to even eighty pounds. When broken, the fracture is sometimes conchoidal, seldom lustrous, and having a more liver-like aspect, better entitling it to the designation of *hepatic*, by which it is frequently called, than any of the others.

The most recent chemical analyses of aloes have been made by continental chemists, and although they designate the specimens analysed, it cannot be accurately known how far they correspond with the kinds so called in Britain. The chief constituents however are *aloesin* (or saponaceous principle), present sometimes to the amount of 81 per cent.; *resin*, varying from 25 to 50 per cent.; *vegetable albumen*, absent from the best kinds, present in others from 5 to 12 per cent.; *gallic acid*, a trace according to Traunsdorff; *aloetic acid*, according to Pereira. Aloes is however of rather a more complex nature than appears from this view. Aloesin, or aloe-bitter, is entirely soluble in cold water, but not in absolute alcohol. When hot water is used, something is taken up, which is deposited as the water cools: to this the name of resin has been given, perhaps not with perfect propriety. The aloesin is looked upon as the cathartic principle of aloes, the resin rather as an irritant and objectionable ingredient. Hence in some of the 'Pharmacopœias' an extract is ordered to accomplish their separation, a proceeding altogether unnecessary, when aloes of the best quality can be obtained by giving a proper price for it. The formation of a decoction by heat is still more objectionable, as a much superior preparation is made by cold water alone, more grateful to the stomach, and not less effective if given in rather larger dose.

Few more valuable drugs exist, as is proved by the numerous preparations made either of aloes alone, or with some other articles combined with it. These combinations have various objects in view, some to heighten its powers, others to modify, and some to get rid of certain well-founded objections to its effects. The chief of these are noticed here.

In large doses it is decidedly aperient, but is unlike many other cathartics in so far that increasing the dose beyond a certain point by no means increases the effect. This can be accomplished however by associating it with other cathartics, and still more decidedly by uniting it with tonics, such as iron or quinia. Aloes and quinia with antimonial powder, and aromatic powder to cover the unpleasant taste, form a combination of great utility in many gastric derangements, especially where the head is implicated. Thus, when persons are so fortunate as to be rallying from the stage of collapse in Asiatic cholera, this combination given frequently improves the secretions and abates the fever. In some fevers with numerous liquid motions it may also be given with striking benefit, the motions diminishing in frequency and increasing in solidity, as well as becoming of a more healthy appearance. In the congested state of the bowels and brain which precedes water in the brain, aloes, either in this combination or in some other form, is of great utility. (Yeats *On Water on the Brain.*) Persons predisposed to apoplexy are more benefited by aloes than by most other purgatives, especially if they have been previously subject to a hæmorrhoidal flux which has been suppressed.

The combination which increases the purgative power of aloes in the most remarkable degree is formed by adding one drop of strong (undiluted) sulphuric acid to four grains of Barbadoes aloes, and forming a pill, two of which, given every two, four, or six hours, will almost invariably relieve the most obstinate cases of constipation, such as occur in painters' cholic, ileus, and other diseases. It is even more efficacious than croton-oil, and not so apt to excite inflammation of the intestines. This augmentation of power seems to be in conformity with a general law, by which many vegetable principles have their properties heightened by adding an acid, either mineral or vegetable. Thus ammoniacum becomes a more powerful expectorant by adding dilute nitric acid to the mistura ammoniaci; and the fœtid gums, such as assafoetida, are rendered more potent by solution in vinegar. ('Acetum Antihystericum,' formula No. 1, in Copland's 'Dictionary of Medicine.')

Aloes, especially the compound decoction, is a most valuable emmenagogue, particularly when combined with tincture of ergot or preparations of iron. From its action on the lower part of the bowels it is deemed an improper purgative in pregnancy or during the menstrual flux. It is also considered improper for persons subject to piles. This objection has been attempted to be obviated by various means, but the best way is to combine it with other agents, as stated by Dr. Christison, as many persons can take the compound gamboge-pill, or compound extract of colocynth, who cannot take aloes alone. The best means of covering the unpleasant taste of aloes when given in the liquid form is the compound tincture of lavender.

ALPACA, or PACO. The natural history of this animal is treated of under LLAMA, P. C., pp. 72, 73. The introduction of alpaca wool in manufactures has attracted considerable attention, and the question of naturalizing the alpaca in this country, in Germany, and in Australia, is also an object of much interest. The wool of the alpaca is superior to English wool in length, softness, and pliability. The fleece averages from 10 to 12 lbs., while that of our sheep is seldom more than 8 lbs.; and while the staple of English wool does not often exceed six inches in length, that of the alpaca varies from eight to twelve inches. The lustrous appearance of the alpaca wool renders it applicable to many of the purposes for which silk is usually employed in textile fabrics; and it is found a useful substitute for Angora wool. The manufacture of plain and figured stuffs from the fleece of the alpaca was commenced at Bradford, in Yorkshire, a number of years ago, and these fabrics have been much admired. The consumption of alpaca wool in this country in the seven years ending December, 1843, is estimated by Mr. Walton at 12,000,000 lbs. A Parliamentary paper (197, Sess. 1844) gives the import of wool of the llama and alpaca tribe for the year 1843 at 1,458,032 lbs., and the consumption was probably higher in that year than it has ever yet been. The price is from 2*s.* to 2*s.* 6*d.* per lb. Towards the close of 1844 five different articles were manufactured at Bradford for her Majesty, from the wool of an alpaca which had been kept at Windsor. The fleece weighed 16½ lbs., and when sorted and combed 10 lbs., including 1 lb. of white wool, the remainder being almost entirely jet black. One of the articles manufactured was an apron, in which the wool of the alpaca, without the admixture of any other wool, was used for the first time in this country; for though very large quantities have been woven at Bradford, it has usually been in fabrics where the warp was of cotton or some other material, and the weft only of alpaca. Amongst the other articles manufactured for her Majesty were a striped and figured dress; the warp consisting of rose-coloured silk, and the weft of black alpaca with figures on alternate grounds of alpaca and silk. This dress, which measured 12 yards, required 2¼ lbs. of alpaca. A plaid dress, measuring fifteen yards, and containing 2½ lbs. of alpaca, was woven with an intermixture of silk and worsted. Another article was a plain black alpaca lustre dress, the warp of fine cotton twist, and the weft of alpaca. This required 3½ lbs. of alpaca, and when taken from the loom it resembled silk from its lustrous quality, and was of course much softer.

Besides the use of the wool in textile fabrics, the flesh of the alpaca is also wholesome and palatable. The carcass weighs on an average about 180 lbs.

The question of naturalizing the alpaca has been taken up with great enthusiasm by a few persons; but very little progress has yet been made in convincing the country of its practicability. The alpaca inhabits the mountainous and inhospitable regions of Peru, and is remarkable for its abstemiousness. It thrives on coarse food. Those which have been brought to this country have been confined in parks and richly cultivated lands, and have been treated with too much care and tenderness. Mr. Walton asserts that they will live where our hardiest sheep would starve, and that the wildest parts of Great Britain are best suited to their habits. In the 'Transactions of the Highland and Agricultural Society,' 1844, there is an account, by Mr. Stirling, of the attempt which is now making to introduce the alpaca into Scotland. During the severe winter of 1843-4, when sheep required to be regularly fed with turnips and hay, the alpacas perseveringly sought their own food, and did not experience a single day's illness. Mr. Stirling says that they were kept within enclosures better than sheep, and never attempted to leap a fence. In 1841 the Highland and Agricultural Society offered their gold medal for 'a satisfactory account, founded on actual observation and experiment, of the attempt to naturalize the alpaca in Scotland;' and in 1844 a prize was offered by the Society for the best pair of alpacas born and bred in Scotland, and the best two, male and female, imported. If, as Mr. Walton states, the alpaca may be pastured on lands which are now waste and unprofitable, and where the hardiest sheep would starve, the naturalization of the animal would undoubtedly prove a great 'national benefit;' but if this is not the case, it is a question whether a constant demand for the wool as an article of import would not be quite as beneficial. The Peruvians would be induced to bestow greater care on the management of their flocks, and the possession of so valuable an export would bring them under influences of a civilizing nature, which would render them better customers for our commodities. The expense of importing the alpaca is very great, and the long voyage kills more than two-thirds of the number shipped.

(Walton *On the Alpaca; its Naturalization in the British Isles considered as a National Benefit.*)

ALTDORFER, ALBRECHT, painter and engraver, and one of the most celebrated of the old German masters, was born at Altdorf in Bavaria, in 1488. This has been shown by Heineken, who acquired his information from a senator of Regensburg (Ratisbon), who found documents concerning the family of Altdorfer in that city. Those who speak of him as a Swiss have been misled by Sandrart, who was the originator of the error.

Altdorfer was himself a member of the interior senate of Regensburg, of which city he was enrolled a burgess in 1511; he was also architect of the city of Regensburg. He was probably the son of Ulrich Altdorfer, an artist of Regensburg, who gave up his right of burghership in 1491.

Altdorfer did not paint much, but his pictures show a surprising patience and industry. There is in the Pinakothek at Munich a picture by him, representing Alexander's battle of Arbela, of which the labour is prodigious. It bears the date 1529; it is not of large dimensions, but contains almost an innumerable mass of small figures, all in the German military costume of the day, every article of dress or military implement being made out with the greatest exactness; and all the various and probable incidents of a battle profusely introduced. There is perhaps not another picture in existence which contains so many figures; the design is however strictly Gothic, and Altdorfer has wholly neglected the powerful aid of aërial perspective. This picture was formerly at Schleissheim, whence it was taken by the French to Paris, and Napoleon was so much delighted with it, that he ordered it to be hung up in his bath-room at St. Cloud, where it remained until 1815. Though one of the most interesting and remarkable productions of German painting, it has never been engraved; the very sight of it, however, would probably appal many engravers. His other pictures are in a similar style; he scarcely ever painted large figures: the Saviour with Mary and John, St. Peter, St. Catherine, and another saint, at the convent of Mölk, which are the size of life, are the only known exceptions, and these have been attributed to Albert Dürer, who is supposed by some to have been the master of Altdorfer, but it is a mere conjecture.

There are several of Altdorfer's pictures at Schleissheim, near Munich; some at Nürnberg and Regensburg; a Birth of Christ at Vienna, and a Susannah and the Elders in the Pinakothek at Munich.

As a wood-engraver Altdorfer is more generally known, and he is inferior to Albert Dürer alone, of the old German or little masters; he is called by the French, Le Petit Albert: his cuts, amounting to about 80, are slight, and occasionally ill drawn, but they are executed with great freedom. Holbein is said to have studied Altdorfer's cuts, which, from a a certain similarity of style, notwithstanding the superiority of Holbein, is not improbable.

His metal plates on copper and pewter are more numerous than his woodcuts, and amount to about 112, but they are inferior to his cuts, and very inferior also to the engravings of Dürer and Aldegrever; they are extremely hard, occasionally very badly drawn, and generally bad in the extremities.

From the dates on his works he appears to have been in earlier life an engraver, and in about the year 1525 to have given up engraving for painting. His prints are dated from 1500 to 1525, and on two of his principal pictures we have the dates 1526 and 1529: 1538, the reported year of his death, is found upon one picture. He lived chiefly at Regensburg, and died without issue. Regensburg at one time possessed many of Altdorfer's works, but they have been removed to Munich; among them is nearly a complete collection of his prints, which were presented to the town library by the Stadtgerichts-assessor Peuchel. The subjects of Altdorfer's prints are historical, sacred and profane, and mythological; with a few landscapes and some designs for goldsmiths. A set of thirty-eight small cuts by Altdorfer, illustrating the Fall of Man and his Redemption, was published in 1604, by a person whose initials were G. L. F., as the designs of Albert Dürer, according to the title; yet in the preface the publisher states that they are certainly by Altdorfer. The complete set contains forty cuts. Heineken, Huber, and Bartsch have given lists, more or less complete, of Altdorfer's prints.

(Sandrart, *Teutsche Academie*, &c.; Heineken, *Dictionnaire des Artistes*, &c.; Fiorillo, *Geschichte der Zeichnenden Künste*, &c.; Huber, *Manuel des Amateurs*, &c.; Bartsch, *Peintre-Graveur.*)

ALTERED STRATA. In addition to the consolidation and division by cracks, joints, and fissures, to which all rocks have been subjected, in unequal degrees, there are special cases of uncommon induration, internal re-arrangement of particles, and even the production of new mineral ingredients, which happen in the strata near to rocks of igneous origin, and along certain great fractures and flexures. Heat is usually appealed to for these effects, and justly; but in addition to mere pervading warmth, Von Buch supposes vaporization of some ingredients (as magnesia, which converts limestone to dolomite), and the solution of others in hot water to be necessary to explain the various contents of mineral veins.

ALU'NNO, NICCOLO', one of the old Umbrian painters of the fifteceth century, less known than he deserves to be. There are very few of his works extant, and Vasari notices him only in the Life of Pinturicchio, and treats him as his contemporary. Mariotti however, in his 'Lettere Pittoriche Perugine,' states that Alunno was established as a painter at Foligno as early as 1460, and that he painted at least two years before that date. He was a native of Foligno, and his works are signed 'Opus Nicolai Fulginatis,' or 'Nicolai Fulginatis Opus;' but there was a Niccolo Deliberatore, likewise of Foligno, and therefore all the works with this signature may not be by Alunno.

His chief works were in a chapel of the cathedral of Assisi, of which there is now scarcely a trace left; Vasari speaks of a Pietà as a part, with two angels bearing torches, and weeping so naturally, that in his opinion no painter could have done them much better. Besides which Vasari mentions as capital works a Nativity, in the church of Sant' Agostino, at Foligno; an altar-piece for San Francesco, and another for the high altar of the cathedral of Assisi. There is still at Foligno, over a side altar of the church of San Niccolò, a picture of that saint and the infant Christ, which was painted by Alunno in 1492: it had formerly a predella, or a long picture in various compartments, which served it originally as a base, according to the old Italian custom with altar-pieces; but being one of the paintings which the French thought fit to send to Paris, it was returned at the general restoration of the plundered works of art, without its predella, which is now in the gallery of the Louvre. It contains six pictures, one of which is an allegorical piece, of two angels holding a scroll, upon which are written some verses which are legible with difficulty, celebrating the abilities of Alunno, and the generosity of a lady of the name of Bressida. The other five pictures are from the life of Christ. They are drawn in a dry and meagre style, and are very brown in colouring, and have strong contrasting lights; but they have much expression, and are executed with facility. Alunno excelled in expression; he was in the habit, in his large pictures, of painting the heads from the life, which gave them a truth and reality not found in the works of many of his contemporaries. The period of his death is not known, but he painted after 1500; he painted in the old manner in water-colours, or à tempera. Alunno painted also some standards used in religious processions; they are called gonfaloni. There is still extant a gonfalone of this description by him made of very fine canvas, in the church of Santa Maria Nuova, at Perugia, with the inscription—'Societas Annunciata fecit fieri hoc opus, 1466.'

(Vasari, *Vite de' Pittori*, &c.; Lanzi, *Storia Pittorica*, &c.; Rumohr, *Italienische Forschungen*.)

ALVAREZ, DON JOSE', a very distinguished Spanish sculptor and one of the most eminent artists of the nineteenth century, was born at Priego, in the province of Cordova, in 1768. His father was a stonemason, and Alvarez's youth was spent as a labourer in that business, as his father was too poor to support him otherwise. He however evinced an ability for sculpture at an early period, and employed what time he could spare from his daily labour with a view to educate himself as a sculptor. In his twentieth year he made such progress as to obtain admission into the academy of Granada, in which he soon distinguished himself for his ability in modelling. A lion destroying a serpent, which he made for a fountain at Priego, obtained for him the patronage of Don Antonio de Gongora, the Bishop of Cordova, the founder of the academy of that place, who took Alvarez into his house, and caused him to be elected a member of the academy. Notwithstanding his proficiency, however, in 1794 he left Cordova and entered as a student into the academy of San Fernando at Madrid, of which as 'the Andalusian' he soon became the most distinguished student. He obtained the first prize of the academy, for a basso-rilievo of the procession of Ferdinand I. and his sons carrying barefooted the miraculously discovered body of St. Isidore to the church of St. Juan de Leon.

In 1799 he was granted a pension of 12,000 reals by Charles IV. to enable him to prosecute his studies in Paris and in Rome. In Paris he paid great attention to anatomy, and studied in the public dissecting-rooms; and he gained there additional academical honours: he obtained the second great prize in sculpture awarded by the Institute. Alvarez was a devoted admirer of the sculptures of the Parthenon which Choiseul Gouffier had brought to Paris from Constantinople; he made many drawings of them, and his improved taste was manifest in a statue of Ganymede, which he made in 1804, and by which he acquired the reputation of one of the first of modern sculptors. Napoleon, then emperor, paid two visits to the studio of Alvarez, and presented him with a gold medal of the value of 500 francs. Notwithstanding this personal honour, Napoleon's after-conduct regarding Spain excited in Alvarez an invincible aversion to him: he would never model his bust, and when Joseph Bonaparte was proclaimed king of Spain, Alvarez, then at Rome, was imprisoned in the castle of St. Angelo for refusing, as a pensioner of the Spanish government, to take the oath of allegiance to the new king; he was however released shortly afterwards. After the completion of his statue of Ganymede, Alvarez's pension was increased to 28,000 reals, and he left Paris for Rome, where he thenceforth chiefly resided. In Rome he executed or modelled many much admired works, the best of which was a group of Antilochus and Memnon in 1818, for which he was nominated court sculptor by Ferdinand VII., who commissioned him to execute the group in marble: it is now in Madrid.

In 1825 he was appointed principal sculptor to the King of Spain, and was decorated with the cross of Civil Merit. In 1826 he visited Madrid for the purpose of selecting the best statues and other sculptures in the king's palaces to be placed together in the museum of the Prado; but he died within twelve months of his arrival, in the sixtieth year of his age. From his office, the circumstances connected with his death, and the honourable commission about which he was engaged, it is evident that the reports which appeared in the French newspapers at the time of his death about his extreme poverty bordering upon destitution must be false. There are many of his works at Madrid, several from antient mythology; some full-length statues, and a few busts. Busts he did not willingly model, but the few he did are reputed excellent likenesses, and among them are those of Rossini, the composer, and Cean Bermudez, the author of the Dictionary of Spanish Artists.

It is generally admitted that Alvarez excelled in many qualities of a high order, in invention, in expression, and in design; and he is by his admirers compared with Canova. That he is less generally known than many of his more fortunate or more renowned contemporaries, is probably more owing to an ignorance of his works than to their inferiority. He was a member of the Institute of France, of the Academy of St. Luke of Rome, and of the academies of Carrara and Naples. He left three sons, who were allowed to retain a portion of their father's pension. The eldest, who promised to be a sculptor of ability, died at Burgos in 1830, in his twenty-fifth year.

There was another distinguished Spanish sculptor of this name, DON MANUEL ALVAREZ, who was born at Salamanca in 1727. After acquiring the rudiments of his art with two sculptors of Salamanca, he repaired to Madrid, and became the pupil of Don Felipe de Castro, the king's sculptor, whom he assisted in many of his works. He obtained the first prize of the academy of San Fernando in 1754, by which he was entitled to study in Rome, with a pension from the Spanish government, but he declined the advantage on account of the weak state of his health. In 1757 he was elected a member, in 1762 vice-director, in 1786 director of the academy of San Fernando; and in 1794 sculptor to the king. He died in 1797, generally regretted, in the seventieth year of his age. His statues and busts are very numerous in the churches, palaces, and monasteries of Spain, especially at Salamanca, Toledo, Zaragoza, and Madrid. Alvarez was commonly called by his fellow-artists El Griego, or the Greek, on account of the purity and vigour of his design, and his accuracy of execution—a great compliment.

(*Archive für Geschichte*, &c., 1829, No. 15; *Seminario Pintoresco Español*, No. 52; Cean Bermudez, *Diccionario Historico de los mas Ilustres Profesores de las Bellas Artes en España.*)

ALVEOLI'TES (Lamarck), a genus of fossil Polypiaria, from the cretaceous and tertiary strata.

AMALTE'O, POMPO'NIO, a distinguished painter of the Venetian school, born at San Vito in the Friuli, in 1505. He was the scholar of Pordenone, and painted much in the style of that master, though he was less bold in execution and inferior to him in invention. His Three Judgments however in the court of justice or loggia at Ceneda, which were completed in 1536, were long supposed to be the works of Pordenone, both through their style and the misstatement of Ridolfi. They are the Judgment of Solomon, the Judgment of Daniel, and a Judgment of Trajan, and are considered Amalteo's masterpieces.

Vasari praises, in the Life of Pordenone, some frescoes by Amalteo in the Castle of San Vito, for which he was ennobled by Cardinal Grimani, the signor of San Vito, and patriarch of

Aquilea. Amalteo was distinguished for good drawing, a quality rare among the Venetian painters.

Pomponio's brother and pupil, GIROLAMO, had also great ability for painting, but he generally painted small pictures highly finished. He died young, or otherwise, says an old writer, he would have rivalled Pordenone in reputation. By which observation we may infer, with Lanzi, that the story told by Ridolfi about his being induced to give up painting and to turn merchant, through a promise of an allowance of 100 ducats per annum from Pomponio, is not true. The meaning of the story is, that Pomponio was jealous of his brother. It seems that such a transaction did take place between Titian and his brother. Amalteo's paintings in fresco and in oil are very numerous in and about the district of Friuli, but he was unequal: many of his pieces have very little merit. He had several scholars, some of whom distinguished themselves. One of his pupils, Gioseffo Moretto, married his daughter Quintilia, who likewise painted and executed some works in sculpture. The date of Pomponio's death is not known, but it was probably prior to 1588, according to the following inscription upon a picture at San Vito:—'Inchoavit Pomponius Amalteus, perfecit Joseph. Moretius, A. 1588.'

(Altan, *Memorie intorno alla Vita di Pomponio Amalteo*, in the *Opuscoli Calogeriani*, vol. xlviii.; Renaldis, *Della Pittura Friulana*; Lanzi, *Storia Pittorica*, &c.)

AMAN, JOHANN, Hofarchitect at Vienna, was born at St. Blasien in Baden, in 1765. While the works of the minster at St. Blasien (completed in 1784) were going on, they were his constant study, and inspired him with the earnest desire of applying himself to architecture as his future profession, which wish the liberality of the Prince-bishop Gerbert enabled him to realize. That prelate became his patron, and placed him under suitable instructors, not for architecture alone, but also other branches of art. His proficiency in one, and that not the least difficult of them, must have been rapid, for in 1788, when only twenty-three, he executed the twelve painted glass windows for the new minster, in the style of antient works of that kind, on which occasion however he had the benefit of the precepts of Anton Pfluger, a brother of the order, who had discovered a mode of preparing colours for glass-painting, which Aman here made use of. This work being completed, his patron sent him to Vienna, whence, after studying two years and obtaining the first premium at the academy, he returned to Baden. His practice as an architect commenced in 1791, when he was employed by the Austrian 'Bau-direction' to erect a church and parsonage-house at Freyburg. In 1793 his first patron's successor, the Prince-abbot Ribbele, sent him for further improvement to Rome, where, besides pursuing his more immediate studies, he profited by the access afforded him to various libraries and cabinets of antiquities, and also by his acquaintance with the learned architectural archaeologist Hirt. He returned to Germany in 1795, but did not long remain in Baden, for in the following year, when the French crossed the Rhine, he betook himself to Vienna, nor was it long before he there found an opportunity of displaying his talent in a building erected by him near the Rosenthurm, for the reception of the Müller collection (1797). Whatever it was in itself, for merely the bare fact is mentioned, it had the effect of recommending him to the favour of the Emperor. In 1799 he was employed by Schikaneder and Zitterbart to design a new theatre for them, but he does not seem to have been engaged for it any further, since the building is said to have been spoiled by many deviations from the original plans. During the next year or two he was occupied on some public improvements, viz. those of the Hohe Markt, the two Dorotheen Hofe, &c., and on the death of Prosche in 1803 was appointed his successor as Hofarchitect. This led to his being employed (1806) to prepare designs for a new theatre at Pesth, the first stone of which was laid in 1808 and the house opened in 1812. From 1810 to 1819 he was chiefly occupied with repairing St. Stephen's spire, and restoring and embellishing upon an extensive scale the buildings of the celebrated imperial villa of Schönbrunn, besides which he prepared the designs and model for a new court theatre (1817). Except that he was afterwards employed upon various improvements at the imperial palace, Vienna, nothing further is recorded of him, nor are any particulars given as to his personal history: therefore his family circumstances are not known. He died in 1834.

(Nagler, *Künstler-Lexicon*; *Conversations-Lexicon für Bildende Kunst.*)

AMA'TO, GIOVANNI ANTONIO D', a distinguished painter of the early half of the sixteenth century, and one of the best of the Neapolitan painters, was born at Naples in 1475. His master is not known: he seems to have educated himself chiefly by studying the works of Maestro Buono, who died in 1485, and an altar-piece of Pietro Perugino, which is in the Cathedral of Naples.

Amato was a remarkably pious man, and probably superstitious, for he never commenced a picture of the Madonna and Bambino, his most favourite subject, without first taking the sacrament, and thus purifying himself for the holy task. He carried his feeling of propriety so far as to consider it wrong to paint even a partially naked woman; and impressed with this feeling he refused to paint the decorations of the triumphal arch which was erected in honour of Charles V. when he visited Naples: he recommended Andrea da Salerno to the authorities in his place.

Though as a painter he lived chiefly in the sixteenth century, his style is more that of the quattrocentisti, and is very similar to that of Perugino, but, with equally good colouring, the forms of Amato are fuller than those of Perugino. He painted in oil and in fresco, but his frescoes have almost all disappeared: they have either been whitewashed or have disappeared in the repairing of their localities. His best picture is considered to be the Dispute on the Sacrament, in the Cathedral of Naples.

Amato was a man of general acquirements, and devoted much of his time with assiduity and delight to the cultivation of letters. He wrote a Commentary upon difficult passages in the Sacred Scriptures, which is said to have been highly prized even by the clergy. These writings were well known to the Cavaliere Massimo Stanzioni, who speaks of them; but Dominici endeavoured in vain to identify them. He died at Naples in 1555, aged eighty.

Of Amato's numerous scholars, his own nephew of the same name, born in 1535, was one of the most distinguished. He was called Il Giovane, the Young, to distinguish him from his uncle, who however was himself sometimes called Il Vecchio, or the Elder. The nephew after the death of his uncle studied with Gio. Bernardo Lama, an older scholar of the elder Amato. His best work is a large and admirable altar-piece of the Infant Christ, in the church of the Banco de' Poveri at Naples: he was a beautiful colourist. He died at Naples in 1598.

(Dominici, *Vite de' Pittori, &c. Napolitani.*)

AMBERGER, CHRISTOPH, a celebrated old German painter of the sixteenth century, was of a family of Amberg in the Ober Pfalz, whence his name; but Amberger himself was, according to Von Mechel, born at Nürnberg about 1490. His father was a stonemason, and his grandfather was a carver in wood at Amberg. Nothing is known of Amberger's early history previous to 1530, when he was already a painter of some note and in great employment at Augsburg. The works which he executed at this time however were chiefly in distemper, a circumstance which Sandrart particularly regrets, as it is a very perishable style, for he says that they were deserving of great praise. He painted the exteriors of some houses in this manner; and, upon canvas, twelve pictures of the history of Joseph in Egypt, which are still at Augsburg. There is also in the gallery of Augsburg a portrait in the same manner of the Emperor Maximilian, which is generally attributed to Albert Dürer.

Amberger painted also in oil and in fresco. His oil pictures are chiefly portraits, much in the style of Holbein, whose portraits he studied and copied. Fiorillo states that many of Amberger's copies pass as the originals of Holbein. His historical pieces in oil are very small, and executed in the hard manner and sharp Gothic style of the period in Germany, without any feeling for aërial perspective, though the rules of linear perspective are well observed in his works: his colouring is rich. His best works are at his native place Amberg, in the Church of St. Martin and in the Franciscan convent there.

Amberger painted the portrait of the Emperor Charles V., apparently twice, but certainly once, for a portrait of him by Amberger is in the gallery of Berlin, and according to the inscription upon the picture it was painted in Charles's thirty-second year, or in 1532. Sandrart speaks of a portrait which was painted in 1530; but from the fact that Charles sat to Titian this year at Bologna, he is not likely to have allowed himself to be painted again so soon, and Sandrart's date may be wrong, and the portrait he speaks of may be that in the Berlin gallery painted in 1532. However, about the portrait of which he speaks, he says that Charles expressed himself highly satisfied with it, ordered thirty-six rix-dollars, three times what Amberger asked, to be paid to him, gave him a gold chain and medal, and said that it was as good a picture as the one Titian had made of him, which had cost him one hundred rix-dollars.

Amberger is generally supposed to have died about 1563 at Augsburg: he was however still living in 1568 according to some judicial records in that place. As in type 3 is often misprinted for 8, and vice versâ, the commonly received date of 1563 may have originated in a misprint of 1568, which was probably the year of his death.

(Sandrart, *Teutsche Academie*, &c.; Mechel, *Catalogue des Tableaux, &c. de Vienne;* Waagen, *Gemälde Sammlung zu Berlin;* Nagler, *Künstler-Lexicon.*)

AMBLY'PTERUS (Agassiz), a genus of fossil Ganoid fishes, from the coal formation of Edinburgh.

AMBLYSE'MIUS (Agassiz), a fossil fish, from the oolite of Northamptonshire.

AMBLYU'RUS (Agassiz), a genus of fossil fishes, from the lias of Somersetshire.

AMERICAN ANTIQUITIES. At the commencement of the present century the existence of antiquities in America was hardly known in Europe, if we except those in the vicinity of the town of Mexico, and at a few places in the Andes of South America. But since that time we have become acquainted with such a number of antient monuments, that they bid fair to exceed those of the other parts of the globe, Asia excepted. The countries formerly subject to Spain have now been laid open to unlimited investigation, and those parts of North America where antiquities exist have only been settled within the last sixty years by Anglo-Americans. In the last-mentioned countries the monuments of the antient population are generally overgrown with forest-trees, which concealed their existence until the country was fully explored.

The North American antiquities are of two descriptions: they are either fortifications or mounds. The fortifications are not found to the east of the Appalachian Mountains; but on the west of them they occur in many places. The most eastern are in New York, on the banks of Black River, which falls into Lake Ontario at its eastern extremity; but here, as well as in the Genesee county and other parts of New York they are small and difficult to trace. Farther west two extensive systems of fortifications may be traced. One extends over the southern portion of the state of Ohio, and is enclosed on the east by the course of the river Muskingum, and on the west by the Miami. The most northern fortifications extend into the county of Licking, to the vicinity of the place where the Muskingum river originates. Near Newark in Licking there are four forts, enclosing from twenty to forty acres each, and consisting of earthen walls from eight to thirty feet high. Two of these forts are perfect circles, one a perfect square, and the fourth is an octagon. These forts are severally connected by roads running between parallel walls, and communicate by similar roads with some creeks. Other less extensive fortifications are in Perry county, but those near Marietta, near the confluence of the Ohio and Muskingum, occupy a considerable space. These are the antient fortifications in the valley of the Muskingum. In the valley of the Scioto a square fort with eight gateways is united to a circular fort surrounded by two walls and a deep ditch between them. The town of Circleville, in the county of Pickaway, is partly built in the circular fort. Extensive works of a similar kind exist on Paint Creek in the county of Ross, west of Chillicothe; and others at the confluence of the Scioto river and the Ohio, near Portsmouth. There are several isolated fortifications to the east of the Little Miami river, and in the country between this river and the Great Miami.

The other system of fortifications occurs on the banks of the Mississippi, but we are not so well acquainted with the localities. There are several forts in the vicinity of St. Louis, on both sides of the Missouri river, and they extend thence farther southward. On the banks of White River in the state of Arkansas there is a wall which encloses an area of 640 acres, which is equal to a square mile, and in its centre is the foundation of a large circular building, supposed to have been a temple.

The square forts, like the pyramids of Mexico, face the cardinal points. When they have only one entrance, it looks towards the east. The walls are usually made of earth, but there are also one or two instances where they are of stone. To convey a more precise idea of their construction and disposition, we shall give an account of the works near Marietta. They consist of several walls and mounds of earth, in direct lines, and in square and circular forms. The largest square fort contains 40 acres, encompassed by an earthen wall from 6 to 10 feet high, and from 20 to 30 in breadth at the base. On each side are three openings, at equal distances, resembling 12 gateways. The entrances at the middle are the largest, particularly on the side next to the Muskingum. In front of this gateway is a covered way, formed of two parallel walls of earth, 231 feet from one another. These walls at the most elevated part on the inside are 21 feet in height, and 42 in width at the base, but on the outside they average only about 5 feet in height. This covered way forms a passage of about 20 rods in length, leading by a gradual descent to the low grounds, where at the time of its construction it probably reached the river. The walls commence 60 feet from the ramparts of the fort, and increase in elevation as the way descends to the river, and the bottom is rounded in the centre in the manner of a well-formed turnpike-road. In the interior of the fort are three square mounds. One at the north-west corner is an oblong square, 190 feet long, 132 feet broad, and 9 feet high, level at the summit, and even now nearly perpendicular at the sides. Another elevated square is 150 by 120 feet, and 8 feet high, and similar to the other, except that instead of an ascent to go up by on the side next the wall, there is a hollow way 10 feet wide leading 20 feet towards the centre, and then rising with a gradual slope to the top. The third square mound is 180 by 54 feet, with ascents at the ends 10 feet wide, but it is not so high as the others.

At a short distance to the south-east is another smaller fort, containing 20 acres, with a gateway in the centre of each side, and at each corner; these gateways are defended by circular mounds in front of them, either within or without the enclosure. Still farther to the south-east is a mound in the form of a sugar-loaf. Its base is a regular circle 150 feet in diameter and 21 rods in circumference. Its altitude is 30 feet. It is surrounded by a ditch four feet deep, fifteen feet wide, and defended by a parapet four feet high, through which is a gateway towards the fort 20 feet in width.

These fortifications are peculiar to the plains drained by the Ohio and Mississippi; in no other part of the globe are similar works found. Mounds or tumuli however occur in many other countries of Europe and Asia. In the countries bordering on Lake Erie they are of inferior size and fewer in number than in those which lie nearer the banks of the Ohio. It is believed that these mounds exist all over the countries between the Appalachian range and the Rocky Mountains, and as far south as the Gulf of Mexico. They vary greatly in their dimensions. Some are only four or five feet high and ten or twelve in diameter, whilst others rise to the height of 80, 90, and some more than 100 feet, and cover many acres. Their base is round or oval, and their shape that of a cone, but sometimes flat at the top. They are made either of stone or of earth. Many of them are in the vicinity of, and sometimes within the walls of the fortifications, and it is thought that some of them thus situated have been used as stations to discover the approach of an enemy. But it is evident that the greater number of them are sepulchral monuments. In most of the lower ones great numbers of bones have been found. In the more elevated tumuli only a skeleton or two have been found. In the monuments of the last description, some utensils and trinkets are usually found, as hatchets made of stone, vases of earthenware, vases and ornaments of copper, a little iron sometimes, and sometimes a small piece of copper plated, and very rarely a little gold. One of the larger of these tumuli is found on the banks of the Ohio, 12 miles below the town of Wheeling in Virginia. Its figure is a truncated cone, measuring 295 feet at the base, 60 at the top, and 70 in perpendicular height. The height appears to have been originally greater, and the form more regular. This mound was opened in 1839, and there were found in the centre two cavities, one towards the base and the other towards the top. In the lower cavity were found two skeletons in a standing position, but nothing else. In the upper cavity was a single skeleton and along with it 1700 ivory beads, 500 small sea-shells of the volute class; 66 pieces of mica, each of which contained four perforations, apparently for the purpose of uniting them, and five copper bracelets or arm-bands, but without being soldered at the points of junction. None of these relics evinced any artistical talent or acquirements beyond what are possessed by existing Indian tribes. But there was also found in this mound a small elliptical stone table, with 24 distinct characters arranged in parallel lines. It appears that they are not letters, but hieroglyphics. Some very high tumuli are found in the neighbourhood of St. Louis, and among them are two which have two or three stages or terraces, which are considered as important in an historical point of view, as they seem to connect the antiquities and consequently also the civilization of the antient tribes that inhabited the United States with those of Mexico; for these tumuli approach in shape to the teocallis of the Mexicans.

We pass to the Mexican antiquities. On the river Gila, which falls into the Rio Colorado, some large ruins are said to exist under the name of Casas Grandes. Humboldt considers these ruins as one of the temporary stations of the Azteks in their migrations from the north to the south, and he has given some account of them and the surrounding population according to the information published by two monks in 1792. These ruins have not been found since. It is true that nobody has sought for them, but the country in which they are supposed to exist has been traversed by several persons, who do not mention the high civilization of the Indian tribes inhabiting these regions. It appears that the country is uninhabited, and that being the case, ruins may escape the attention of travellers for a long time. But there are Casas Grandes in the state of Chihuáhua between 30° and 31° N. lat., where for several leagues the country is covered with the ruins of buildings, among which also some edifices of very considerable extent are met with. Numerous earthen idols somewhat resembling in style those of Egypt have been disinterred, and also jars and other articles. But those ruins have not yet been examined and described by any scientific traveller. Humboldt considers them also as one of the stations of the Azteks, and the extent of the ruins favours his statements. The antient buildings within the limits of the Mexican confederation are the teocallis, or houses of the gods. They are four-sided pyramids, rising by stages or terraces to a considerable elevation. When the Spaniards first visited the capital of the Azteks, they found there an immense edifice of this kind, which however was destroyed by the fanatic zeal of some Spanish clergymen, when the new town of Mexico was founded. There however still exist a considerable number of such buildings. A group of such pyramids still exists in the Vale of Mexico at Teotihuacan, about 20 miles north-east of the capital. It consists of two large pyramids which were consecrated to the sun and to the moon, and are surrounded by several hundred small pyramids, forming regular streets, which run exactly north and south or east and west. The larger of the two pyramids is more than 160 feet in perpendicular height, and the other is more than 130 feet high. The base of the first is 900 feet long. The small pyramids which surround the two grand ones are from 30 to 40 feet high, and according to the tradition of the natives, they were used as burial-places for the chiefs of the tribes. The two large teocallis have four stages or landings. The interior of these edifices consists of clay mixed with numerous small stones; but this nucleus is enclosed by a thick wall made of a kind of pumice-stone. It is stated that on the platform of these edifices two colossal statues of the sun and the moon were originally placed. East of these teocallis of Teotihuacan, and not far from the shores of the Gulf of Mexico, is the pyramid of Papantla, situated in a thick forest. The form of this teocalli, which has still six stories, but formerly had probably seven, is more tapering than any other monument of this kind yet discovered, but the height is only 57 feet, and the base only 25 feet on each side. It is built entirely of hewn stones, of an extraordinary size and very well shaped. Three staircases lead to the top; the stages are decorated with hieroglyphical sculptures and small niches arranged with great symmetry.

The largest, most antient, and most famous of the Mexican teocallis is that of Cholula. It has four stages of equal height, and its sides front exactly the four cardinal points. It is 178 feet high, and each of its sides at the base is 1448 feet long. It is stated that on the top of this pyramid an altar originally existed, dedicated to the God of the Air, but the place is now occupied by a small Christian chapel. It is also stated that this teocalli had not been erected by the Azteks, the ruling nation at the arrival of the Spaniards, but by the Tolteks, who had been the ruling nation before their time, and that at the epoch of the arrival of the Spaniards it had been standing 500 years. The teocallis or Mexican pyramids were at the same time temples and burial-places, and it appears that the small chapel at the top of the pyramids was the principal part of them. This part, which was the temple, has mostly been removed and replaced, as in the case of the teocalli of Cholula, by a small Christian church, and up to 1840 we had no idea of the form of these structures at the top. But in that year Mr. Stephens, an American traveller, found a well preserved teocalli among the ruins of Ocosingo, in the province of Chiapas in Mexico, and it appears that the edifice by which the structure is crowned is in a comparatively good state of preservation. This edifice certainly differs greatly from what it was expected to be, and the account of it in Mr. Stephens' book is very interesting. The ruins of Santa Cruz del Quiché in Central America bear a great resemblance to the teocallis of Mexico and Chiapas, though it is well known that this town was a fortress, and not a temple. It would however appear that the different nations who succeeded one another in the possession of Anahuac had adopted the same kind of construction in their fortifications which we find in their religious buildings. This is proved by the fortress of Xochicalco, situated not far from the town of Cuernavaca, on the road leading from Mexico to Acapulco. This is an isolated hill, 386 feet high, which has been surrounded by a ditch, and divided by the work of man into five stages or terraces, which are coated with masonry. The whole forms a truncated pyramid, whose four sides exactly front the four cardinal points. On the top of the hill is a flat space, containing more than 12 acres, on which there are the ruins of a small building, which may have been a kind of watch-house.

The antiquities hitherto noticed differ in character very much from those of the Old World, except that Humboldt finds a resemblance between the Mexican teocallis and some of the pyramids of Sakkarah in Egypt. But there are also ruins of buildings, which evidently have not been very different from those erected in several parts of Europe. At the time when Humboldt visited America only one group of ruins of this description appears to have been known in Mexico, at Mitla or Miguitlan, south-east of Oaxaca, which go under the name of the Palace, and of which he gives rather a detailed description. But since he wrote his 'Views of the Cordilleras,' &c., numerous ruins of this kind have been discovered. It does not however appear that, with the exception of the ruins of Mitla, any of this description have been found in Mexico, or in the country west of the isthmus of Tehuantepec, nor on this isthmus itself; they lie to the east of it, in countries which may be considered as forming parts of the peninsula of Yucatan. Mr. Stephens visited 44 antient cities, though his stay in the country was short. He is of opinion that these structures were erected by the ancestors of the present population, and at a period little anterior to the arrival of the Spaniards, and the great number of the ruins certainly favours his opinion. It is not known how many there may be in other parts of the country, but they are certainly very numerous between 19° 45′ and 20° 45′, and especially between 20° and 20° 20′, on both sides of a low ridge of high grounds, which in these parts runs from W.N.W. to E.S.E. Along the southern base of this ridge groups of ruins occur at distances of five or six miles from one another, and appear to form a continuous series. The ruins are most numerous at Uxmál, Kabáh, Gabna, Kewick, Labpahk, and Chichen. Though no ruins of considerable extent appear on the shores of the Bay of Campeachy, some are found on those of the Bay of Honduras at Taloon (20° 12′ N. lat.), and in its neighbourhood at Tancar. Some inconsiderable ruins exist in the island of Kankun, not far from Cape Catoche, the most north-eastern point of Yucatan.

These antiquities are called ruins of cities, and we find it expressly stated that in some places several square leagues are encumbered with ruins of buildings in a state of great decay, and with rubbish. But it must appear a matter of surprise that so many cities were found in a country which had no commerce and was almost entirely destitute of manufactures. That these countries had no foreign commerce is evident from their want of sea-faring vessels above the size of a moderate canoe, and still more from their entire want of a general currency. No coins have ever been discovered in America, nor any thing which could have served for the purpose of money. If there did not exist a commercial intercourse between Yucatan and the neighbouring countries, no places of deposit for the goods to be exported would be required, nor for such articles as were imported from other countries, and could not be consumed in the country. Under such circumstances it is natural that the exchange of goods being confined to those produced in the country itself, and effected without the aid of a metal currency, was limited to barter, and did not require the intervention of a third person, but every article passed directly from the hands of the producer into those of the consumer. The degree of civilization which the inhabitants had acquired was certainly such as to imply the existence of several mechanical arts and trades, but it is not easy to comprehend how any article could have been required to such an extent as to constitute a regular branch of manufacturing industry. The state of society therefore did not require towns, neither on account of commerce nor for the establishment of manufactures, and yet we find it stated that the number of towns is great. It is evident that for the government of the country a single town would have been sufficient. We may therefore presume that these ruins are not the ruins of towns; but of what kind of buildings they are the remains it is very difficult to ascertain, as we are entirely unacquainted with the state of society in these countries when those structures were erected.

Travellers call them ruins of cities, probably under the first impression which such extensive remains make on those who see them. But whenever they have taken the trouble to make a plan of the ruins, it is found that there is only a small number of buildings. There is always one building of great extent, rather resembling the palaces of Europe than common dwelling-houses; and this edifice has received different names. At some places it is called the Governor's House, and at others the Cacique's House. This edifice exhibits a great quantity of architectural embellishments. There are columns of different sizes, corridors, paintings, ornaments in stucco, &c. The front of the building is 300 feet long, and its width frequently exceeds 200 feet. The whole is so disposed as to form three or four terraces, the top of the whole being a large level space constituting the roof, which is enclosed with a low wall. The front of these buildings is generally ornamented with numerous sculptures. This edifice is evidently the principal object in every group of ruins. It is surrounded by several other buildings, the use of which has not been ascertained. Among these outbuildings, as it were, sometimes an edifice is found which, according to our ideas, may have been a temple; but nothing has been produced which proves them to have been places of public worship. Generally there is one, and sometimes two pyramids near the palace, but even their use is uncertain. As the ruins are not found in places which have been the sites of extensive towns, we are inclined to think that they have been the residences of a ruling priesthood, or that the political constitution has been founded on theocratical principles. But perhaps they have been baronial establishments. It is known that the political constitution of Mexico rested chiefly on feudal principles, and that the bulk of the nation were bound to give a considerable part of their time and labour for the advantage of an hereditary nobility. We may therefore presume that this was also the case in Yucatan; and such a state of society appears to have been much favoured by the peculiar character of the country, where water for irrigating the fields can only be obtained at the expense of great labour. [YUCATAN, P. C., p. 722.]

The most famous of these ruins are those of the city of Palenque, as it is called, which lie near the boundary-line between Mexico and Central America. These ruins were discovered in the middle of the eighteenth century, and from that time it has been always stated that they cover a space of six leagues in circumference, and contain public works of great magnificence. We now know that the ruins consist only of a large building called the Palace, and four or five other buildings of inferior size, in a tolerable state of preservation, with the remains of a few others so utterly dilapidated that it is impossible to say what they have been. The palace stands on an artificial elevation of an oblong form 40 feet high, 310 feet in front and rear, and 260 feet on each side. The palace itself stands with its face to the east, and measures 228 feet in front by 180 feet deep. The height is not more than 25 feet, and it had a broad projecting cornice of stone all round. There are no windows. The front contains 14 openings resembling gates, each about nine feet wide, and the intervening piers are between six and seven feet wide. The building is constructed of stone, with a mortar of lime and sand, and the whole front has once been covered with stucco and painted. The piers are ornamented with spirited figures in bas-relief, but only six of them remain. The outer walls of the palace, as it were, are formed by two parallel corridors running lengthwise on all the four sides; they are about nine feet wide. The floors are of cement, as hard as the best in the remains of Roman baths and cisterns. The space enclosed by these corridors contains four court-yards, separated from one another by corridors of less extent, several sets of apartments, but connected again by passages between the corridors and rooms. The number of the apartments exceeds 20. The bas-reliefs in stucco and in stone, in the court-yards of the palace, attract attention partly on account of the manner in which they are executed, and partly on account of the style of the figures. In one of the court-yards is a tower whose base is 30 feet square; it has three stories, and is conspicuous for its height and proportions. Nearly contiguous to this great palace is one of inferior dimensions. It stands on a pyramidal structure 110 feet high on the slope. This building is 76 feet in front and 25 feet deep. It has five doors and six piers, all standing. The whole front was richly ornamented in stucco, and the corner piers are covered with hieroglyphics, each of which contains 96 squares. Besides these two tablets, there are in the corridors of the interior three others, likewise covered with hieroglyphics. The other two or three buildings are less remarkable, but they also contain a few bas-reliefs of value. All these buildings stand on the top of artificial mounds resembling pyramids, and the slopes of these mounds have evidently been faced with stone, which however has been thrown down by the growth of the trees which now cover them.

The ruins of Santa Cruz del Quiché are connected with the conquest of this part of the country by the Spaniards, and are therefore the only remains which have an historical value. They are situated near 15° N. lat., at the southern extremity of the peninsula of Yucatan. These ruins are far from being extensive, and very little remains of the work erected by the natives before the arrival of the Spaniards, for the purpose of rendering this place impregnable. These ruins are on a hill with a flat summit, which is surrounded on all sides by deep ravines. A part of one of the ravines is stated to have been made by the natives; and it is said that upon it 40,000 men had been employed at one time. The flat top of the hill was once occupied by the palace of the kings of Quiché, by a seminary or military school, and other buildings belonging to the royal house of that name, but at present nothing is found there except confused and shapeless masses of ruins.

The last-mentioned antiquities are the work of the Tolteks, a nation which appears to have once been in possession of nearly the whole of the Mexican Isthmus, and which even at the arrival of the Spaniards was the predominant nation east of the isthmus of Tehuantepec, where the kingdoms of Quiché and Katchequil were the most powerful states. It is stated that the Tolteks had attained a higher degree of civilization than the Azteks, and the ruins of their buildings appear to confirm this opinion. It is however problematical if the ruins found east of the isthmus of Chiquimula belong to the same people, as they are distinguished from all other American antiquities by very marked characteristics. The most extensive of these ruins, and certainly the most remarkable, are those of the city of Copán, which are on the banks of the river of the same name, which joins the river Motagua from the south. This city was in existence at the time of the arrival of the Spaniards, and was destroyed by them on account of an insurrection, which happened among the natives some years after they had submitted to the foreigners. At present no human habitation is found among the ruins, and the whole site of the town is overgrown with large trees and underwood. The ruins are dispersed over a space about a thousand feet in length and five hundred in width, and consist of the remains of strong and high walls constructed of massive hewn stones, and of several pyramidal buildings, but there are some square altars, of which one is sculptured on the four sides and the top, and of a considerable number of stone idols, most of them still standing, though a few have fallen to the ground. These idols have the shape of columns, and are from twelve to twenty feet high. They are mostly covered with sculptures on all four sides, from the base to the top. The sculptures are very rich, and made with great art and labour. They are all of a single block of stone. Most of them present a human figure fantastically dressed and adorned, but they differ greatly in design. In a few the backs and sides are covered with hieroglyphics. The altars are also of a single block of stone. They are in general not so richly ornamented as the idols. The sculpture on the best preserved of these altars is in bas-relief, and this is the only specimen of that kind of sculpture found at Copán, all the rest being in bold alto-rilievo. It is six feet square and four feet high, and the top is divided into thirty-six tablets of hieroglyphics. The sides of this altar are covered with sculptures representing each four human figures in sitting attitudes. There are perhaps no ruins which show greater art and ingenuity and more labour than the ruins of Copan, and they may in these respects be compared with the temples of Elephanta and Ellora in Hindustan. It appears that other ruins of a similar description occur in this part of Central America. We know at least that some idols of stone are found at a place called Quirigua, which is situated on the banks of the river Motagua, several miles east of Encuentros, which is the place where the river is reached by the great road leading from the port of Ysabal to the town of Guatemala. The idols are exactly in the same style as those of Copán, but they are two or three times as high. At this place is also found an obelisk, or rather a carved stone, twenty-six feet above the ground and probably six or eight feet under. The sides represent figures of men, and are finely sculptured.

It is probable that other ruins will be found in the states of Honduras and Nicaragua, as these countries too, at the time of the Spanish invasion, were inhabited by nations which were not savages, but acquainted with some of the arts of civilized life. A modern traveller states that as far south as the district of Chontales, which lies north-east of the Lake of Nicaragua, monuments of antiquity exist, but he gives no description of them, nor does he state of what those monuments consist. Farther to the east and in the state of Costarica and on the Isthmus of Panama no monuments have yet been discovered, and it is not probable that such relics will be found, as this part of America was inhabited at the arrival of the Spaniards by tribes which had scarcely emerged from the lowest state of civilization. No antient monuments are met with in the republics of Venezuela and New Granada, though it is certain that the Muyscas, a nation inhabiting the table-land of Cundinamarca, or of Bogotá, had made considerable progress in civilization. There are however a few antient edifices in Ecuador, on the table-land of Quito. Not far from the volcano of Cotopaxi are the ruins of a large building called the Palace of the Incas. It is a square measuring on each side about thirty yards, and it has four doors. The interior is divided into eight apartments, three of which are still in tolerable preservation. Not far from the mountain-pass of Assuay is what is called the Fortress of Cañar, a building consisting of a wall of very large stones, about five or six yards high. It has an oval form, of which the greatest axis is nearly forty feet long. A modern traveller mentions an antient fortress called Huikhay, situated not far from the town of Jauja in Peru, which evinces a great degree of military architecture, but it is rapidly going to decay. The antient Peruvian monuments are not, like those of Central America, distinguished by sculpture and rich ornaments, but by solidity and simplicity, as is proved by the great road of the Incas, running from Quito to Cuzco and farther southward, and by the massy stone buildings which are dispersed over the mountainous countries enclosed by the ranges of the Andes. There are also the ruins of some destroyed towns in the lower country along the Pacific, but they are in such a state that no traveller has thought it worth his while to give us a description of them. Neither in Brazil nor in Paraguay and the states of La Plata have antient monuments been discovered.

This short and rapid survey of American Antiquities is incomplete. Such as it is, it shows the immense extent of country over which they are dispersed, and gives a slight indication of the great difference in character which they exhibit. This difference must be an additional stimulus to investigate their origin and use, to all those who take an interest in the history of the human race; but the study of American Antiquities presents much greater difficulties than that of the antiquities of other quarters of the world. There is no history of the nations who erected them, nor are there any facts on record with which we can connect them. We do not know by whom and under what circumstances these remarkable monuments were erected; nor do we know what purpose they were to answer. When we investigate the antiquities of Europe we find in most cases that these circumstances can be ascertained. Either the erection of these buildings is recorded in history, or some inscription or other indication informs us of the time in which they were built or by whom. There are a few antiquities, such as the Celtic remains, as to which some discrepancy of opinion exists, but even here we can approach to probable conclusions. The monuments of Egypt are covered with the names of kings who erected or embellished them, and the Greek historians have recorded such traditions as were current in Egypt when they visited that country. We cannot say so much of the rock-cut temples and other great monuments of Hindustan. Few inscriptions are found on them, and the nations who erected them are remarkable for their neglect in recording historical facts. But the sculptures which adorn these monuments are so closely connected with the present state of society in that country and with the religion of the people, that it may be asserted that they mutually explain one another, and that a person who is thoroughly acquainted with the people and their religious institutions and opinions is thereby enabled to understand the sculptures on the monuments. In this way nearly all the antient monuments in the Old World may be explained by the aid of historical records or inscriptions, or by their evident connection with the present state of the inhabitants. But it is different with the monuments of the New World. They are not mentioned in historical records, nor do they contain inscriptions. It is true that many of them contain hieroglyphic characters, which were probably sufficient to convey some historical information to the nations which erected them and knew their signification. But to us they are dead letters. We do not know the state of society of the people who erected them, and we are unacquainted with the meaning of the hieroglyphic characters. Further, we cannot derive from the present condition of the nations of America anything which can explain their antiquities. Their condition has been abruptly and greatly changed, much more so than that of the nations of Europe when their countries were inundated by the barbarous nations which in the fourth and fifth centuries issued from the central parts of Asia and the north of Europe. The Spaniards, who conquered the most civilized portions of America, had urgent political motives for exterminating all those families which had acquired a degree of authority with the natives, and to reduce the whole population to a state of degradation; and what they began from political motives, they finished from religious zeal. It is quite impossible to connect the present condition of the native population of Yucatan with the ruins discovered at Uxmal or Chichen, or to draw from it any facts which can elucidate the monuments, though it is probable that these monuments were erected by the ancestors of the present native inhabitants. These difficulties are still greater in the United States of North America, where it is certain that the native tribes which lately occupied those countries in which the monuments exist, did not erect them, but that they are the memorials left by a nation which in some remote times was in possession of the country, and which had attained a higher degree of civilization than the present Indian population. A slight acquaintance with the monuments and the present Indian tribes is sufficient to show that no kind of connection can have existed between them, and the Indians themselves declare that they are ignorant of the time when and the purpose for which these monuments were erected.

(Humboldt, *Vues des Cordillères et des Monuments des Peuples indigènes de l'Amerique*; Priest, *American Antiquities and Discoveries in the West*; Bradford, *American Antiquities and Researches into the History of the Red Race*; Stephens, *Incidents of Travel in Central America, Chiapas, and Yucatan*; Stephens, *Incidents of Travel in Yucatan*; Norman, *Rambles in Yucatan*; Hardy, *Travels in Mexico*; Vetch, 'On the Monuments and Relics of the Antient Inhabitants of New Spain,' in *London Geog. Journal*, vii.

AMIGO'NI, JA'COPO, one of those painters who, by some chance not quite apparent, obtained a popularity in his life time immeasurably beyond his deserts according to more modern critics. He was born at Venice in 1675. After he had acquired some reputation in Venice, he added considerably to it in the service of the elector of Bavaria, by some works he executed in Munich, and particularly some fresco ceilings at Schleissheim. He met with equal success in London, where he came in 1729, and painted a few staircases in fresco, and many portraits in oil. He painted also Shakspere and the Muses over the orchestra of the then new theatre at Covent Garden. He returned to Venice in 1739, having saved 5000*l.* during his ten years' stay in London. In 1747 he went to Madrid with the appointment of painter to the king, Ferdinand VI. He died at Madrid in 1752, where two of his daughters were still living in 1773, both married; one of them, Signora Castellini, practised as a portrait-painter in crayons.

Amigoni's frescoes are purely ornamental, mere variegated decorations; the following is Walpole's critique upon his style, severe, but perhaps not much less true than severe. 'His manner was a still fainter imitation of that nerveless master Sebastian Ricci, and as void of the glow of life as the Neapolitan Solimena; so little attention do the modern Venetian painters pay to Titian, Tintoret, and Paul Veronese, even in Venice. Amiconi's women are mere chalk, as if he had only painted from ladies who paint themselves. Nor was this his worst defect; his figures are so entirely without expression, that his historical compositions seem to represent a set of actors in a tragedy, ranged in attitudes against the curtain draws up. His Marc Antonys are as free from passion as his Scipios. Yet novelty was propitious to Amiconi, and for a few years he had great business.'

He painted some small conversation pieces in the style of some of the Dutch painters, which Lanzi prefers to his larger works. Of the latter one of the best is a Visitation, at the Padri di San Filippo at Venice. He engraved a few prints for his amusement, and instructed Joseph Wagner in engraving, who engraved many of Amigoni's works. The prints after Amigoni are very numerous; Heineken enumerates 127, including the portraits of several crowned heads, among them Peter the Great; and one pope, Benedict XIV.

(Zanetti, *Della Pittura Veneziana*, &c.; Bermudez, *Diccionario Historico*, &c.; Walpole, *Anecdotes of Painting in England*, &c.; Lanzi, *Storia Pittorica*, &c.; Heineken, *Dictionnaire des Artistes*, &c.)

A'MMAN, JOST, a very celebrated Swiss engraver and designer of the sixteenth century, born at Zürich in 1539. Though a Swiss by birth, he was a German by adoption, for he established himself in Nürnberg in 1560, and gave up his right of burghership in Zürich in 1577. As is the case with most of the old German masters, little or nothing is known about Amman's life; many writers speak of him as a painter, yet there is not a single painting of his known: Sandrart and Doppelmayr speak of him as a painter on glass only. Amman's designs are extremely numerous; a painter of Frankfort, of the name of Keller, who lived with Amman four years, told Sandrart that the drawings he made whilst he was with him would fill a large waggon. Though he did not live long, he surpassed every artist that preceded him in the number of his designs. There are about a thousand wood-cuts attributed to him, but whether he cut all or even any of them himself is not known. Bartsch also doubts whether all the etchings attributed to Amman are etched by him; he supposes some to have been etched by Stephen Hermann. His designs generally appeared as the illustrations of books; few books were published in Amman's time without illustrations. Siegmund Feyerabend of Frankfurt was the publisher of most of Amman's works; many of them were published after his death. He died at Nürnberg in 1591.

His works comprise nearly every subject—History, sacred and profane, general costume, military costume, field-sports, natural history, heraldry, and other subjects. His drawing is generally good, and in the costume very accurate and evidently drawn from nature; his animals also are executed with much spirit. Strutt, speaking of his style of engraving, says, 'It is neat and decided; but if his strokes are more regular than was usual with the engravers on wood of his time, it is to be feared that as much as he gained by the pains he took with this part of his execution, he lost in freedom and spirit.'

One of his most remarkable works is Πανοπλία, published first at Frankfurt in 1564; again in 1574, and again in 1588. This book is very scarce; it is a description of all the principal trades and occupations of Amman's time, containing 115 illustrations on wood of various mechanics and tradesmen, &c. in appropriate costume; he has represented himself as the engraver. Hans Sachs used Amman's plates for his work entitled 'Eigentliche Beschreibung aller Stände auf Erden' ('Particular Description of all Ranks upon the Earth'), printed at Frankfurt in 1568 and 1574.

Another remarkable work is 'Icones Livianae,' &c., published also at Frankfurt, in 1572 and 1573, containing 103 illustrations of Livy's 'Roman History.' They were published also with some additions and a German translation of Livy in 1573, in the same place; and again at Strassburg in 1631. The first cut is a portrait of Feyerabend, the publisher.

Feyerabend published also, in 1564, 103 illustrations of the clerical and monastic costumes of the Church of Rome, with Latin descriptions; but three German editions have since been published. And also a book of female costumes with 120 cuts: 'Gynæceum, sive Theatrum Mulierum,' &c., Frankfurt, 1586. Also in the same place, the books of Pliny the elder, 1584, folio; a set of 12 illustrious women, beginning with Eve, on copper; and in 1587 a Dance of Death, 'Der Todten Tantz,' in 49 cuts; besides many other works of less merit or interest.

Amman was also an author: he wrote a book on poetry, painting, and sculpture, which was published at Frankfurt, first in 1578, and later as a Manual of Painting, 'Artis Pingendi Enchiridion.'

(Sandrart, *Teutsche Academie*, &c.; Doppelmayr, *Historische Nachricht*, &c.; Strutt, *Dictionary of Engravers*; the *Dictionaries* of Heineken, Füssli, and Nagler; and *Le Peintre-Graveur* of Bartsch.)

AMMANA'TI, BARTOLOME'O, this distinguished sculptor and architect was born at Florence in 1511, and bred in the very height of the golden age of Italian art. Thus educated in such a nursery, with Baccio Bandinelli and Sansovino for his tutors, he could not easily fail to produce works worthy of his opportunities and his education. His father, Antonio da Setignano, died when Bartolomeo was young, but he left him master of sufficient property to be in a condition to choose his own profession and to follow it.

When Ammanati returned from Venice to Florence, Michel-Angelo was at the height of his reputation as a sculptor, and Ammanati became one of his most devoted admirers and imitators, and, like many other painters and sculptors, catching chiefly the defects of Michel-Angelo's style, fell into the error of treating the limbs as the most essential part of man. In this spirit Ammanati executed several works in various cities in Italy. He made three great figures at Naples for the monument of the poet Sannazzaro; a colossal Neptune for the Piazza di San Marco at Venice; a colossal Hercules at Padua; the Neptune of the Piazza del Gran Duca at Florence; and a colossal statue of Mount Apennine, 'Il Monte Apennino,' at Pratolino near Florence. The Neptune of the Piazza Gran Duca was ostensibly designed in competition with Benvenuto Cellini, the Fleming John of Bologna, and Vincenzo Danti; but according to Cicognara the competition had nothing to do with the Duke Cosmo's adoption of Ammanati's design; the duke, says Cicognara, did not even see the designs of two of the competitors.

Ammanati was also much employed in Rome by several popes,—by Paul III., Julius III., and afterwards by Gregory XIII.

During the interval between the two periods that he was employed by these pontiffs, he attained great fame at Florence as an engineer and an architect. He constructed the celebrated Ponte della Trinità, which spans the Arno in three light and elegant elliptical arches, calculated to allow the sudden floods of that river to pass without the slightest risk: it still exists, and has withstood lately (1844) the most impetuous flood that has visited the Arno for centuries, in which even the newly constructed iron suspension-bridge was swept away. The old Ponte della Trinità, which was replaced by the bridge of Ammanati, was destroyed by the floods of 1557. Ammanati made also some additions to the Pitti Palace, which had been commenced from a model by Brunelleschi, and has been finished only within the last ten years. At Rome he built the Palazzo Ruccellai, afterwards Ruspoli; the court and façade of the Collegio Romano, built for the Jesuits by order of Gregory XIII.; and the Palazzo Sacripanti for the Corsini family. His principal works of sculpture in Rome are the figures of Justice and Religion and the other sculptures of the tomb of the Cardinal del Monte in the church of San Pietro in Montorio.

Many of the works of Ammanati are naked, which, as he grew old, he seems to have deeply regretted; and he wrote a letter as an apology to the Academy of Florence, which was published in 1582, and in which he exhorts the rising artists to drape their figures, the representation of the naked being, as he then thought, offensive and injurious. Baldinucci has reprinted the letter. His wife, to whom he was married in 1550, was the celebrated Laura Battiferri of Urbino, distinguished as a poetess. She was a member of the Society of the Intronati of Siena. Her poems have been twice published, at Florence in 1560, and at Naples in 1694. She died at Florence in 1589, aged sixty-five. Ammanati survived her three years, and died, according to Baldinucci's copy of the inscription on his monument, in 1592, aged eighty-one. His body was laid near his wife's, in the chapel of San Bartolomeo, which he had prepared for the purpose, in the church of the Jesuits, San Giovannino, at Florence. He bequeathed the greater part of his property to the Jesuits.

There is in the library of the Florentine Gallery a manuscript by Ammanati, entitled 'La Città,' in which he has treated of all the buildings necessary for a city.

(Baldinucci, *Notizie dei Professori del Disegno*, &c.; Cicognara, *Storia della Scultura*.)

AMMODYTES, a genus of fishes belonging to the division of *Apodal Malacopterygii* and family *Anguillidae*. The body is very long and the head lanceolate. On the back is a dorsal fin extending nearly its whole length. The anal fin is also long; and the caudal, which is forked, is separated from both the dorsal and anal. Two species occur on the coasts of the British Islands, the *Ammodytes tobianus* and the *Ammodytes lancea*. The former is the larger, and is distinguished by the greater size of the head, and by the dorsal fin, which commences in a line with the extremities of the pectorals, whilst in the *A. lancea* it commences in a line with the middle of the pectorals. The Sand-Eel, by which name the first species is popularly known, attains a length of between 12 and 15 inches. When alive the back is of a dark bluish-green, and the sides and belly bright silvery-white. It frequents sandy shores in great numbers, but is capricious in its visits, more so than its congener. At the ebbing of the tide it buries itself with great dexterity and rapidity in the wet sands to the depth of from 4 to 6 inches, whence it is extracted by means of various instruments, such as peculiarly formed gripes and sickles with blunt edges, made for the purpose. It is much esteemed by fishermen as a bait, and is also sought after on many parts of the coast as an article of food, being very delicate eating when fresh, and excellent when dried in the sun and grilled.

The sand-launce, *Ammodytes lancea*, is a smaller species, and usually of a more brownish hue, with a tinge of red about the head. It is more abundant than the Sand-Eel, and has always been distinguished from it by the fishermen, though for a long time confounded with it by naturalists. The distinctions between the two species were first pointed out by M. Lesauvage of Caen. Both appear to be generally distributed through Northern and Western Europe. In Scotland the Sand-Eel is known by the name of the Horner, and in the Isle of Man the two species are distinguished from each other as the Grey Gibbon and Red Gibbon.

(Yarrell, *British Fishes*, vol. ii.; Parnell, *Fishes of the Frith of Forth.*)

AMMONIA—*Medical Properties of.* This alkali is distinguished from the others by the appellation of Volatile, because at the ordinary temperature and pressure of the atmosphere it never exists in a fixed state, but either in a gaseous form, in which case it immediately combines with any carbonic acid which it encounters in the air, or is absorbed by water or spirit, from both of which it is easily liberated, particularly if heat be applied. Having been formerly obtained by distillation of shavings of hartshorn or other animal matters, it is familiarly known under the name of Spirit of Hartshorn. The combinations with carbonic acid have the same properties as the pure alkali, in respect to volatility, and only a diminished degree of causticity.

The gas in an undiluted state is highly pungent, with a suffocating odour, is irrespirable, and irritates and inflames the animal tissues. (Christison.) Diluted by passing through the air, from which it absorbs moisture and carbonic acid, which serve further to lessen its acrimony, it is occasionally, but rarely, applied to the eyes, in some passive inflammations, and to keep up vigilance in cases of somnolence from narcotic poisons. This last mode of using it is scarcely to be recommended, as dangerous inflammation of the eyes may subsequently follow. Indeed all employment of even the less caustic forms of administration, when much insensibility exists, such as in faintings, epileptic fits, or from narcotic poisons, likewise in experiments on persons in the state termed mesmeric coma, requires great care. Fatal inflammation of the windpipe has ensued by merely holding carbonate of ammonia (smelling salts) or a handkerchief dipped in strong aqua ammoniae under the nostrils. (Nysten.) When it is to be introduced into the stomach, this should be done by means of the stomach-pump, to avoid any of it passing into the windpipe. Besides its local action, exciting inflammation and its effects, ammonia is itself poisonous, its secondary effect on the nervous system, particularly the spinal column, being sufficient to cause tetanic convulsions. Though Eau de Cologne may be grateful to adults, the vapour is unsafe for children. (See *Lancet* for April, 1844.)

Ammoniacal gas absorbed by water constitutes the *aqua* or *liquor ammoniae*. This is formed of two different degrees of strength: the one of a density of 882 at 62° F. called *fortior*, much too strong for any medicinal purpose, and only employed for some chemical purposes; the other of the density of 960, which also generally requires to be diluted further with water when intended for internal use, or with oils when for external use, as it is very frequently to form rubefacient liniments. The solution of the carbonate is likewise frequently employed in combination with oils. These, if long applied, or frequently repeated, cause inflammation which terminates in suppuration and ulceration.

Ammonia, when suitably diluted to be taken into the stomach, causes a feeling of warmth, with increased energy of the nervous power. Hence it acts as a prompt and valuable counter-poison to Prussic Acid, the bites of serpents, and the poison of many diseases, such as Cholera Asiatica, and typhoid fevers, at the commencement of which great depression of the nervous system is observed. In lesser degrees of depression, such as the languor of hysterical females, or in atonic gout, ammonia or its carbonates are daily resorted to. It is likewise employed to counteract acidity in the stomach. It must not be overlooked however that the long continued use of ammonia produces the same ill effects as the other alkalies when taken in excess. [Alkalies, P. C. S.]

The salts of ammonia require a brief notice. The properties of the different combinations of ammonia with carbonic acid are too similar to those of the pure alkali to be noted separately, except to state that carbonate of ammonia furnishes a good emetic in the earliest stage of fever with great depression, and is in smaller doses given freely throughout adynamic fevers, sometimes in the effervescing form, especially when action of the skin is desired. Citric acid is employed to cause it to effervesce.

Hydrochlorate of ammonia is little employed in this country internally, but it may be beneficially used in combination with cinchona bark in fevers. In large doses it is poisonous. It is however chiefly employed to form discutient and evaporating lotions in conjunction with vinegar and spirit. For these it is most valuable.

Acetate of ammonia has little of the causticity of the pure alkali or the carbonates, neither is it volatile. It is so deliquescent that it cannot be kept in the solid form, and is always administered in weak acetic acid. This forms a most grateful refrigerant at the commencement of slight inflammatory complaints, and if the patient be kept warm, generally induces perspiration. For this purpose it requires to be freely given. It is also a diuretic, but not much employed. Properly diluted with rose-water it forms a cooling eyewash, most grateful after some forms of inflammation, to relieve the turgescence which remains, or even to remove turgescence which has not been preceded by inflammation. Scarpa thought it useful against commencing amaurosis.

AMMO'NIACUM—*Medical Properties of.* This gum-resin is fully described in P. C., vol. i. p. 459, where it is ascribed, on the authority of the former edition of the 'London Pharmacopœia,' which was misled by Willdenow, to the Heracleum gummiferum, Willd., an error corrected in the subsequent one, where it is correctly referred to the Dorema ammoniacum (Don, in 'Linnean Trans.,' vol. xvi. p. 599), which was discovered by Lieut.-Col. Wright, growing near Yezd Khāst, a town of Irāk Ajemi, the antient Persis, about 42 miles south of Ispahan. Its Persian names are Ooshk and Ooshook. It has more recently been found on the low hills near Herat, likewise abundantly in Syghan, near Bameean, on the north-west slope of the Hindu-Coosh range of mountains. (Christison.)

Ammoniacum was known to the antients: but it is supposed that what they used came from Africa as well as Asia, and was procured from a species of Ferula, either the F. orientalis (Linn.) or the F. tingitana (Linn.).

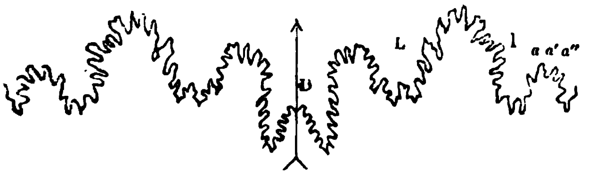
The Persian plant yields the juice chiefly from the stalk, especially the points of divarication of the umbels, owing to the punctures of numerous coleopterous insects. 'The gum is so abundant, that upon the slightest puncture being made, it instantly oozes forth, even at the ends of the leaves.' (Capt. Hart, *Trans. of Medical Society of Calcutta*, vol. i. p. 369.) The juice quickly dries, and is either picked off or allowed to accumulate till it falls on the ground. This collection takes place about the middle of June. A tenth part is remitted as tribute to the government; the rest is sent to Bushire, on the Persian Gulf, and thence to Europe. The best comes by Bombay. The juice of the Syghan plant is obtained by making successive slices of the root, as in the case of assafœtida. The samples vary much in quality. The directions given to purify the inferior sorts, by softening them in boiling water, and squeezing them through a cloth, though capable of removing mechanical impurities, impair the power of the gum-resin, by driving off the volatile oil, which even in good specimens is not very abundant, 32 ounces yielding by distillation only one drachm.

The officinal form for administering ammoniacum is the

mixture, in which it is partially dissolved and partially suspended in water. It is a most valuable expectorant, and may have its virtues increased by the addition of squills or ipecacuanha. Dilute nitric acid greatly heightens its powers. It is also an ingredient in the compound squill pills. Externally it is applied as a plaster, to disperse indolent swellings, either softened by vinegar, a form which has kept its place amid all the changes in medical agents for nearly two thousand years, or combined with mercury, which is often beneficial.

AMMONITES, a fossil genus of Cephalopodous Mollusca, allied to the recent genus Nautilus. [CORNU AMMONIS, P. C.; GONIATITES, P. C.; POLYTHALAMACEA, P. C.] In the opinion of all naturalists this great group of fossils requires to be subdivided. The Goniatites of the Palæozoic rocks have been effectually separated, the Ceratites of the triassic strata may be also withdrawn, but still the number of genuine ammonites which remain is too enormous to be treated except in sections more or, less founded on structural affinities. Without discussing what may be the best principles for such a classification, we may refer to that of Von Buch, as most generally accepted by geologists. This is mainly founded on a consideration of the sutures, or sinuous lines at the surface of the shell, formed by the edges of the diaphragmal plates which separate the chambers. (The forms of the mouth are gradually becoming known to us, and these may hereafter become valuable indications of natural affinity.) The following are Von Buch's groups, with their prevalent geological distribution:—

Arietes.—The back is usually broad, and carinated (often a furrow on each side of the keel); the ribs are simple and strong. The sutural line formed upon the following general model:—



The group of Arietes, including Amm. Bucklandi, A. Conybeari, &c., belongs almost wholly to the lias formation.

Falciferi.—The back is narrow, and acuminated to a sharp keel (no furrow on its sides); the ribs are elegantly and sigmoidally bent. The sutures differ from those of the Arietes, the dorsal sinus D being much less deep, with diverging and not parallel sides; the sinus L is very much deeper, and there are three or four smaller ones, *a a′ a″*, near the inner edge of the whorls. The latter whorls usually embrace the preceding ones.

These ammonites are numerous in the upper lias and lower oolite formations. A. Strangwaysii of Sowerby is an example. (Ammonites Walcottii does not belong to this division.)

Amalthei.—The back is generally acute and keeled, the keel generally crenated; the ribs generally a little sigmoidal; the latter whorls embracing the preceding ones. The sutures are in general form much like those of the last division, but more richly laciniated and foliaceous.

This group belongs to the upper lias and oolitic formations. Ammonites amaltheus of Schlottheim (A. Stokesii, Sowerby) is an example from the lias.

Capricorni.—The back broad, without a keel. The ribs simple, straight, strong, and crossing the back. Inner whorls exposed. The sutures often approach to those of the Arietes in respect of the sinus D; but the posterior edge of D, L, and l range on the same line, and the undulations are all lower and less foliaceous than in the Falciferi and Amalthei. Ammonites planicostatus (Sowerby) is an example. The species are common in the lias.

Planulati.—The back and sides rounded; no keel; the inner volutions exposed. The ribs are often divided over the dorsal region. The sutures are remarkably laciniated and complicated; the sinus (L) extremely deep, and generally trifurcate.

The species occur commonly in the lias and oolitic formations. Ammonites communis, Sowerby, is an example from the lias; A. plicatilis, Sow., from the coralline oolite.

Dorsati.—The back is broad and not keeled; the whorls often quadrate: the ribs are simple on the sides, but divided over the back, and generally bear a tubercle at the point of division. Ammonites Davœi, Sowerby, is an example from the lias.

Coronarii.—The back without a keel, usually broader than the sides; the ribs are straight and simple on the sides, but divided into two, three, or more as they cross the back, and the point of division is usually sharply tuberculate. The sutures resemble those of the Planulati. The species occur in the oolites, as A. Humphresianus, Sow.; A. Gowerianus, Sow.; and in the lias, as A. Bechei, Sow.

Macrocephali.—The back is without keel, and round and broad, and the umbilicus deep. The ribs are straight on the umbilical face and simple, but sometimes arched, and generally divided across the back. The sutures resemble those of the Planulati, but are somewhat differently proportioned to the dorsal and umbilical surfaces. The species occur in oolite and chalk. The Ammonites sublævis, Sow., is a good example, from the Kelloways rock.

Armati.—The back without a keel, often broader than the sides; ribs tuberculated on the sides. The inner whorls exposed. The sutures have the dorsal sinus (D) large and deep, the lateral sinus (L) widely removed from it and very deep, and somewhat trifurcate. Occurs in the lias and oolite, and more plentifully in the chalk. Ammonites Bakeriæ of Sowerby is an example.

Ornati.—The back flat or even hollow, narrow, and not keeled; the broad sides joining it at a right angle, marked in general by a row of small tubercles or the numerous fine ribs which cross the back and toward the inner edge unite in parcels to form acute or knotted ridges. (The old shells are often plain.) The sutures have the dorsal sinus (D) shallow, the lateral (L) deep. The species are almost confined to the Oxford clay and Kelloways rock. As Ammon. Calloviensis, Sow.; A. Duncani, Sow.; A. gemmatus, Phil., &c. (Von Buch rightly separated from these the *Dentati* in his original memoir, though they have been injudiciously reunited again.)

Dentati.—To this group we refer Ammonites splendens, Ammonites lautus, Ammonites dentatus, &c. of the golt. The back is flat or concave, and margined by tubercles, or prominent ends of strong ribs, often united near the inner edge into tuberculated ridges, but not crossing the back. The sutures resemble in general form the preceding.

Flexuosi.—The back narrow, with borders tuberculated or serrated by the terminations of the ribs, and in a young state with a tuberculated keel. The ribs are ridged or tubercled near the inner edge. This group is quoted from the upper oolitic and chalk formations, and A. asper and A. flexuosus are examples.

The classification above sketched is very far from perfect. It is difficult to define the groups, when we pass from the typical to the ordinary species, and there are many forms which refuse to be included in the formulæ. Still it is an admirable sketch, and when the Ammonitidæ are fully developed, according to the principles thus exemplified by Von Buch, we shall have them recognised, not as a genus with subdivisions, but as a family including many genera. There are admirable remarks on the Ammonites in D'Orbigny's 'Paléontologie Française,' and a very instructive examination of their structure by this writer in the 'Annales des Sci. Nat.' (1841) N.S., xvi. p. 113, which also contains Von Buch's papers (1829) xvii. 267; xviii. 417; xxix. 5.

AMO'MUM—*Medical Properties of this and allied Genera.* This comprehensive heading is adopted to include many aromatic stimulants, such as cardamoms, grains of paradise, &c., which are obtained from several plants related to amomum. German pharmacopolists even term Pimento berries, or Jamaica allspice, *semen amomi*, but this is never so called in Great Britain. Much obscurity hung over the history of the true cardamoms, which recent investigations have removed; and as Dr. Pereira has treated the whole subject at great length in his 'Materia Medica,' his statements are chiefly followed here.

The true, officinal, or Malabar cardamoms, are procured from the Elettaria Cardamomum (Rheede, 'Hortus Malabaricus,' vol. ix.), White; the botanical characters of which were described by Dr. Maton ('Trans. Linn. Soc.' x. p. 254). The Edinburgh College term it Renealmia (Rosc.); the London, Alpinia Cardamomum (Roxb.). It occurs in the mountainous parts of Malabar, and is also cultivated. The cardamoms of the Wynaad, which are the most esteemed, and bring the highest price, are cultivated. The fruit is the part collected, but the seed alone is used. The seed-vessel or husk is altogether devoid of aroma or pungency, but the seeds should never be taken out of it till required for use, as they keep much better in their natural envelope: 100 parts of best cardamoms yield 74 parts of seed and 26 of husks. This kind of cardamoms, called the small or lesser, presents three varieties in commerce, viz. shorts, short-longs, and long-longs, placed in the order of their merit. The first and best are about three to six lines long; the second, about six; the last from seven lines to an inch. Trommsdorf analyzed the small cardamoms, and obtained—essential oil, 4·6; fixed oil, 10·4; a salt (probably malate) of potash, combined with colouring-matter, 2·5; fecula, 3·0; nitrogenous mucilage, with phosphate of lime, 1·8; yellow colouring-matter, 0·4; and woody fibre, 77·3.

The fixed oil somewhat resembles castor oil. The excellence of the specimen depends on the volatile oil; this is small in inferior kinds; the best yield about six drachms and a half for every pound of the fruit. Jamaica cardamoms yield only four scruples for one pound of fruit. Like oil of turpentine, lemon, &c., it consists only of carbon and hydrogen.

Ceylon cardamoms, or larger, sometimes termed long, are produced in that island; but some of the less valuable of the Malabar fruits are termed Ceylon cardamoms. The name of 'grains of paradise' is sometimes given to this plant. It strictly belongs to an African plant, Amomum Grana-Paradisi (Smith), A. Meleguetta (Roscoe). Grains of paradise are used to sharpen vinegar, beer, liquors, &c., and brewers who have them in their possession are liable to heavy penalties. [ADULTERATION, P. C. S.] The duty on grains of paradise was reduced from 2*s.* per lb. to 15*s.* per cwt. by 5 & 6 Vict. c. 47.

Cardamoms are in great favour in the East as a spice, and also as an aromatic stimulant in the treatment of disease. In Europe they are as highly esteemed as carminative and stomachic agents. Dr. Christison observes that they form part of eighteen officinal preparations, besides their own tinctures.

AMONTONS, GUILLAUME, a diligent mechanician and experimenter in natural philosophy, was born at Paris in August, 1663. He was, during all his life, afflicted with deafness in consequence of a fever in his childhood; and, after a sickness which lasted but a few days, he died in October, 1705, being in the forty-third year of his age.

The taste of Amontons led him, at first, to the study of architecture and the processes of land surveying, and he appears to have been occasionally employed in the practice of both those branches of art. It is said that he was induced to apply himself to the study of mathematics by the desire of constructing a machine which should exhibit a perpetual motion: an opinion of the possibility of such a machine certainly lingered among the half-learned of that age; and, if Amontons really attempted to form one, his failure had the good effect of disposing him to cultivate the legitimate branches of science.

At that time the instruments employed for measuring the density, temperature, and humidity of the atmosphere were in an imperfect state; and several years of the life of Amontons were spent in improving them or in devising others. He invented a barometer, consisting of a slender conical tube of glass containing a column of mercury whose length varied by the variations in the upward pressure of the atmosphere on the base of the column; the open end of the tube, which was the greatest, being below, and the mercury being retained in the tube by a leathern bag. He also invented one, consisting of a tube bent so as to form three parallel columns, of which the first and the third contained mercury, and the intermediate one only air. Amontons contrived what he called a 'universal thermometer:' it was a tube of glass, 30 inches long, containing mercury, and to which was adapted a scale of inches; and, by comparing its indications with those of a column of mercury in an ordinary barometer, he was able to determine the expansion due to temperature alone: he also invented a species of hygrometer, consisting of a coloured fluid contained in a glass tube which terminated below in a leathern bag. The contraction or expansion of this bag, in consequence of variations in the humidity of the air, produced corresponding variations in the length of the columnof fluid.

But the most remarkable circumstance in the life of Amontons is his invention of what must be considered as a species of telegraph. His proposal was to have signal-posts established at intervals between the two extreme stations, which were to be Paris and Rome: a man at each post, being provided with a telescope, was to observe the signal (a letter of the alphabet) made at one station, and to repeat it to the next; the process being carried on thus along the whole line. Two experiments are said to have been made by him in 1702, in presence of the royal family of France, but it is not said with what success. Dr. Hooke had however anticipated the discovery about 18 years.

The only work which Amontons published is one entitled 'Remarques et Expériences physiques sur la Construction d'une nouvelle Clepsydre, sur les Baromètres, Thermomètres et Hygromètres,' Paris, 1695. He was, subsequently to the publication of this work, chosen a member of the Académie des Sciences; and among the 'Mémoires' of that body are those of Amontons on the expansion of fluids by heat, on the muscular strength of men and animals, and on the friction of materials.

(*Biographie Universelle; Eloge d'Amontons*, by Fontenelle.)

AMPE'RE, ANDRE' MARIE, was one of the many scientific men who, since the commencement of the present century, have distinguished themselves by the application of the highest branches of mathematical analysis to physical propositions, and particularly to such as relate to electricity, magnetism, and light.

Of his private life little is known; and his history, like that of most of the men who have passed their days in scientific pursuits, consists merely in statements of his birth and death, with a list of the works which he composed. He was born at Lyon, in 1775, and it appears that he resided in or near that city till about the year 1804, when he removed to Paris, where he died in 1836. Before this removal he was professor of physics in the central school of the department of Ain; and, subsequently, he held the appointment of professor of analysis in the Polytechnic School of Paris.

His first publication is entitled 'Considerations sur la Théorie mathématique du Jeu' (Lyon, 1802), in which it is satisfactorily proved that, if a person play habitually in society, he must infallibly, even though he play on equal terms, be ruined; since he is, as it were, playing with finite means against an opponent who may be considered as infinitely rich, and who therefore may continue the game indefinitely. In 1805 Ampère presented to the Class of Physical and Mathematical Sciences of the National Institute a paper entitled 'Recherches sur l'Application des Formules générales du Calcul des Variations aux Problemes de Mécanique;' and in the 'Annales de Chimie' (1814) there is published his letter to Berthollet on the subject of Definite Proportions, or the Atomic Theory.

Some connection between the electric, galvanic, and magnetic powers in nature had been long suspected on account of the observed effects of lightning on the directive property of a magnetized needle; and in 1819 M. Oersted observed that the wire connecting the opposite poles of a galvanic or voltaic battery caused a magnetized needle suspended near it to deviate from that position which it assumes when beyond the influence of any disturbing power. This remarkable phenomenon being made public, the philosophers both of this country and of the continent repeated the experiment in various ways; and almost immediately, by the discoveries to which their researches led, raised up a new branch of science. Among the earliest of these philosophers was Ampère, who, in September, 1820, read before the Académie Royale des Sciences a paper in which it was stated that the voltaic pile, or galvanic trough itself, produced a like effect on a needle suspended near it, when its opposite poles are connected by a wire; and soon afterwards he communicated an important discovery which proved that some, at least, of the phenomena of magnetism could be represented by electricity alone. He showed that if two wires connect the opposite poles of a battery, they attract one another when so disposed that the currents pass along them in the same direction, and repel one another when the currents flow in contrary directions; and he contrived a delicate apparatus by which the phenomena were exhibited.

Faraday having discovered that if a wire be suspended over one pole of a magnet, and the galvanic fluid be made to pass along the wire, or if the wire be fixed and the magnet suspended over it; the wire in one case, and the magnet in the other, would revolve about the fixed object; Ampère, to whom the discovery was communicated, immediately repeated the experiment, and subsequently contrived an apparatus in which the suspended magnet was, by the influence of the wire, made to revolve on its own axis. He also invented the well known apparatus, consisting of a copper cylinder surrounding one of zinc, and containing diluted sulphuric acid, both of which cylinders being supported by conical points over one end of a magnet placed in a vertical position, revolve about the magnet; from right to left if the north end be uppermost, and in a contrary direction if the south end be uppermost. M. Arago afterwards, in conjunction with or at the suggestion of Ampère, succeeded in communicating magnetism to a needle by placing it within a helix of copper wire, the extremities of which were connected with the poles of a battery.

From the mutual attractions and repulsions existing, apparently in electrical, or, as they may be called, electro-magnetic currents, Ampère inferred that such currents revolve continually about a magnet; at first he supposed that the centres of their revolutions were in the axis of the magnet, but he was subsequently led to consider that currents revolve about each atom in planes a little inclined to the general axis of the magnet: setting out with this principle, he satisfactorily deduced, by analytical processes, the phenomena of electro-magnetism, or, as he designated the science, electro-dynamics. He conceived moreover that the magnetic action of the earth is the result of currents circulating within it, or at its surface, from east to west in planes parallel to the magnetic equator: he also imagined that these currents act on balanced or suspended bodies which, like magnetized needles, contain electric currents, causing them to place themselves in such positions that the currents on their under sides may flow in the same directions as those of the earth. He contrived several ingenious machines in which terrestrial magnetism was an agent: among others, he disposed a wire bent in the form of a rectangle or a spiral, so that the plane might turn on a vertical axis; and, placing it in the position of the magnetic meridian, he allowed the electric current to enter at either extremity, when, exactly as a magnetized needle would do, it turned till it became at right angles to that meridian. He also exhibited to the Royal Academy of Sciences a copper wire bent in the form of a helix which possessed the properties of a magnet; the two extremities of the wire returned along the axis of the helix, each way, to the middle, from whence they passed out in opposite directions and served as pivots on which the spiral might turn. When the pivots were connected with the poles of a battery, each end of the helix, on a pole of a common magnet being presented to it, was attracted or repelled.

Ampère published at Paris, in 1822, a work entitled 'Recueil d'Observations Electro-Dynamiques;' in 1824, one which was designated 'Précis de la Théorie des Phénomènes Electro-Dynamiques' (both of these are in 8vo.); and in 1826, in 4to., 'Théorie des Phénomènes Electro-Dynamiques.' Two years afterwards he published a 'Mémoire sur la Determination de la Surface courbe des Ondes lumineuses, &c.;' and six years subsequently an 'Essai sur la Philosophie des Sciences, &c.' Besides these works there were published separately several memoirs relating to his experiments in electro-dynamics; also, in the 'Mémoires de l'Institut,' in the 'Journal de l'Ecole Polytechnique,' and in other works, are many papers relating to Mechanics, Optics, and Natural History.

(*Address of H. R. H. the Duke of Sussex to the Royal Society of London*, 1836; Barlow's *Essay on Magnetic Attractions*; Turner's *Elements of Chemistry*.)

AMPHERI'STUS, a fossil fish, from the Isle of Sheppy. (König, *Icon. Fossil.*)

AMPHI'DETUS, a genus of Echinidæ, found in the crag of Suffolk.

AMPHI'ON (Pander), a genus of fossil Crustacea (Trilobites), four species of which have been described, from Tyrone and Waterford, by Captain Portlock.

AMPHIOXUS. [BRANCHIOSTOMATA, P. C. S.]

AMPHITHE'RIUM (Blainville). This fossil mammal, from Stonesfield, is now termed Thylacotherium by Owen.

AMPLEXUS (Sowerby), a fossil genus of MADREPHYLLIŒA, P. C., remarkable for the simplicity of its structure and the variability of its general figure. Occurs in the mountain limestone and Devonian limestone.

AMPYX (Dalman), a genus of fossil Crustacea (Trilobites), four species of which have been described by Captain Portlock, from Tyrone.

AMY'GDALUS—*Medical Properties of. Amygdalus communis*, a tree native of Asia and Africa, cultivated in the southern parts of Europe, of which there are two varieties, sweet and bitter. Of the sweet almonds the parts which are officinal are the seeds or kernels. When covered with the skin, these are of a clove-brown colour, smooth, with vessels traversing the skin, and forming a raphe. Deprived of the skin, the egg-shaped seed, formed of two cotyledons, is seen of a white colour. They have a sweet and mucilaginous, rather oily taste, and scarcely any odour when fresh, but when spoiled a disagreeable rancid taste.

Analyzed by Boullay, they yielded emulsin, and a fat oil of a very bland kind. Ten pounds of seeds yield four pounds of oil. Upon being subjected to pressure, or treated by means of æther, the oil is separated, and there remains the cake, or farina amygdalae. The commercial varieties are numerous, but the most esteemed are the Jordan almonds.

Triturated with water, sweet almonds form a grateful, sweetish emulsion, which possesses considerable nutritious as well as demulcent properties. This emulsion should never be prepared long before it is required for use; as, besides the certainty of spoiling, there is the risk, when bitter almonds are employed, of some of the poisonous products being developed. Almond paste forms a good emollient application to chapped hands in winter.

Almonds, as an article of dessert, are nutritive, but rather indigestible. In some persons they occasion, more particularly bitter almonds, an eruption similar to nettle-rash, and other troublesome symptoms.

Oil of Almonds.—The almonds having been freed from the skins must be bruised, and pressed in cold, or, if warmed, they must be pressed in iron presses. The oil when first obtained is turbid, but becomes pure by time or by filtration. It is yellowish, or nearly white, if the almonds have been completely freed from the skins before being pressed, translucent, and when cold-drawn is without odour. The taste is purely oily. Specific gravity, 0·911 to 0·920. Consists of, elain 75; stearin 25. It is tolerably fluid at the ordinary temperature of the air, but by reduction of temperature becomes turbid and white, and by a still further reduction is rendered solid. Alcohol when cold takes up 1-25th part. Sulphuric æther and the volatile oils combine with it in every proportion. Caustic potass forms with it a very solid soap. When it has been carefully expressed, it does not become rancid so easily as is believed.

It may be obtained from either variety, but is yielded in greatest abundance by the bitter almond. Ten lbs. of sweet, when cold-drawn, yield from 4 to 4½ lbs.; 16 lbs. of bitter almonds yield 7 lbs.

Almonds which have become rancid yet yield by expression good oil, if a little calcined magnesia be added to the bruised almonds before being subjected to pressure.

Almond oil is often adulterated with poppy oil. It is employed more as an external application, especially to the ears, than internally.

Amygdal. Amaræ, bitter almonds, are smaller and flatter than the sweet. Those most esteemed come from Provence, those least esteemed from Barbary. They have a very bitter taste, and scarcely any odour, but if rubbed between the fingers with a little water, they emit a peculiarly agreeable odour. Triturated with water they form an emulsion, which by distillation yields a volatile oil, containing hydrocyanic acid. This oil is procured in very variable quantity; one pound of almonds yielding in some instances one drachm, in others only fifty grains, in others only ten grains.

A fat or fixed oil is also contained, which may be procured by expression. Hence in the Pharmacopœia, Oleum Amygdalarum is directed to be expressed from the kernels of either variety. For the sake of economy this fixed oil is first procured, and the cake which remains is employed either to yield the volatile oil containing hydrocyanic acid, or to furnish Amygdalin.

Amygdalin is a peculiar product, containing nitrogen. It does not possess the poisonous properties of hydrocyanic acid, yet it is one basis of that powerful agent, and some account of it is necessary to understand the manner in which bitter almonds occasion a poisonous action. It is procured as follows:—the cake remaining after the fixed oil has been expressed is to be treated with boiling highly rectified spirit, containing not less than 80 per cent. of alcohol, so long as anything is taken up by the spirit. The spirit is then to be distilled off, the residuum dissolved in water, then filtered and crystallized. The crystals are to be purified by repeated crystallization. They are either in the form of small colourless shining prisms, or micaceous plates, devoid of odour, having at first a sweetish taste, but afterwards extremely bitter. They are not volatile, but are easily soluble in water, without undergoing the slightest alteration; less soluble in alcohol, and not soluble in æther. Geiger thinks this principle worthy the attention of medical practitioners.

It is this substance which, when acted on by the emulsin, and water, forms both the hydrocyanic acid and the *volatile* oil of bitter almonds. The former will be amply treated of in P. C. S. [HYDROCYANIC ACID.] The latter requires to be known to the public as an agent not inferior in power to prussic acid. Its specific gravity is greater than that of water. It is soluble in alcohol and æther. It is a compound of a very complex kind, containing hydrocyanic acid, hydruret of benzule, benzoic acid, benzoine, benzamide, &c. (Pereira.)

It is sold in different degrees of dilution to cooks, confectioners, and others, to flavour cakes and liqueurs, under the name of essence of ratafia, peach-essence, &c. (See *Lancet*, June 8, 1844, and *The Chemist*, vol. v. p. 335.) From its indiscriminate use, as well as variable strength, many fatal cases result from it. It is also used as a criminal means of destroying life.

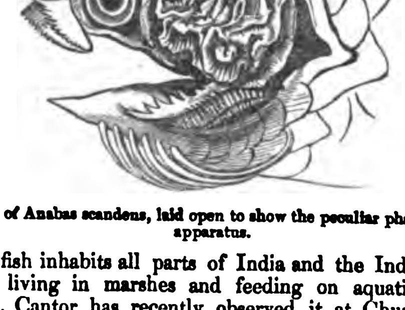
A'NABAS (from ἀναβαίνω, to ascend), the name given by Cuvier to a genus of Acanthopterygious Osseous fishes, remarkable for the power possessed by the species of living for some time out of water and making their way on land. This power depends on a structure characteristic of the family of which it is the type, part of the pharangeals being labyrinthiform, that is to say, divided into a number of irregular lamellae, more or less numerous, forming cavities and little cells capable of retaining a certain quantity of water. This apparatus is so protected, that when the animals are out of their native element the evaporation of the contained water takes place very slowly, and the gills are kept moist, by means of which remarkable provision the fishes of this family are enabled to leave the rivers and marshes where they usually reside, and to travel over land for considerable distances, creeping among the herbage, or along the ground. Although this fact has been but recently known to modern naturalists, the antients appear to have been well acquainted with it, and Theophrastus has recorded the existence in India of certain little fishes which leave the rivers for a time and again return to them: he doubtless alludes to the Anabas and its allies.

The genus *Anabas*, of which there is but one species, the *Anabas scandens* (Perca scandens of Daldorf, Anthias testudineus of Bloch), is distinguished by a well-marked character, the borders of its opercle, subopercle, and interopercle being denticulated, whilst the preopercle is not so, nor even distinctly marginated. The head is round and broad; the muzzle is very short and obtuse, the eye placed very near its extremity. The mouth is small, and large scales cover the head. The body is oblong, compressed centrally and behind. The lateral line is interrupted at its posterior third, recommencing a little lower. The tail is somewhat rounded. The whole body is covered with large scales. There is a single dorsal and an anal fin, nearly equal in height, and in both the spinous rays prevail. The formula of the fin-rays in the *Anabas scandens* is as follows:—

D. 17 or 16-9: A. 10 or 11-10: C. 16: P. 15: V. 1-5.

In colour it appears to vary, being brown or bluish-black or dark green, paler beneath and having violet fins. In form the individuals are constant, and reach the length of six inches.

Anabas scandens.



Head of Anabas scandens, laid open to show the peculiar pharyngeal apparatus.

This fish inhabits all parts of India and the Indian archipelago, living in marshes and feeding on aquatic insects, and Dr. Cantor has recently observed it at Chusan. Respecting its habits there has been much discussion. In 1797 a Danish gentleman, M. Daldorf, communicated an account of its habits to the Linnean Society of London, in which he stated that he had observed it in the act of ascending palm-trees near marshes, and had taken it at a height of no less than five feet above the surface of the water, effecting its movements of ascent by means of its fins and tail and the spines of its opercles, in a similar manner to that by which it progressed along the ground. Another Danish observer, M. John, published a similar statement, adding that it is called in Tranquebar *pannei-eri*, a name which signifies *tree-climber*. Other naturalists, who have equally observed it in its native countries, such as Reinwardt, Leschenault, and Hamilton Buchanan, whilst they record its habit of creeping on the ground and living a long time out of water, deny or omit all mention of its power to ascend trees.

To the same family with *Anabas* belong the genera *Helostoma*, *Polyacanthus*, *Colisa*, *Macropodus*, *Osphromenus*, *Trichopus*, and *Spirobranchus*, of which the habits are as yet very imperfectly known, though the peculiarities of their anatomy warrant us in supposing that they have a similar power of living out of water.

(*Linnean Transactions*, vol. iii.; and Cuvier and Valenciennes, *Hist. Nat. des Poissons*, tom. vii.)

ANABATHRA, a fossil tree, from Allenbank, Berwickshire, is thus named by Mr. Witham, and figured in *Foss. Veg.* t. 8 and t. 10.

A'NABLEPS (from ἀναϐλέπω, to look up), a genus of Malacopterygious Osseous fishes, remarkable for the curious structure of their eyes, which, in consequence of the division of the iris and cornea by transverse ligaments, have two pupils, and appear as if double, whilst there is only one crystalline humour, one vitreous humour, and one retina. There is no other example known of such a modification of structure among the Vertebrata. This peculiarity of the Anableps has given rise to several stories of four-eyed fish, with exaggerated accounts of their habits. The *Anableps tetrophthalmus* inhabits the rivers of Guiana and Surinam. Its body is cylindrical, and covered with strong scales; its head is flattened, and snout blunt. The upper jaw projects beyond the lower. Its anatomy has been made the subject of a memoir by Lacépède, which is published in the second volume of the *Mémoires de l'Institut*.

ANAMORPHO'SIS (ἀναμόρφωσις, a remodelling or change of form) is such a representation of an object that, except when viewed from a particular point directly, or in a cylindrical mirror, or through a polyhedral lens, it will appear to be distorted, or disconnected, or to be a view of something very different from the original object. Such representations are only made for the amusement of young persons, and therefore a very brief explanation of them may suffice; but the art of forming them has been treated at length in the 'Thaumaturgus Opticus' of Niceron, and in the 'Perspectiva Horaria' of Maignan.

Distorted figures which are to appear, when viewed directly from a given point, in the just proportions which they have in an original drawing or print, may be easily traced in the following manner:—The original figure being covered with a net-work of squares within a square drawn about the whole; upon any convenient part of a sheet of paper a line is to be drawn equal in length to the base of the circumscribing square, and divided into a like number of equal parts: then, from a point taken at pleasure vertically under the assumed place of the eye, lines are to be drawn of indefinite length through the points of division, to represent those which, on the original, have been drawn perpendicularly to the base or ground-line. Let next a line be drawn from the assumed seat of the eye on the paper, parallel to that which was made equal to the ground-line, and let it be made equal in length to the given height of the eye above the paper: then, if a line be drawn from the extremity of this line through one end of the divided line till it meets the line drawn from the seat of the eye through the opposite end of the same line, its intersections with all the lines which represent the perpendiculars will be points through which lines being drawn parallel to the divided line, those lines will represent the corresponding lines drawn on the original parallel to the base of the circumscribing square. If, within the trapezoidal areas thus formed, the parts of the original figure which fall in the corresponding squares be drawn, the figure thus traced will be the distorted figure required; and, when viewed from the assumed place of the eye, it will evidently appear exactly as, to an eye in the same point, the original would appear if it were placed in a vertical position with the base of the square on the line which war drawn to represent it; that is, it will appear to be an exact copy of the original.

A distorted representation of some object, which is to appear correct on being viewed from a given point, and by reflexion from a cylindrical mirror whose curvature and position are also given, may also be drawn on a plane by means of a perspective representation, as already described, of the squares drawn within a square circumscribing the original print or drawing. The base of this square must be equal to a chord of the cylindrical mirror; and from the centre of the mirror's curvature, on paper, lines must be drawn through the points of division in the chord to meet the circular arc representing the base of the cylinder; then from the points of meeting diverging lines are to be drawn, making, with the radii, angles equal to those which are made with them by lines drawn to the points in the arc from the seat of the eye; and on them are to be set, from the points in the arc, distances equal to those of the same points from the several lines which, in the projected trapezoid before described, represent the horizontal lines drawn over the original figure. Lastly, curve lines, which are nearly arcs of concentric circles, being drawn through the points thus found, there will be formed a network of mixed-lined trapezoids, within which the parts of the original figure are to be traced so as to correspond to those within the squares first drawn. This distorted tracing being laid horizontally on a table, and the mirror being set up vertically on the arc which represents its base, the reflected image will, to the eye, appear exactly similar to the original figure.

Distorted figures, which are to be seen corrected when viewed through a polyhedral lens or multiplying glass, a lens of which one surface is a plane, and the other is constituted by a number of planes having for example the figures of triangles, may be traced mechanically thus:—Let the multiplying glass be placed in a tube, like the eye-piece of a telescope, at a distance from the end to which the eye is to be applied rather greater than the focal length of the glass, and let a very small aperture be formed in the cover at that end: then, on placing a lamp or candle before the aperture, the rays of light passing through the faces of the lens will project, on a screen placed perpendicularly to its axis, at any convenient distance beyond the focus, a number of luminous spaces corresponding to the several faces of the lens, with intervals between them. In these luminous spaces, whose outlines should be traced with pencil before the light is removed, there must be drawn by hand parts of a landscape or figure, so that, on looking through the aperture, they shall seem to form a correct representation of the intended object.

The portions thus drawn, when viewed in any manner except through the aperture, will be unconnected; and the intervals may be filled up with any objects at pleasure, so that the whole may appear confused, or may represent something different from the original landscape or figure: then, on looking through the aperture, towards the screen, the intervals before mentioned, and the objects drawn on them, will be invisible; and there will appear only the representation of the object formed by the junction of the parts within the outlines first traced, that is, a correct copy of the original object.

ANAMORPHO'SIS. (Botany.) [Metamorphosis, P.C.]

ANANCHY'TES (Lamarck), a fossil genus of Echinodermata, found in the chalk formations abundantly.

ANA'RRHICAS, a genus of Acanthopterygious Osseous fishes, established by Linnæus, and retained by subsequent ichthyologists. They are very nearly allied to the Blennies, so that Cuvier remarked they might be regarded as Blennies without ventral fins. They have round, smooth, blunt heads; elongated bodies, covered by minute scales; a single long dorsal and an extended anal fin, both separated from the caudal; no ventrals; the mouth armed with formidable teeth of two kinds, conical incisors and flat grinders. One species, the wolf-fish, sea-cat, or cat-fish, Anarrhicas lupus of Linnæus, is common in the northern seas, and in Britain is frequently taken on the east coast of Scotland and the Orkneys, though rare on the English shores. Its range extends to Greenland. It grows to the length of six feet, and is a ferocious and formidable animal, destroying the nets of fishermen; when caught it defends itself to its last gasp, inflicting severe wounds by means of its powerful teeth and jaws. It lives chiefly on crustacea and testaceous mollusca, and, like most fish which subsist on such food, its flesh is excellent eating, though, from the ugly appearance of the animal, usually rejected. It finds its way however to the Edinburgh market, where, by naturalists especially, whose knowledge of its good qualities enables them to vanquish their prejudices against its aspect, it is much esteemed. The cat-fish is of a light grey colour marked with seven or eight broad vertical bands of bluish grey. When old it becomes darker. Its skin is covered with slime. The formula of its fin-rays is—D. 74: P. 20: A. 46: C. 16. For figures of this fish see Yarrell's *British Fishes*, vol. i.; Pennant; and Bloch.

ANATO'LIA. Since the publication of the first volume of the P. C. the interior of this country has been explored, in nearly all directions, by travellers who were protected and aided by firmans of the sultan. The present article proposes to give a succinct account of the geographical results of their researches. A complete map of the country, uniting the requisites of completeness and correctness, has not yet been published: the map drawn by Arrowsmith for Hamilton's 'Researches' is the best we have, though it is only fragmentary. The charts of the Russian Survey of the coast of the Black Sea, published in 1840 and following years, are not surpassed by any other. The survey of the western coast has been completed under the superintendence of Captain Graves, but the charts are yet unpublished; this survey, with that of Captain Beaufort of the southern coast, complete the survey of the Mediterranean coast of Asia Minor. The part of Captain Graves's survey comprehending the Gulf of Syme and the adjacent coast was first published in Arrowsmith's map, which accompanies the 'Researches' of Hamilton. The former maps of this part of the coast were very erroneous. The coast of Lycia has been known since the survey of Captain Beaufort, but the interior was first visited and described by Fellows.

Orography.—1. *Mount Taurus.*—The Euphrates from the junction of the Kará-Sú with the Mürád-Chái, near Kápán-Máden, runs in a south-western direction till, in 38° 36′ N. lat. and in 38° 30′ E. long., it enters an Alpine country through the narrow pass of Ilíjah. Stopped by a range of lofty mountains, the river turns east, south-east, south, and south-west, and after having made a curve, the diameter of which from north to south is above 70 miles, resumes its southern course in the environs of the village of Búser. The tract encompassed by this curve of the Euphràtes is a mountain-knot, which may be considered as the eastern beginning of Mount Taurus; its northern limit is formed by the river Tókhmah-Sú, the Melas of the antients, which joins the Euphrates on the west a little below the pass of Ilíjah. This knot, of which the Aghjah or Akjah-Dágh is the highest point, stretches west as far as the town of Merásh, whence it continues in several ranges; and for the sake of convenience we shall call the whole the Akjah mountains, though it would be perhaps as well to call it the Commagenian mountains, since the country thus encompassed by the Euphrates was the principal part of the antient province of Commagene. Well wooded and fertile valleys lead from the Tókhmah-Sú up to the mountains. They wind at first through limestone hills abounding with fossil shells. Where the hills end, long ridges of black volcanic rocks begin; these are succeeded by platforms and tablelands, upon which rock-terraces rise one above another, terminated at the crest in conical summits. On the Belli-Gedik hills Ainsworth found the altitude by the barometer to be 5625 feet, but the Akjah-Dágh is probably twice that height, it having been seen covered with snow in the latter part of May. Other peaks are the Ak-Dágh, as high as or higher than the Akjah-Dágh, the Pelvereh-Dágh, the Tójik-Dágh, and many more, some of which are probably covered with eternal snow. The Gök-Sú, a small river which joins the Euphrates after a southern course, winds through colossal cliffs of limestone, and forms the celebrated pass of Erkenek, the most difficult part of which lies in the valley of the rivulet Erkenek, which joins the Gök-Sú. The antient town of Perre, now probably Pelvereh, was situated in the pass, the only one through which armies coming from the interior of Asia Minor can descend into the valley of the Euphrates, and thence into Mesopotamia or Syria. In this part of the Akjah mountains the rocks consist chiefly of shaly schists, which constitute the axis of the whole Taurus. The valleys are well cultivated and inhabited by Kurds. Near Marásh a chain separates from the principal knot, forks into two branches, and encompasses the Gulf of Iskénderún; the southern branch, formerly Mount Amanus, stretches into Syria, at a short distance from and in a parallel direction with the coast, and at a few miles south of the town of Iskenderún it is intersected by a narrow defile which begins at the village of Beilán, and through which runs the high-road from this corner of Cilicia to Antioch and the other parts of Syria. The defile of Beilán is the southernmost part of a series of long narrow passes between the sea and the steep rocks of Mount Amanus: it begins near Báyás, thence runs to Iskénderún, where it seems to lose the characteristic features of a mountain defile, and thence runs up to Beilán, where it re-assumes its original character. North of Báyás the defile ceases where the plain of Issus begins; the road crosses this plain, and after having turned round the innermost corner of the Gulf of Iskénderún, enters another defile in the chain of Dúrdún-Dágh, the northern part of Mount Amanus. The whole of these passes were called by the antients the Syrian gates (Pylae Syriae), which are renowned in the history of military warfare from Alexander and Darius down to the present time. The narrowest part of the pass across the Dúrdún-Dágh is shut up by an antient stone-wall built of polygonal masses of basalt, without cement, with an archway through which the road goes, and which has the Turkish name of Demir-Kapú, or the iron-gate. Ainsworth, who has written a memoir on the subject, identifies this old fortification with the Amanian gates (Pylae Amanides) of the antients. The river Jíhún, the antient Pyramus, runs along the northern and western slopes of the range of Dúrdún-Dágh.

The principal chain of the Taurus stretches from the environs of Merásh in a western direction across the whole length of the peninsula, and is generally but not always parallel with the coast. We add a few particulars to its description in the P. C. In about 35° E. long. the chain is called Búlghár-Dágh, a very lofty range, through which the Síhún, the antient Sarus, passes in a bed overhung on both sides by steep rocks 1000 feet high, which form the celebrated pass of Gólek-Bógház, known to the Romans as the Portae Ciliciae. During the time that Syria and the pashalik of A'dána belonged to Mehmed 'Ali, pasha of Egypt, the Gólek-Bógház was partly in possession of the Turks, and partly of the Egyptians, both of whom had erected strong fortifications for the defence of their respective portions. The narrow tract between the Búlghár-Dágh and the coast has an alpine character, and under the meridian of Mezetli, the antient Pompeiopolis, the principal chain of the mountains approaches the coast so closely as to become visible from the sea in all its outlines. The whole country round the Gulf of Iskénderún is thus surrounded on one side by the sea, and on the others by lofty mountains, which, being traversed by a few long and narrow defiles, may be successfully defended by a handful of men against the most numerous armies. The tract abounds in fruit, wine, corn, timber, and other productions, and is watered by two navigable rivers, the Jíhún and the Síhún, and many streams of less importance, among which the Tersús-Chái (river of Tarsus), the antient Cydnus, is the chief. This part of Cilicia was once a most flourishing province, and there are few countries of its extent to which so many historical recollections are attached: the towns of Tarsus and Mopsuestia, the cold waters of the Cydnus which endangered the life of Alexander and killed the Emperor Frederick I., and the Plain of Issus, where Alexander defeated Darius. If any power that is master of the sea should have an interest in making a firm footing on the continent of Asia Minor, with the view of either preventing its conquest by an enemy of Turkey, or having its share in the dismemberment of the Ottoman empire, that power would most certainly plant its standard on the Plain of Issus.

On following the Taurus in its western direction, we find the Kará-Dágh and the Allah-Dágh, two lofty peaks which are situated only a little distance from each other, and north of the great chain, in the southern corner of the antient Lycaonia. The name of the Taurus is here Ichlí-Dágh, as Mr. Hamilton states. The Kará-Dágh, an insulated trachytic cone, rises above a sandy plain, and is of barren and dreary appearance; a low ridge stretches from it north-east in the direction of Hasán-Dágh and Mount Argaeus, with which it appears to be connected, forming part of the same system of elevation, and standing consequently on the edge of the great table-land of which we shall speak hereafter. The Allah-Dágh stands on a base of thin-bedded semi-crystalline limestone, dipping south-east, and is connected with the chain of the Taurus, which here chiefly consists of Jura limestone. The Allah-Dágh is the summit of a lower range which runs west, and is parallel to the Taurus. The whole of the Taurus, from the Allah-Dágh west as far as the Bábá-Dágh (Mons Cadmus) in 29° E. long. has not yet been explored, but parts of its snowy chain have been traversed by a few travellers, or seen from the sea in the Gulf of Adalia.

The Bábá-Dágh, or most western part of the Taurus, continues its original western direction under several names, and forms the watershed between the Mendere, the antient Mæander, in the north, and the Dollomon-Chái, and several smaller rivers which flow into the sea of Rhodes, the Gulf of Cos, and the Gulf of Mándeliyeh.

The whole tract which lies between the range of the Taurus and the Mediterranean, and the width of which depends more on the curves of the coast than on those of the mountain range, has an alpine character, though the mountains are not so high as the Alps of Tyrol or Switzerland. It resembles the parts of Hejáz, Yemen, and Hadhramaút, which lie between the great chain of the Yemen-Hadhramaút mountains and the sea. Lycia is an independent part of the tract, though distinguished by the same general outlines. Its northern limits are formed by the principal range of the Taurus, from which branches stretch south, and are so intimately connected with each other by transverse chains as to form a separate mountain system. The eastern part of it is a table-land, but the western part is traversed in its whole length from north to south by the Xanthus, now Echen-Chái, of the course of which we knew nothing till we became acquainted with it through the discoveries of Fellows.

2. *The Anti-Taurus, the great table-land in the interior, and its western continuation.*—From the summits of the Akjah or Commagenian mountains which we have described as the eastern commencement of the Taurus, the eye discovers beyond the river Tókhmah-Sú, its northern boundary, an immense mountain tract bordered on the horizon by a range of snowy peaks. This is the Anti-Taurus. Through its eastern and southern valleys the waters flow to the Euphrates, and in its western and northern parts are the sources of the Kizil-Irmák and Yeshil-Irmák, which empty themselves into the Black Sea. The Anti-Taurus and the mountains of Commagene are the natural eastern limits of Asia Minor. The tract is little known: the Göl-Dágh and Kará-Bábá are two black basaltic mountains in the east, and on some of the neighbouring mountains snow is found during the whole year. North of these peaks there is a chain called Aráb-Bábá, and beyond it, in a most picturesque country, the high conical mountain of Sari-Chi-Chak, a Kurdish word meaning the highest mountain, the easterly continuation of which is of basaltic origin. In its neighbourhood are the Dumbugh-Dágh, which has a high rounded summit, the Erumbat and the Yámur-Dágh, which Ainsworth found covered with snow in July. Chalk is found in the environs of the Sari-Chi-Chak; west of it trachytic rocks are prevalent, and the Dumbugh-Dágh consists partly of euphotides abounding in iron, partly, on its northern declivities, of granite. West of this tract there is a district of gypsum. Beyond it, in the same direction, rises the chain of Kará-Bel, the Paryadres of the antients, covered with firs and oaks, the crest of which has an elevation of 5790 feet measured by the barometer (Ainsworth). The Paryadres is the most northern part of the Anti-Taurus, the principal chain of which stretches west as far as the Arjish-Dágh or Mount Argaeus, in 38° 30′ N. lat., and 35° 20′ E. long., the loftiest peak of the peninsula, and once a volcano. On approaching this cone, says Hamilton, the appearance of the country becomes gradually more wild; the hills consist entirely of trachytic rocks, and the surface is covered to a great extent with boulders of the same formation. Vesicular basalt, boulders of which overlay a yellow feldspathic rock, cover the shoulders of the mountain. After having passed over hills of black basalt, Hamilton reached a conical hill, consisting of sand and ashes with a crater partly broken; then a rocky tract covered with juniper, where the real ascent begins. South of the highest peak stands the Kartún, an isolated rock of feldspathic trachyte, like a gigantic fortress. Two hours' walk further up, the ground spreads out into an amphitheatre, surrounded by steep and lofty ridges of hills, where the party passed the night. On proceeding further on the following day, they found snow in all the crevices, and were obliged to find their way over dangerous glaciers. They succeeded, however, in reaching the highest attainable point of the mountain, though not the actual summit, which is a mass of rock with steep perpendicular sides, rising to a height of 20 or 25 feet above the ridge on which they stood. The summit is a red bracciated scoriaceous conglomerate, containing fragments of trap, trachyte, and porphyry. To the north and north-east extensive glaciers stretched down in one unbroken slope into a sea of clouds, proving all ascent on that side to be totally impracticable. From barometrical observations combined with the result of two angles of elevation taken from different spots below the mountain, Hamilton con-

cludes that the height of Mount Arjísh is 13,000 feet, a trifle more or less, above the sea. Ainsworth calculates it about 1000 feet lower. Strabo observes (p. 538 Cas.) that Mount Argaeus was covered with eternal snows, but his statement that both the Euxine and the Mediterranean are visible from its summit is not true. Mount Arjísh, and Mount Allah-Dágh, which lies about 30 miles south of it, are the two westernmost promontories of the Anti-Taurus properly speaking, the principal chain of which is the Allah-Dágh, according to Hamilton. A ridge of hills that stretches south-west of Mount Arjísh becomes gradually higher, forms the peaks of Hasán-Dágh and Karájah-Dágh, and is connected with the Taurus by the Kará-Dágh and the southern Allah-Dágh mentioned above. The Arjísh-Hasán-Karájah-Kará-Dágh chain in the north-west, the Anti-Taurus and its southern branches in the north and east, and the Taurus in the south surround the easternmost portion of the great table-land, and form an extensive basin, part of which is called the plain of Bór or Nigdeh. The eastern part of this basin is unknown to us; in the middle part are the sources of the Síhún, which flows south and traverses the Taurus as stated above; and the western part is a depression of the table-land which has no visible outlet for its waters, the greater portion of which is absorbed by the Ak-Göl, a lake of considerable extent. A small stream, which after the melting of the snow increases to a great body of water, flows out of the southern corner of this lake into a deep circular pool, 20 or 30 feet lower, and situated in a recess of the surrounding marble cliffs. The pool is about one-eighth of a mile in circumference, and has no outlet, nor does any stream emerge on the other southern side of the hills, from which Hamilton concludes that the water must find a subterranean passage through the limestone and reappear on the south side of the Taurus, traversing Cilicia and flowing into the sea.

From the ridge between Arjísh-Dágh and Allah-Dágh in the Taurus several chains stretch out in a western direction. The first, as we proceed from north to south, is a continuation of Arjísh-Dágh, and runs under the names of Chewrí-Dágh, Kójah-Dágh, Páshá-Dágh, Kartál-Dágh, Urá-Dágh, and Elmah-Dágh, at first west, and afterwards north-west, till it joins the alpine tract round A'ngora; along its northern and eastern sides flows the Kizil-Irmák. The second stretches out from the range between the Hasán-Dágh and the Karájah-Dágh, perhaps from the latter mountain, north-west as far as Mount Emír-Dágh in 38° 48′ N. lat., 31° 20 E. long., and thence west to the Mórád-Dágh (the antient Mount Dindymene), where it divides into different branches which enclose valleys through which the waters flow into the Archipelago. The great rivers Mendere (Maeander) and Kodus (Hermus) have their sources in the environs of that mountain. The first and second chains surround another much larger basin, forming likewise a depression of the high table-land, of which the greater portion seems to have no outlet; its eastern part has certainly none, its waters being swallowed up by the great salt lake Túz-Göl. In its north-western parts the second chain is double; it divides about 38° 20′ N. lat. and 32° E. long., and unites again at the Emír-Dágh; the southern and probably principal chain is the lofty Sultán-Dágh; between the two arms there is a smaller basin, with the Ak-Sheher-Göl, a considerable lake in the east, and the little lake Iber-Göl, at a short distance west from it. The latter receives a little river about 40 miles long, which originates not far from the Mórád-Dágh, and has an eastern direction, which is rather unusual even with the inland rivers of Asia Minor. The waters of the Iber-Göl flow into the lake of Ak-Sheher, which is not indicated on Arrowsmith's map belonging to the 'Travels' of Hamilton. Between the second range in the north-east, the Taurus in the south, and the elevated ridge of the great table-land in the west, there is another basin, the largest of all, which seems to be subdivided into several smaller basins by transverse ridges. This basin contains most of the great lakes. Its south-western part is still unknown.

The group of lakes in this basin forms one of the most striking features of the table-land; they may be divided into two classes, the salt lakes in the east, and the fresh-water (partly salt) lakes in the west. Among the salt lakes the Túz-Göl is the largest, and of great extent; the others, such as the lakes of Sárimsák, Kúpek-Göl, Múrád-sú-Göl, most of which lie in its immediate neighbourhood, cannot be compared with it. The Túz-Göl was visited by Hamilton and Ainsworth. A point situated in 38° 42′ N. lat. and 33° 25′ E. long., lies about in its centre; its direction is south-east to north-west and north; it is about 45 English miles in length; its extreme width is about 18 miles, but its northern extremity is much narrower, and connected with the main lake by a channel five or six miles broad. A ruined causeway connects the opposite banks; it is covered with a thick coat of salt lying over a coat of soft mud: when the waters are high it is submerged; when low it is quite dry. The banks are flat, the environs barren and covered with saline plants; along its eastern side extensive salt marshes stretch from north-west to south-east, and its southern and south-western shores are surrounded by impenetrable marshes partly covered with saline incrustations. The lake yields much salt, which is easily obtained, although the state of saturation of the water, which is very high in the dry season, is diminished in the wet season, owing to several little rivers and streams emptying themselves into the lake. When Hamilton examined the water, in July, it was completely saturated, but it was less salt when Ainsworth saw it in April. Hamilton brought some of it to this country, where it was examined by Mr. Phillips of the Museum of Economic Geology, who gives the following account of the analysis:—"Its specific gravity is nearly 1·2398, but as a few crystals of common salt had separated, either by cold or evaporation, its specific gravity may be considered as equal to 1·24. It contains 32·2 p. c. of saline matter, consisting chiefly of common salt, but mixed with a considerable quantity of sulphate of magnesia and chloride of magnesium, with a little sulphate of lime and a trace of bromine, but no iodine." To this Hamilton adds, "The great peculiarities therefore appear to be its high specific gravity, and the great amount of saline matter. The specific gravity of the water of the Dead Sea, hitherto considered the heaviest, has been stated by Dr. Marcet at 1·21, that of sea-water being 1·028. The amount of saline matter contained in the water of the Dead Sea is, according to the same authority, only 24·5." Traces of volcanic action abound in the environs. Another circumstance of great interest is the apparent connexion between the rock-salt deposits and the red sandstone formation of Kój-Hisár, a small town on the eastern side of the lake near the causeway, with the same formation in Pontus, from which one might conclude that the red sandstone formation of Kój-Hisár belongs to the sandstone rocks which contain rock-salt between Yúz-Gátt and A'ngora, which themselves belong to the system of Pontus. A mass of grey granite protrudes through the red and brown sandstone near Kój-Hisár, sending forth numerous small veins into the adjacent rock, thus proving that the formation of the granite is posterior to that of the sandstone. Beds of white saccharine gypsum, or alabaster, are seen in the brown sandstone underlying the horizontal limestone.

The group of the fresh-water lakes begins with the Ak-Göl in the south-east, which has been mentioned in the descriptions of the first basin of the table-land. It is about seven miles long by three wide. West of it, in the third and largest basin, we first met with the Sóghla, the antient Trogilis, in 37° 15′ N. lat. and 32° 15′ E. long., which is about eight miles long and six wide, and the lake of Bei-Sheher, the Caralitis Pusgusa of the Byzantines, in 37° 40′ N. lat. and 31° 50′ E. long., a magnificent sheet of water which extends above 20 miles from south-south-east to north-north-west, and is from four to seven miles wide. On its western side the rocks rise abruptly from the water's edge. The two lakes are separated by a lofty ridge of limestone mountains, through which the Bei-Sheher-Sú, the outlet of the Bei-Sheher lake, has formed a narrow channel. This river empties itself into the Sóghla lake, which has no outlet, and is consequently the deepest part of this portion of the basin. North-west of the lake of Bei-Sheher are the lakes of Egerdir and Hóírán, which however are one lake; the northern part is called Hóírán, and the southern Egerdir. The narrow channel by which they are united lies in 28° 8′ N. lat. and 31° 3′ E. long. Their combined length is about 30 miles, and each of them is about six miles in its greatest width. They are full of fish, and surrounded by steep and wooded hills, intersected by picturesque valleys and well-cultivated plains. Hamilton compares their appearance with that of the lakes in Italy. North of them are the lakes of Ak-Sheher and Cháí-Kö, already mentioned. The lake of Egerdir has a southern outlet, a deep, clear, and rapid river, the further course of which is not known. The question as to the course of its waters is of high geographical importance. If it flows due south the river will be barred by the great chain of the Taurus; and although it is possible, but not probable, that it forces itself an open passage through that range, and reaches the Gulf of

Adalia, it is as likely that it escapes through the limestone of the Taurus, and, after a subterranean course of considerable length, reappears on its southern foot as a new river. If however that river flows into the neighbouring lake of Bei-Sheher, which empties itself into the lake Sóghla, we see a small lake with no visible outlet, although it is fed by the waters of two very large lakes, and perhaps those of the whole basin. As it is not likely that such a volume of water is evaporated from a comparatively small surface, we should in this case also be led to believe that the water of the Sóghla lake escapes through some catabathron, and makes a subterranean passage through the Taurus, which Hamilton supposes to be the case with the lake Ak-Göl.

If we consider the most prominent features of the great table-land of Asia Minor, the great number of extinct volcanos, the masses of basalt and other volcanic productions, the innumerable basaltic cones which are spread in all directions on that plateau, the granite which protrudes through the overlying beds of limestone, and finally the salt lakes, and an extensive tract covered with salt marshes, we are inclined to believe that the whole was once an inland sea, like the Caspian and the Aral, filled with brackish water, and that the bottom of that sea was raised by volcanic action, whereupon the waters poured forth in all directions; and on their descent to the surrounding seas digged those deep valleys which, in the southern and western parts of the peninsula, lead in straight lines from the ridge, or exterior parts of the table-land, down to the Mediterranean, the Archipelago, and the Sea of Marmara. The diminished volume of the remaining waters might then have been absorbed, or have found subterranean escapes, till the tract remained in that state in which it is now. The great quantity of fresh-water shells found on the hills of the plateau are an objection to supposing it to have once been a perfect salt sea. It was either all brackish, or divided into several large lakes, some of fresh water and some of salt. It would be important to know, if among the fresh-water shells there are many belonging to such shell-fish as live indifferently in fresh and in brackish water. It will not be very difficult to explain why the courses of the rivers flowing into the Black Sea are not in straight lines. If the origin of the table-land should ever be satisfactorily shown to be what it is here conjectured to be, the peninsula of Asia Minor would no longer be considered a continuation of Armenia and Kurdistán, for the connexion between the mountain systems of those countries and the Taurus, the Anti-Taurus, and the Pontic mountains, is no obstacle to this conjecture; and as the great ranges which stretch through the country from east to west would in that case, with the exception of the Anti-Taurus, only be the edges of the plateau, the peninsula would be divided into the table-land, the eastern mountain-knot, and the outskirts along the three seas. But as long as these matters are merely hypothetical we must be faithful to the common division, which is made with reference to the great ranges that stretch across the country from east to west, and of which we now proceed to describe the third.

3. *The Euxine range.*—The country between the Anti-Taurus in the south, and the Black Sea in the north, is filled up with mountains, the centre of which seems to be in the southern part between the Gaúr-Dágh, the Almáli-Dágh, and the Gújik-Dágh, whence several chains stretch to the west and north; others stretching eastward connect these mountains with those of Armenia. We shall call this group, which has no general name, the Lazian group, from the Lazes, a warlike nation of Caucasian origin, known in history from early times down to the present day, and whose original abodes begin on the eastern slopes of these chains. The Lazian group, the third landmark of Asia Minor towards the east, is the watershed between the Euphrates, which flows into the Persian Gulf, and such of the rivers emptying themselves into the Black Sea as are situated east of the mouth of the Kizil-Irmák. On the eastern side of the crest of the Lazian group are the sources of the Chórúk-Sú, a river about 150 miles long, which flows east and north till it reaches the Black Sea near Bátúm: its whole course is beyond the limits which are generally ascribed to Asia Minor. Several smaller rivers flow from its northern slopes into the Black Sea. One of these is the Piksit or Surmel, a small river which has its mouth a little east of Trebizonde. A chain of woody mountains, which detaches itself from the eastern part of the Lazian group, and stretches as far as the sea, runs east of the Piksit, and may be considered the natural boundary of Asia Minor on this side. The eastern limits of Asia Minor are generally identified with an imaginary line stretching from the corner of the Gulf of Iskénderún, due north-east, as far as a point situated some distance east of Trebizonde. A good map will show that this line corresponds exactly with the eastern face of the three groups, the Taurus, the Anti-Taurus, and the Lazian mountains. Among the different ranges which detach themselves from the Lazian group, we shall first mention that long chain, or, more correctly, series of interrupted parallel chains, which run west and almost parallel with the coast of the Black Sea. These chains are known under several names. Between Trebizonde and the mouth of the Yeshil-Irmák we find the Mason-Dágh; and between that river and the Kizil-Irmák the Nebbian-Dágh with its southern parallel ranges, the Ak-Dágh and Táwshán-Dágh. They are surmounted by lofty peaks, which are however much lower than those of the Taurus and Anti-Taurus. The whole tract is a plateau, being the first terrace on coming from the Black Sea; above it run wooded chains, with an average height of 1500 feet above the level of the plateau. Towards the sea the plateau is broken into numerous ridges and deep valleys, the beauty of which is highly praised by travellers, and the picturesque character of the scenery is most striking in the neighbourhood of the coast. The same character prevails west of the Kizil-Irmák, from the point where it breaks through the chain of the Adá-Dágh. The Ilik-Dágh, with a mean elevation of 4000 feet over the sea, abounds with forests of fir-trees that yield excellent timber; and the Yerálah-Göz is a plateau of the same description surmounted by ridges of about 3200 feet elevation. South of these plateaus lies the Alkás-Dágh, the summit of which was found covered with snow in October; and north of them are the Káz-Yúsuf-Dágh and others which border on the sea. In 41° 25′ N. lat. and 33° E. long. is the plateau of Iflání, which begins in the south near the town of Záfarán-Bólí, with several projections which terminate abruptly with steep acclivities, on which high rock-terraces tower one above the other. On the plateau there are many ranges, partly bare and partly wooded, and large tracts are covered with fragments of rock. West of this plateau, and divided from it by the river Orderi, is Mount Durnah-Yálá-sí, the antient Mons Orminius, which has rough slopes, wooded sides, and a bare crest at least 3000 feet high. Limestone and basaltic rocks abound in both of these mountains. Mount Durnah-Yálá-sí is connected with the Bólí-Dágh and the Karám-'Ali by the Sarkhún-Yálá-sí and the Yáílá-Dágh (Mons Hypius) in the south, and the Kará-Dágh, the O'wah-Dágh, and the Köpekchi-Dágh, in the north. West of the Karám-'Ali-Dágh is the Gök-Dágh, or Bithynian Olympus, and between them flows the Zákáríyeh or Sangarius. The Gök-Dágh is only a north-eastern beginning of the Keshish-Dágh, or Mount Olympus of Brusa; its western projections stretch through Mysia and terminate in the promontories of the sea of Marmara, the Hellespont, and the Archipelago.

Having thus traced the outlines of the northern chains which begin in the east with the Lazian group, we proceed to give a sketch of the mountain tract between those chains in the north and the great table-land in the south. From the junction of the western chains of the Lazian mountains with the Kará-Bel, which have been already described as a northern continuation of the Anti-Taurus, some ranges stretch west, which the natives call Gemín-Belí-Dágh, and Kóseh-Dágh. They are generally parallel with the 40th degree of N. lat., and their western continuation is the Chámlú-Bel. They rise above a high table-land, which is generally a level plain, and form the watershed between the Yeshil-Irmák in the north, and the Kizil-Irmák in the south. A large mountainous tract lies to the west and is encompassed on the south-west and north by the great bend of the Kizil-Irmák, of which we know very little. It is a table-land, the edges of which, towards the Kizil-Irmák, are intersected by deep valleys and ravines, and form a long sharply indented wall of rocks of the grandest character. Pursuing the right bank of the Kizil-Irmák, from the 36th degree of E. long., we first see the Ak-Dágh right opposite the snowy peak of the Arjísh-Dágh, stretching west. Where the Kizil-Irmák first takes a north-west direction, the edge of the table-land is called Akjik-Dágh; farther on in the same direction is the Hasán-Dágh, a bare sharp two-headed peak, and still farther on the Báránlí-Dágh, a lofty chain rising high above a table-land more than 3000 feet high, and covered with snow in April. This tract chiefly consists of granite, and has altogether a sierra-like aspect. North of the Báránlí-Dágh is the fine plain of Sógher, and north of it lies the Begrek-Dágh, an extensive granitic district, composed of low, rounded, whitish, and bare hills, broken up by deep ravines, and covered with a scanty vegetation. The northern edge of the table-land surrounded by the Kizil-Irmák begins at Tókát in 40° 17′ N. lat. and 36° 50′ E. long.(?), with a chain of high limestone hills surmounted by steep and craggy pinnacles, which lower as they stretch to the west, parallel with, but at a considerable distance from, the left bank of the Tókát-Sú. At Túrkhál the chain is again high, and presents several steep cones. Thence to Zilleh, south-west, and thence north to Amasia is a high table-land, partly fertile, partly a barren plain composed of limestone, which is prevalent near Amasia. The craggy edges of this plateau towards the Tókát-Sú rise to a great height above the valley and are broken by deep ravines. The rocks near Amasia are highly picturesque, and the description which Strabo (p. 561, Cas.) gives of his birthplace has been verified by modern travellers. From Amasia a range of low hills, consisting chiefly of volcanic sand or peperite, occasionally stratified, runs west, partly bordering the plain west of Amasia; 13 miles west of this town the hills rise into huge masses of rocks. From Chórum the table-land has the same character, being partly a level plain and partly a hilly tract, which to the north of that town is bordered by the Kirk-Delim mountains, which may be considered as the most northern projection of the great table-land. The tract from Chórum south-west as far as the Begrek-Dágh described above, is little known; its edge towards the Kizil-Irmák is more craggy and deeply cut than the sides of the table-land towards the Tókát-Sú, except the immediate environs of Amasia. About 30 miles west-south-west from Chórum, and at no great distance from the Kizil-Irmák, are the rock-salt mines of Cháyán-Kö, situated in a rugged ridge of hills of red sandstone conglomerate. The surrounding country, especially towards the river, is a succession of hills, consisting of red marls and gravel of a grey or bluish colour, the very counterpart of the saliferous districts of England. South of Chórum, towards the interior of the table-land, there is a succession of winding valleys sunk below the level of the plateau, and lying between schistose rocks varying much in colour and consistency. The high plain has a barren aspect. Towards Yüz-gátt, south of Chórum, there are deep ravines, and many broken rocks, which amidst protruding masses of trap and other igneous formations bear evidence to the convulsions which have agitated the country. The waters flow north-north-east into the Tókát-Sú, a fact which proves that the slope of the table-land is towards the north. A little north of Yüz-gátt is the Habak-Tepe, a lofty hill, and the central culminating point of the tract whence ridges radiate in all directions: some of them consist of coarse sandstone, passing into a loose conglomerate containing pebbles of blue crystalline limestone, secondary limestone, jasper, sandstone, and schistose rocks. West and south-west of the town of Yüz-gatt, and at a considerable distance, there is a range of mountains called Chichek-Dágh, which seems to be the edge of the second terrace of the table-land, on ascending it from the west; the first being formed by the Begrek-Dágh and the Báránlí-Dágh described above. The tract east of these two chains beyond A′ngora is likewise an elevated table-land, but broken by deep valleys and ravines, through which the Kizil-Irmák and the Zákáríyeh with its tributaries have forced their way, and has in many places an alpine character. Many plateaus consist of trappean or granitic rocks, upon which the red sandstone appears to have been deposited as in a basin. Limestone occurs everywhere with masses of trachytic formation overlying it. On the plateaus there are rugged chains of mountains with broken and picturesque outlines; and high cones of volcanic origin bear evidence that this part of the country has been reduced to its present state by the action of fire, and that the work was completed by water. The plateaus, especially that of Háímaneh, are bleak and miserable, but the valleys are fertile, and yield corn, wine, and fruit of every description. Among the chains that stretch in all directions are the Ardij-Dágh, south of A′ngora, about 3600 feet high; the Kartal-Dágh, south-east; the Idris-Dágh, east; the Kará-Bazár-Dágh, north-east; and the Göklú-Dágh and Ishik-Dágh, which form one or perhaps more parallel ranges interrupted by table-lands which begin about 25 miles west of A′ngora and stretch in a north-eastern direction for about 50 miles. The base of the hills is formed of an immense number of basaltic prisms of great regularity of form, some vertically disposed, others horizontally. Above these, masses of a similar character tower up in rocky pinnacles of fantastic shape, in which the colossal prisms are variously disposed. This motley distribution of basaltic prisms, says Ainsworth, surpasses anything at the Giants' Causeway, Fairhead, or the Cave of Fingal, and most resembles sketches that have been published of the volcanic scenery of the islands of St. Helena and Ascension. In the northernmost corner of these mountains, in the valley of the Kerimis-Sú, near its sources, are the mines of Sahlún. There another table-land begins, the slope of which inclines towards the Black Sea, which is only 75 miles distant. The Kerimis-Sú flows south and joins the Zákáríyeh. The height of the plateau near A′ngora is 3000 feet above the level of the sea, and as it is one of the lowest, the average height of the surrounding table-lands may be fixed between 3000 and 4000 feet. They are consequently about 2000 feet lower than the plateau of the great central table-land, the average elevation of which has been estimated at from 5000 to 6000 feet; and they are 2000 feet higher than the table-lands that occupy the northern margin of the peninsula along the Black Sea. It would therefore seem that the part of Asia between the Black Sea in the north and the Taurus in the south is composed of three terraces, which we may call the Euxine, the Galatian, and Phrygo-Cappadocian terraces. The beds of the rivers which originate on the Galatian terrace and descend through the Euxine terrace to the sea, are not (so far as we know) interrupted by steep transverse barriers, so as to make the waters flow down in cascades, whence we may conclude that the ascent to the terraces is gradual, unless future observation should show that such cataracts have existed, and that the opposing barriers have been washed away by the water. Considerable portions of the courses of the Yeshil-Irmák, the Kizil-Irmák, and especially the Zákáríyeh (Sangarius) are still unexplored and offer a good opportunity for such observations; and it would be no less interesting to examine the pass through which the Síhun breaks through the Taurus.

The tract between A′ngora and the upper part of the Zákáríyeh and thence westward as far as Mount Olympus is very little known, except in its south-western part, which is traversed by the great road from Constantinople to Kútáhíyeh and Kóníyeh which passes over a high plateau of barren aspect. The same character prevails in the middle district, between Kútáhíyeh and the left bank of the Zákáríyeh, with the exception that the eastern part, between Germá and A′ngora, contains large plains and some valleys, where the clayey soil is well cultivated. Chains have been seen there stretching from east to west. The highest portion of this table-land seems to be between Séwri-Hisár and Kútáhíyeh, where the river Zákáríyeh is supposed to have its origin. The northern part of the tract has scarcely been visited at all: a Turkish gentleman of Brúsá who has several times travelled on the direct (?) road from that town to A′ngora, and crossed the Zákáríyeh by a stone bridge (at Kíwá?), has told the writer that the country is generally level, but is mountainous east of the Zákáríyeh, and that this river flows in a beautiful winding valley between high and steep rocks.

This sketch will be concluded with a few remarks on the mountain system in the most western part of the peninsula. The Mórád-Dágh, which has been described as the western promontory of the midland system of mountains, is a centre from which several high ranges stretch west and north. A lofty and wooded chain connects it with the Olympus of Brúsá, separating the fertile valley of the Edrenos from the barren table-lands of Kútáhíyeh. A second chain branches west under the names of Ak-Dágh and Demirjí-Dágh, and terminates with Mount Ida: two parallel branches of this chain stretch north: they are the watersheds between the river Edrenos in the east and the Simáúl-Sú in the west, and between this river and the small watercourses that flow into the Hellespont. A third chain runs south of and parallel with the A′k-Dágh and the Demirjí-Dágh, forming a barrier between the river Ghiediz-Cháí in the north and the Mendere or Maeander in the south. The western part of that chain branches and forms the Kiziljá-Músa-Dágh, the antient Tmolus, in the north, and the Kestáne-Dágh, the antient Messogis, in the south: between them flows the little Mendere. The Bábá-Dágh, a lofty chain that rises south of the (Great) Mendere, belongs to the Taurus range, as mentioned above: its height must be very great, since Fellows saw its snowy summit from the high table-land near Kútáhíyeh, a distance of 150 English miles, which however he incorrectly states at 110 miles only. The tract between the Bábá-Dágh and the Mórád-Dágh is a high table-land, though not so high as the great central table-land; and it seems to be an intermediate terrace between that tract and the less elevated plateaus on the western coast. Its general aspect is barren, whole districts being covered with sand and fragments of volcanic products; basaltic cones rise everywhere, marble is abundant, limestone occurs generally, and in many places the surface of the table-lands is undulating. This circumstance gives additional strength to the hypothesis that the central table-land was once a lake. The Mórád-Dágh with its eastern chains, the Sultán-Dágh and the Emír-Dágh, and its western continuations the Ak-Dágh and Demirjí-Dágh, consist of schistose and metamorphic rocks; most of the trachytic outbreaks occur on this line; the peaks are generally trachytic or basaltic rocks, and traces of former eruptions are very numerous. This chain is part of the great central axis of the peninsula; its height must be considerable, since the whole range was covered with snow in the month of April. The chains by which the Mórád-Dágh is connected with the Olympus, and between which the river Edrenos flows, begin in the south with trap dykes which have burst through crystalline limestone and yellow schist, traversed by numerous veins of quartz; farther north the declivities show cliffs of white cretaceous limestone, with a horizontal stratification in which Strickland discovered fossil fresh-water tertiary shells. Mount Olympus is supposed to consist of plutonic rocks, which are indicated at its northern and western foot by beds of limestone penetrated to some distance by quartzose granitic veins; the limestone is of the scaglia formation. Towards the lower part of the river Edrenos there are greenish trachytic rocks.

The general characters of the geology of the peninsula, says Hamilton, are simple. The eastern extremities consist of trachytic rocks, which towards the west are succeeded and partly overlaid by black volcanic breccia and peperite, containing angular fragments of trap or trachyte. The western part of the peninsula consists of calcareous rocks which seem to belong to the scaglia or cretaceous formation. All these are horizontal, and the lower portion is a hard compact scaglia like that of Greece and the Ionian islands. This (the lower, hard portion) contains no fossils, but is overlaid by beds thirty or forty feet thick containing a great variety of shells, amongst which are Corbula and Modiola. The beds vary considerably in hardness, and some are rather silicious. Near the summit of the hill are the antient quarries, in which lie large blocks hewn and ready to be removed. The same writer says that he could not find the line of junction between the limestone and the trachyte, so as to form any conjecture of their relative ages.

Hydrography—1. *Rivers.*—Our knowledge of the rivers and lakes of the peninsula has been greatly extended by the discoveries of recent travellers. In enumerating them we proceed from the gulf of Iskénderún west along the coast of the Mediterranean, &c. The Jíhun (Pyramus) has its sources near Merásh in the eastern beginning of the Taurus, in 37° 35′ N. lat., 36° 55′ E. long., flows south-west for above fifty geographical miles, through a narrow valley, along the western foot of the Dúrdún-Dágh, turns south and south-west, pursuing that course for 35 miles, and taking a sudden turn towards east, falls into the small bay of Ayás. Its antient course from the point where it turns east was south-west and south-east, and its former mouth may still be traced near Cape Kará-Tásh at the entrance of the gulf. Its whole length is above 100 miles; it receives on its right the Sáúrun, which descends from the Taurus. Its upper part is confined between steep rocks; it reaches the plain of A′dána in 37° N. lat., but the hills of the Dúrdún-Dágh accompany it in the east as far down as Mount Misis. The lower part of the Jíhún is navigable. The sources of the Síhún, the antient Sarus, are in the central table-land in 37° 42′ N. lat., 34° 25′ E. long.; its course is about 60 geographical miles south-east through the Cilician defiles of the Taurus, and 40 geographical miles south-west till it reaches the gulf of Iskénderún in 36° 44′ N. lat., 34° 53′ E. long. It enters the plain of A′dána above this town, and is navigable in its lower part. The whole length is about 90 geographical miles. The whole course of the Síhún and the Jíhún is not known.

The Tersús-Chái, the antient Cydnus, a small river, originates near the southern entrance of the Cilician pass, on a plateau of 3800 feet elevation, and after a south-south-east and south-west course of 40 geographical miles, which is only partly known, empties itself in the sea a little west of the mouth of the Síhún. The Gök-Sú (Calycadnus) has its sources in the Taurus, in about 37° N. lat., 33° E. long.; it drains the western part of Cilicia, and after a south-eastern course of about 65 miles through a mountainous tract, joins the sea a little below Seléwkeh, the antient Seleucia. Among the rivers mentioned by the antients in Pamphylia are the Eurymedon, the Cestrus, and the Cataractes. The maps do not give the present name of the Eurymedon, but the river designated by that name is described by Fellows as a noble river; the Cestrus is the present Aksú, and the Cataractes the Dúdon. They are not inconsiderable. Some water-courses that have been observed on the central table-land, north of the Taurus, which flow from west to east, are supposed to be their respective sources. It is not unlikely that the Eurymedon is formed by the southern outlet of the lake of Egerdir mentioned before, and that it is swelled by the waters of lake Sóghla after they have forced their way through subterranean passages across the Taurus; for the volume of the water of the Eurymedon is too large for a river the length of which would not exceed 60 geographical miles, if its sources lay only in or a little beyond the great range of the Taurus. The Xanthus is now Etchen-Chái The description of this river will be appropriately accompanied with a few remarks on Lycia, one of the most interesting parts of the peninsula, and unknown to Europeans till Fellows published his account of that country. The Xanthus has its sources in the snowy range of the Taurus, and flows due south as far as Hórán,[*] where it receives, on the left, a tributary of about 25 miles length, and much longer than the portion of the main stream above that point. From Hórán the river winds through a beautiful valley between wooded hills and picturesque rocks in a south direction with a slight western inclination; and a little below the ruins of the antient city of Xanthus it turns abruptly west and falls into the sea, after a course of about 50 miles. Below Hórán it is crossed by a fine bridge of five arches. The tract south of a line between this bridge and the bay of Makri (Glaucus) in the west, the river Xanthus and the sea, is filled up by mountains known by their antient names of Cragus and Anti-Cragus, surmounted by peaks 3000, 3300, 5490, and 5940 feet above the sea. From Hórán a range stretches south-east towards the sea, pressing close upon it with a steep summit of 4800 feet elevation; the northern part is indicated on the map in Fellows' 'Discoveries in Lycia' as being covered with (eternal ?) snow. This is the antient Mons Massicytus. East of it is the high table-land mentioned above, which has a mean elevation of more than 4000 feet, being part of the antient district of Cibyratis, a name which in the Byzantine period designated the whole country of Lycia, the Cibyratae being known as the best sailors among the Greeks, especially for ships of war. On this table-land there is a river that falls into a cavern and disappears. A few miles south of the cavern there is the lake of A′wclán, which has no outlet, is three or four miles wide and ten long, and lies in the middle of a highly cultivated plain which is above 3000 feet high. Between the table-land and the eastern coast of Lycia is the Taktalu-Dágh, the antient Mount Solyma, with a snowy summit 7800 feet high. The range of Mons Massicytus and the table-land beyond it form a terrace which is lower than the Taurus, but higher than the elevated tract along the southern shore. The tract along the shore is traversed from west to east by the little river Dembre; it is a terrace, lower than the table-land, and rising with bold precipices above the sea. The exterior of Lycia resembles on a small scale the northern part of the peninsula between the Black Sea and the central table-land; and the Dembre and the Xanthus are on a small scale in the south what the Yeshil-Irmák and Kizil-Irmák are on a large scale in the north. In the same relation in which Lycia stands to the whole peninsula, the peninsula with its central table-lands, barren rocky plains, salt and other lakes without outlets, and lower terraces leading to the coast, where the vegetation is quite different from that of the midlands, stands to all Asia, and this circumstance might not have escaped the keen eye of the later antients, and suggested to them the name of Asia Minor or Little Asia.

The next river to the Xanthus is the Dollomon-Chái (Calbis). Its sources are supposed to be about 37° 15′ N. lat., 29° 50′ E. long., in the high table-land north of the range of the Taurus, and the part of it visited by Fellows flows in a deep ravine through a plateau 5000 feet high. Its course, which at first is from east to west, soon becomes south-west, but nearly the whole of it is unknown, except the part near its mouth, a little north-west of Cape Ghinázi, where Fellows had much trouble in crossing it. The whole length is nearly 100 miles. No large river occurs between the Dollomon-Chái and the Mendere. This river, the celebrated

---

[*] In Arrowsmith's map belonging to the Journal of Hamilton, this part of its course is north-west to south-east.

Maeander, has its source in 38° N. lat., 30° 20 E. long., in a chain (Mons Aulocrenas) stretching from east to west towards the Bábá-Dágh, and bordering the elevated plains of Dínáír. Hamilton states that it issues from a small lake fed by subaqueous springs, and surrounded by steep and lofty mountains. This corresponds with the account of Pliny. The town of Dínáír, the antient Apamea Cibotus, is close by, and in its environs is the spot in the plain where Marsyas paid so dearly for his presumptuous rivalry of Apollo (Xenophon, *Anabasis*, i. 2); but the cavern where Apollo hung up the skin of his rival seems to have fallen in. The course of this river is 24 geographical miles north-west, through the high plain of Dínáír; 16 geographical miles south-west, and 20 geographical miles north and north-west, partly through high plains, partly through a deep rocky valley; 110 geographical miles west-south-west, in numerous windings through a beautiful valley that becomes wider and more fertile as it approaches the coast. Its whole course is above 170 geographical miles. Its tributaries are, on the right, the Sanduklí-Cháí, which comes from the south-eastern continuation of the Mórád-Dágh, and the Bánás Cháí, 50 geographical miles long, which rises at the foot of the Mórád-Dágh, and joins the Maeander where this river begins its regular west-south-west course. The Kópli-Sú, a smaller river, joins the Bánás Cháí immediately above its junction with the Maeander. From this spot down to the coast only small streams join the Maeander on the right. On the left it is joined by the Chóruk-Sú, the antient Lycus, a small river flowing from east to west; the Kará-Sú (Mosynus ?), a still smaller stream, which comes down from Mount Bábá-Dágh; and the Chíná-Cháí, the antient Marsyas, the sources of which are about 35 geographical miles south-south-east from its junction with the Maeander, in the western continuation of the Bábá-Dágh. The Little Mendere, the antient Cayster, has its source in the angle formed by the Kestáne-Dágh (Messogis) in the south, and the Kiziljá-Músá-Dágh (Tmolus) in the north. It falls into the Gulf of Scala Nuova, after a western course of 60 geographical miles. The Kodus or Ghiediz-Cháí, the antient Hermus, has its sources in the Mórád-Dágh, south-east of the town of Ghiediz; its course is 20 geographical miles west, 36 south-west, nearly 100 geographical miles in a generally west direction, and 15 geographical miles south-south-west, till it falls into the bay of Smyrna, which it loads with its clayey and sandy deposits. In its upper part, the only river of consequence that joins it on the left is the antient Cogamus, now Allah-Sheher-Sú (?), the sources of which are only a few miles from the middle part of the Maeander, in 29° E. long. It joins the Hermus after a north-west course of 50 miles, through a beautiful and highly cultivated valley. On the right, the Hermus receives in its upper part the Aineh-Cháí and the Demirjí-Cháí (Hyllus ?), two small rivers which come from the Ak-Dágh and the Demirjí-Dágh, and in its lower part it receives the Ak-Sú (Hyllus ?). The middle part of the Hermus, between the mouth of the Cogamus, and the sudden turn which it makes near its mouth to the south, is very imperfectly known. North of the Hermus are the Bákir-Cháí (Caïcus), the Túzlá, and the Mendere (the famous Scamander), flowing west, and the Bóklá-Cháí (Aesepus ?), which flows north into the sea of Marmara. The only important river which flows into the sea of Marmara is the Edrenos, the antient Rhyndacus, which is formed by the junction of two rivers. One of them, the Rhyndacus or Edrenos Proper, originates in the lofty chain which connects the peaks of Mórád-Dágh and Ak-Dágh, and after a winding north-west course through a beautiful valley falls into the large lake of Abullionte (Apollonias); it issues from the northern corner of this lake, and empties itself into the gulf of Múdáníah, after a course of above 120 geographical miles including the curves. The other branch is the Súsúgherlí-Sú, the antient Marcestus, which comes from Símáúl, at the foot of the Ak-Dágh, where it is called Símáúl-Sú: it flows west for 60 geographical miles, and north for 80, and joins the Rhyndacus a little below the point where it issues from the lake of Abullionte. The Rhyndacus also receives the Kará-Dere-Sú, the outlet of the great lake Mányás. Until Hamilton made these rivers the subject of very careful examination we knew very little about them. Between the Rhyndacus and the Zákáríyeh there are only small rivers, the Nílúfer or Lúfer-Sú, near Brúsá, and the outlet of the lake of Iznik or Nicaea. The Zákáríyeh, the antient Sangarius, is the second in magnitude of the rivers of the peninsula. Its sources are either on the high table-land between Kútáhíyeh and Séwri-Hisár, so that the river passing by Chánder in 39° 16′ N. lat., 31° 24′ E. long., is the main branch; or a river which comes down from the Emír-Dágh, in a northern direction, and passes by Hergán Káleh, is the principal branch. These two streams unite about six miles east of Chánder, whence the river flows east and north till it is joined by the Enguri or A′ngora-Sú, by which the mountainous tract round A′ngora is drained. From this spot, in 39° 45′ N. lat., 31° 55′ E. long., down to its mouth, the river has been seen by European travellers only at a few places. Its general course however is known, and in tracing it we follow a map of Bithynia, in the first volume of Hammer's 'Geschichte des Osmanischen Reiches.' This map will be found defective as to geographical correctness in many parts, but we may rely upon its general correctness, and with regard to its details and the names of localities; as there is perhaps no man in Europe who knows Bithynia, the original abode of Osmán and his tribe, so well as Baron von Hammer. The direction of the Zákáríyeh, from its junction with the A′ngora-Sú, as far as 31° E. long., is west; thence it flows west and north-west till it reaches the north-eastern promontories of the Ermení-Dágh, a lofty and wooded range connected with the Olympus of Brúsá by the Túmánij-Dágh. At the foot of the Ermení-Dágh, near Sögüd, a few miles west of the Zákáríyeh, stands the tomb of Er-tóghrul, the father of Osmán. From the Ermení-Dágh, which is close to the stream, the river takes a more northern direction. Below Sáríkíá, a village about 10 minutes south of the latitude of Nicaea, the river is fordable at a place called 'Sürkün,' that is 'ford.' The most western part of the river, according to the map, is in 30° 10′ E. long.; but we cannot rely upon the map as to the fact; and the curve of the river in this part varies much in different maps. In the latitude of Nicaea there is a stone bridge over the river near Kíwá (Kinneir's Gaiwa), and here the great roads from Constantinople and Nicaea to A′ngora unite. From that spot the direction of the Zákáríyeh is north-east, and in the latitude of Nicomedia it turns suddenly east, but it soon flows north, north-north-west, and north, and it enters the sea in 41° 71′ N. lat., 30° 42′ E. long. From the point where it suddenly turns east the river formerly ran north, and the old bed is still visible. A fine bridge of antient construction, 1087 feet in length, leads across the bed, through which a small arm of the Zákáríyeh flows north. Near this spot the main branch is crossed by a wooden bridge. Near Kíwá the Zákáríyeh flows for 13 miles through a gloomy intricate defile, with high and rugged precipices rising perpendicularly on both sides. The summits of the mountains are covered with excellent timber, oak, beech, sycamore, and ash. The Sangarius, says Kinneir, is in general about 100 yards wide (near Kíwá), contains an immense body of water, and flows with surprising rapidity. The stone bridge over it was, according to an inscription, built by Sultan Bayázíd (I. ?), and the middle arch was broken by the force of the current. Ainsworth crossed the river on a wooden bridge near the antient bridge, which is over the dry bed. The width of the river was 372 feet, with an average depth of two feet, and a rate of about three miles an hour. He adds that the river was liable to considerable rises: he crossed it in September, the driest month of the year. The tributaries of the Zákáríyeh, besides those mentioned above, are on its left, the Pursúk-Sú, the antient Thymbrius, which comes from the Mórád-Dágh, and after a northern and north-eastern course of about 50 geographical miles, and passing by Kútahíyeh and Eskí-Sheher (Dorylaeum), joins the Zákáríyeh about 10 geographical miles below this town. The Yení-sheher-Sú (Melas ?) joins the main river near Kíwá, after a north-eastern course of 50 geographical miles: it comes from the Olympus of Brúsá. A river which flows from the east falls into the Zákáríyeh on its right, below Sáríkíá, after a westerly course of 40 miles. It has no name in the map, and may be the lower course of the Kerimis-Sú. The length of the Zákáríyeh may be estimated at 220 geographical miles. The distance in latitude between its mouth and the sources of the Thymbrius, which has often been taken for the main river, is 2° 20′; but between its mouth and the Chár-Sú, which joins the A′ngora-Sú, and consequently belongs to the upper system of the river, there is only a difference in latitude of 40′; and there are only 30′ difference between it and the sources of the Kerimis-Sú. The defile near Kíwá is the place where traces of former cataracts may be found, for the river here descends into the Euxine plateau. The mouth of the Filíyás, the antient Billaeus, is in 41° 35′ N. lat., 32° 6′ E. long. Its lower part has been visited by Ainsworth, who describes it as 'a noble river' flowing through a most beautiful valley from south to north. We know nothing of its upper part except a portion of it near Záfarán-Bólí, where there is a wooden bridge over it. This is mentioned in the first volume of Ainsworth's 'Travels' (p. 66), and we are enabled, by an extract from his MS. journal, which the author has communicated to us, to add, that the junction of the Sóghánlí-Sú, a rivulet which flows from the plateau of Ifláni, with the Hamámli-Sú, 'a goodly river coming from the south,' about seven miles west of Záfarán-Bólí, forms the Filíyás. From this point the river flows west and afterwards turns to the north. The route of Ainsworth from the valley of the Kizil-Irmák, by Cherkesh and Bólí west to Dúzchah, is not laid down on the map which accompanies his work. Arrowsmith's map which accompanies Hamilton's 'Travels,' also leaves a blank for the country thus traversed by Ainsworth, and neither indicates the towns of Cherkesh and Chomomlik visited by the traveller, nor the water-courses which he crossed on his way. A careful comparison of the different passages in Ainsworth's work with each other and those of some other travellers leads us to conclude that the Hamámli-Sú, which flows from Cherkesh north up to the environs of Záfarán-Bólí, is the main branch of the Filíyás. The sources of this river must be looked for in the west, in the Bólí-Dágh. The Milán-Irmák (Hypius), which originates in the same direction, but further north, in the Yáilá-Dágh, and of which only the upper part is known, is most likely the first tributary which the Filíyás receives on its left. It may also be that the Milán-Irmák is the main river under another name. Bounded by the Bólí-Dágh on the south, and the Yáilá-Dágh, the Filíyás runs east; the mountains north-east of the Ishik-Dágh make it take a northern course: this portion is called Himámli-Sú; closely pressed in the north by the Durnah-Yáilá-sí (Mons Orminius), it turns west at Filíyás, but being stopped by the Kará-Dágh it flows north along the eastern foot of this chain. The Filíyás thus effects the drainage of the tract which begins between the mouth of the Zákáríyeh and the sources of the Milán-Irmák in the west, and is bordered in the south by the range between the Bólí-Dágh and the Ishik-Dágh, and in the east by the chains between the Ishik-Dágh and the Black Sea. The waters west and south of this border flow into the Zákáríyeh, and east of it they are tributaries of the Kizil-Irmák.

The Kizil-Irmák (Halys) is the largest river of the peninsula. Its sources are now known: they are in the Gemín-Belí-Dágh, in 40° N. lat., 37° 40′ E. long., in the northernmost part of the second or Phrygo-Cappadocian terrace. The river at first flows south, but it soon takes a south-west direction, which it pursues for about 150 geographical miles, through a picturesque valley, along the northern border of the great central table-land.

This part of its course is partly conjectural. In 38° 40′ N. lat., 34° 4′ E. long., it turns north-west, with some western bends, and flows in that direction as far as a point in 40° N. lat., 33° 34′ E. long., for about 75 geographical miles. This part is likewise imperfectly known. Thence it flows north-east, east, and again north-east as far as Osmánjík, for 100 geographical miles: this part is much better known. From Osmánjík its course is supposed, and has partly been observed, to be west for about 20 and thence north-east for about 30 geographical miles, as far as the defile of Kará-Tepe, a narrow pass overhung by huge precipices. A portion of this pass is formed by an angle of the main river, and another portion by the valley of the Gök-Irmák, called here Costambúl-Cháí, or Kará-Sú. From this spot the river flows south-east for 15 geographical miles, and thence north-east for about 40 miles. It empties itself into the sea by two navigable channels, in 41° 48′ N. lat., 36° E. long. The lower part is only known towards its mouth, which flows through a flat alluvial tract. The whole length is above 430 geographical miles: the distance in latitude between its mouth and its sources is only 1° 50′. We know of no considerable tributaries to this river except the Gök-Irmák, mentioned above, which rises in the mountains of Uzun-Búrún, west of Kastámúni, which lies on its eastern bank: the Gök-Irmák has an eastern course of about 70 geographical miles, and flows through a valley bordered by high rocks, and generally fertile and well cultivated. The Kizil-Irmák does not appear to be adapted for regular navigation by large craft: the waters are low in the dry season; but they greatly increase in winter and spring, when the snow melts on the high mountains, which supply its tributary streams. The Yeshil-Irmák, the antient Lycus, is the last considerable river in the eastern part of the peninsula: we know little of it. Its sources are at the north-western foot of the Lazian group, in 40° N. lat., 39° E. long., and it enters the Black Sea below the fortress of Chársbámbah after a north-western and at last a north course of 100 miles. It receives on the left the Tókát-Sú, the antient Iris, the sources of which lie between Niksár, on the Yeshil-Irmák, in the north, and the large town of Tókát in the south. Its course is west, with occasional bends to the north as far as Amasia, a distance of 70 geographical miles, the windings included; and from Amasia west and north-west for 35 miles. The Tókát-Sú receives on its left the Chóterlek-Irmák: its sources are in the Kirk-Delím Mountains, north of Chórum, and only a few miles east of the Kizil-Irmák; and it joins the Tókát-Sú after an eastern course of 60 geographical miles, including the bends, through the nearly unknown plateau mentioned above. A little below its junction with the Tókát-Sú the Yeshil-Irmák descends through a narrow pass into the Euxine terrace: this is another spot where traces of former cataracts may be discovered. The Yeshil-Irmák enters the sea by several mouths, the principal of which is navigable, and the surrounding tract is a delta formed by the deposits of the river. East of the Yeshil-Irmák there are only coast rivers. Hamilton was surprised at the large body of water which many of them had notwithstanding the shortness of their course. The largest of these rivers is the Tirebóli-Sú. Its sources are in the Lazian group, in 40° 20′ N. lat., 39° 45′ E. long.; its mouth is a little east of the town of Tirebóli (Tripolis), in 41° 2′ N. lat., 38° 48′ E. long.; its direction is from south-east to north-west.

Lakes.—Besides those mentioned in the description of the great central table-land, there are the following:—The lake of Abullionte (Apollonias) lies on the south-western border of Bithynia, between Mount Olympus and the Gulf of Múdánieh: it stretches from east to west 20 miles, and 12 from north to south. On the south it is bordered by the beautiful wooded mountains of the Olympus, on the north-east and north by trachytic hills, and towards the north-west by marshes. The north-eastern portion is studded with many islands: on one of them, which is connected with the main land by a wooden bridge, stands the town of Abullionte, the antient Apollonia ad Rhyndacum. The town, some of the islands, and the whole surrounding countries, are full of antient ruins. The lake abounds with fish, and supplies the markets of Brúsá and Constantinople. The river Edrenos is 280 feet broad a little below the spot where it issues from the lake, and it is crossed by a wooden bridge. The lake of Mányas, the antient lake of Melitopolis, is west of that of Abullionte, on the eastern borders of Mysia: it is 14 miles long from east to west, and 8 miles wide from north to south. The shores are low and marshy, but the tract north and west of it is well cultivated, and produces much wine, which is highly esteemed by the Greeks. At Kazakli, at the western extremity of the lake, there is a Christian population, the descendants of a colony of Kossaks, but they now speak Turkish. The lake of Búldúr (37° 45′ N. lat., 30° 25′ E. long.) is so called from the town of Búldúr, which stands near the southern part of it: it contains five thousand houses, and has a numerous population, of which a considerable portion are Greek. The length of the lake from north-east to south-west is about 17 miles, and its width about four. The southern shore is flat, and the banks are very muddy. The neighbourhood produces much gum-tragacanth, which comes from a low prickly plant (gón) resembling a species of furze. It is obtained by making an incision in the stem near the root, and cutting through the pith, when the sap exudes in a day or two, and hardens in the opening, after which it is collected by the peasants. Its price is about 3*s*. 2*d*. a pound, and it is sent to Smyrna, where it is sold under the Turkish name of 'ketereh.' The water of the lake is blackish, with a strong taste and smell of sulphuretted hydrogen gas: it is very shallow, and it is covered with wildfowl. The lake corresponds rather with the description of the Palus Ascania by Pliny (*Hist. Nat.*, xxxi. 10), but it cannot be the Palus Ascania of which Arrian says that its water was so salt that it crystallized naturally, and that the inhabitants felt no want of the sea, as they got salt from the lake. (Arrian, *Anabasis*, i. 29, ed. Schmied.) But there is another lake in the neighbourhood which corresponds with the account of Arrian. This is the lake of Chárdák, about 14 miles north-west of the lake of Búldúr; it is about 20 miles long from east-north-east to west-south-west, and from two to four miles wide: it is surrounded by high hills, with precipitous and lofty cliffs. In summer the lake is very shallow, at least near the banks, which are muddy, but in winter the water rises. In the dry season the water is perfectly saturated with salt, which crystallizes on the surface, and is scraped off the mud with large wooden spades. The broad muddy seam along its banks is likewise covered with salt coats, and great quantities of salt are annually produced here. A species of salicornia grows upon the banks. This lake seems to be the Palus Ascania of Arrian; but it is also identified with the lake mentioned by Herodotus (vii. 30) as being situated near the town of Anaua in Phrygia, and from which salt was extracted. We owe the more accurate knowledge of these four lakes to Hamilton. We omit the lake of Nicaea, though large, and the most picturesque sheet of water in the peninsula, and many others, as they have either been described under other heads, or are not important enough in a general description of the whole country.

Mineral Productions.—Both Hamilton and Ainsworth, who have contributed so much to our knowledge of the peninsula, had a firmán to inspect the mines, and they visited many which were hitherto unknown except to natives. Mining skill is in a very low state in this country. There are copper-mines near Bákír-Kurehsí, not far from the Black Sea, in the plateau of Iflání; near Chalwár, on the eastern side of the Lazian group; near Tirebóli, on the Black Sea; near Tókát, and many other places. Iron-mines, near Unieh, on the Black Sea; silver with copper, in the mines of Tirebóli; silver and lead at Denek, in the Begrek-Dágh, east of the Kizil-Irmák. Nitre is got at Kará-Búnár, in the south-eastern part of the central table-land. Rock-salt abounds in all parts, especially in the north-eastern part of Asia Minor and in the tract round A'ngora. Hot springs occur in all the provinces: those of Brúsá are celebrated, and are even visited by European patients. The hot springs near Eregli, in the south-eastern part of the central table-land, require a short notice. They issue out of narrow crevices on the summit of a ridge of low hills near that town, and form a succession of small pools and conical hills, which have been created by the gradual deposit of the earthy matter with which the water is charged, and which forms at first small pools round each orifice, which, by the rapid evaporation of the water, are soon raised into cones. The confined water and gases are heard bubbling under ground. Some of these springs deposit pure salt round their orifices, others pure sulphur, and others sulphate of lime or gypsum, which is the most frequent. (Hamilton, ii. p. 307, &c.)

Population.—A closer examination of the accounts of recent travellers leads to interesting results on this point. The opinion that a line drawn from the corner of the Gulf of Adalia to the mouth of the Zákáríyeh would divide the country into two parts, so that in the western portion the Greeks would form the majority, and in the eastern the Turks, is quite erroneous. In Lycia the Greek population is not one-tenth part of the population, and in Bithynia the Turks are at least three times as numerous as the Greeks. The Greeks are more numerous in the western part than in the east, and they form a considerable portion of the population of all the commercial towns, and several districts in the western part are exclusively inhabited by them. All those who call themselves Turks are not of Turkish origin, and there are several hundred thousand so-called Turks who are descended from Greek ancestors. There are also Mohammedan Armenians in the east. Those among the Turks who style themselves Osmanlis are settled in the country, and lead an agricultural life, though many of them live during the summer time in tents, which they carry to those places which are used exclusively for agricultural or pastoral purposes, leaving their houses empty in the villages. The Turkomans are most numerous in the east; but such among them as are shepherds, and lead a real nomadic life, wander as far as the table-lands of the western provinces. The Yürüks are nomadic Turks, probably of the same origin as the Osmanlis, and are numerous in the northern, middle, and eastern parts. In the same districts there is a considerable number of Kurds, who are either permanently settled, or wander with their herds to the western table-lands; and sometimes, though seldom, as far as Brúsá. The Turkish peasants are a brave and honest set of men, full of confidence, faithful, trustful, ready to assist, liberal, generous, and by no means so grave as the Turks are generally represented; but fond of social pleasures, chatting, dancing, and singing; they are very ignorant and credulous. Fellows, perhaps, gives too favourable a description of them; but he was in the Arcadia of Asia Minor. Religious prejudices are less strong in the peninsula than in European Turkey, and generally the population of Anatolia may be considered as the best part of the whole population of the Turkish empire.

We add some of the routes of Hamilton, and some of the positions of latitude computed by him:—

1, Road from Múdánieh to Smyrna, distance in hours:—Múdánieh to Brúsá, 6; to Hasán-Aghá-Kö, 6; to Kirmasli, 6; to Kesterlek, 4; to Adranos, 9; Harmánjík, 8; Táúshánlí, 8; Oránjík, 8; Azání, 2; Ghiediz, 8; Ushák, 10; Ahat-Kö, 6; Segikler, 5; Göbek, 8; Suleimánlí, 2; Tákínak, 6; Kúlá, 8; Adálá, 8; Sardis, or Sert, 15, the direct road being but 12; Kassábá, 6; Smyrna, 12: 151 hours. 2, From Sinope to Amasia:—Sinope to Delliler, 4; Mehmed Bei-Oghlú-Kö, 8; Bóyáwád, 6; Dúrán, 6; Cheltík, 9 Vizír-Köprí, 3; Káúwsá, 4; Ládik, 4; Sepetli, 9; Sónnísá, 3; Herek, 6; Niksar, 6; Tókát, 9; Zilleh, 4; Amasia, 8: 97 hours. 3, From Amasia to Afíóm-Kará-Hisár:—Amasia to Háji-Kö, 12; Chórum, 6; Tekíyeh-Hatáp, 4; Alâjah, 4; Yüzgátt, 8; Nefez-Kö, 6; Bóghâz-Kö, 4; Yüzgátt, 6; Alájah, 8; Súngúrli, 8; Kúchúk-Kö, 9; Kaláíjik, 9; Akjah-Tásh, 3; Káwli, 6; A'ngora, 6; Báluk-Kuyúmji, 6; Beljáyes, 6; Mölk, 6; Sewrí-Hisár, 8; Alekiám, 6; Hamzá-Háj, 6; Beíát, 6; Eskí-Kará-Hisár, 5; Afíóm-Kará-Hisár, 4: 154 hours. 3, From Afíóm-Kará-Hisár to Dínáír:—Afíóm-Kará-Hisár to Akkar, 9; Yálóbách, 9; Aúshár, 5; Egerdir, 9; Isbártá, 6; Búldúr, 6; Ketzí-Burlú, 6; Dínáír, 4: 54 hours. 4, From Dínáír to Smyrna:—Dínáír to Bálát, 6; Káklek, 8; Chónós, 4; Denizli, 4; Sárai-Kö, 5; Kúyújá, 8; Núzeli, 2; Aidín, 8; Ephesus, 10; Smyrna, 6: 70 hours. Latitudinal positions observed with Kater's circle:—Brúsá, 40° 11′; Azání, 39° 14′ 30″; Chárshámbah, 40° 11′; Vizír-Köprí, 41° 8′ 30″; Tókát, 40° 17′; Amasia, 40° 38′ 30″; Yüzgátt, 39° 47′ 45″; A'ngora, 39° 56′; Sewrí-Hisár, 39° 27′ 30″; Búldúr, 37° 42′ 45″; Dínáír, 38° 3′; Cyzicus, 40° 22′ 30″; Afíóm-Kará-Hisár, 38° 43′ 15″; A'k-Sheher, 38° 17′ 30″; Kóníyeh, 37° 50′ 30″; Kaisáríyeh (Caesarea), 38° 41′ 50″; Kará-Hisár, 38° 20′; Karámán, 37° 9′; Isáúra, 37° 10′.

(Hamilton, *Researches in Asia Minor*, &c.; Ainsworth, *Travels and Researches in Asia Minor*; Fellows, *Asia Minor*; *Discoveries in Lycia*.)

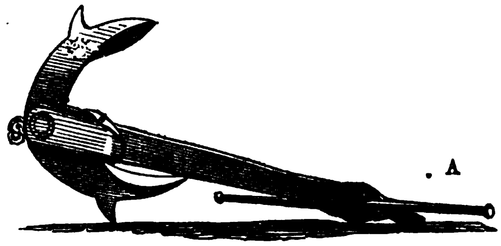
ANATOMY ACT. Before the passing of 2 & 3 Will. IV. c. 75, on the 1st of August, 1832, the medical profession was placed in a situation both anomalous and discreditable to the intelligence of the country. The law rendered it illegal for the medical practitioner or teacher of anatomy to possess any human body for the purposes of dissection, save that of murderers executed pursuant to the sentence of a court of justice, whilst it made him liable to punishment for ignorance of his profession; and while the charters of the medical colleges enforced the duty of teaching anatomy by dissection, the law rendered such a course impracticable. But as the interests of society require anatomy to be taught, the laws were violated, and a new class of offenders and new crimes sprung up as a consequence of legislation being inconsistent with social wants. By making anatomical dissection part of the penalty for crime, the strong prejudices which existed respecting dissection were magnified tenfold. This custom existed in England for about three centuries, having commenced early in the sixteenth century, when it was ordered that the bodies of four criminals should be assigned annually to the corporation of barber-surgeons. The 2 & 3 Will. IV. c. 75, repealed § 4, 9 Geo. IV. c. 31, which empowered the court, when it saw fit, to direct the body of a person convicted of murder to be dissected after execution. Bodies are now obtained for anatomical purposes under the following regulations enacted in 2 & 3 Will. IV. c. 75, which is entitled 'An act for regulating Schools of Anatomy.' The preamble of this act recites that the legal supply of human bodies for anatomical examinations was insufficient, and that in order further to supply human bodies for such purposes various crimes were committed, and lately murder, for the sole object of selling the bodies of the persons so murdered. The act then empowers the principal secretary of state, and the chief secretary for Ireland, to grant a licence to practise anatomy to any member or fellow of any college of physicians or surgeons, or to any graduate or licentiate in medicine, or to any person lawfully qualified to practise medicine, or to any professor or teacher of anatomy, medicine, or surgery; or to any student attending any school of anatomy, on application countersigned by two justices of the place where the applicant resides, certifying that to their knowledge or belief such person is about to carry on the practice of anatomy. (§ 1.) Notice is to be given of the place where it is intended to examine bodies anatomically one week at least before the first receipt or possession of a body. The secretary of state appoints inspectors of places where anatomical examinations are carried on, and they make a quarterly return of every deceased person's body removed to each place in their district where anatomy is practised, distinguishing the sex, and the name and age. Executors and others (not being undertakers, &c.) may permit the body of a deceased person, lawfully in their possession, to undergo anatomical examination, unless, to the knowledge of such executors or others, such person shall have expressed his desire, either in writing or verbally, during the illness whereof he died, that his body might not undergo such examination; and unless the surviving husband or wife, or any known relative of the deceased person, shall require the body to be interred without. Although a person may have directed his body after death to be examined anatomically, yet if any surviving relative objects, the body is to be interred without undergoing such examination. (§ 8.) When a body may be lawfully removed for anatomical examination, such removal is not to take place until forty-eight hours after death, nor until twenty-four hours' notice after death to the anatomical inspector of the district of the intended removal, such notice to be accompanied by a certificate of the cause of death, signed by the physician, surgeon, or apothecary who attended during the illness whereof the deceased person died; or if not so attended, the body is to be viewed by some physician, surgeon, or apothecary after death, and who shall not be concerned in examining the body after removal. Their certificate is to be delivered with the body to the party receiving the same for examination, who within twenty-four hours must transmit the certificate to the inspector of anatomy for the district, accompanied by a return stating at what day and hour, and from whom, the body was received, the date and place of death, the sex, and (as far as known) the name, age, and last abode of such person; and these particulars, with a copy of the certificate, are also to be entered in a book, which is to be produced whenever the inspector requires. The body on being removed is to be placed in a decent coffin or shell, and be removed therein; and the party receiving it is to provide for its interment after examination in consecrated ground, or in some public burial-ground of that religious persuasion to which the person whose body was removed belonged; and a certificate of the interment is to be transmitted to the inspector of anatomy for the district within six weeks after the body was received for examination. Offences against the act may be punished with imprisonment for not less than three months, or a fine of not more than 50*l.*

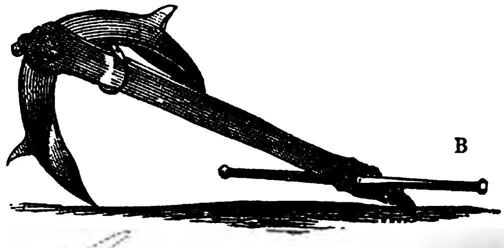
The supply, under this act, of the bodies of persons who die friendless in poorhouses and hospitals and elsewhere is said to be sufficient for the present wants of the teachers of anatomy; and the enormities which were formerly practised by 'resurrection-men' and 'burkers' have ceased. The number of bodies annually supplied in London for the purposes of dissection amounts to 600.

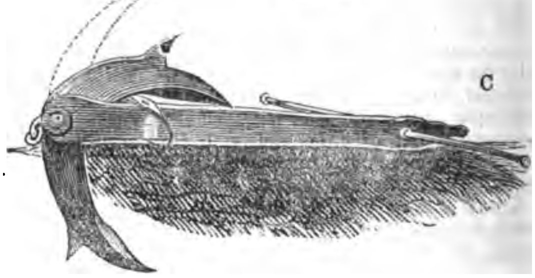
ANCHOR. Among the changes proposed within the last ten years in the construction of anchors, the most remarkable perhaps is that brought forward by Mr. Porter, for which a patent was obtained about five years ago.

The objects designed to be attained by this new construction are said to be mainly the two following:—the avoidance of the consequences of what is termed 'fouling,' by the cable passing over the exposed fluke of the anchor when the vessel is swinging in a tide-way; and the avoidance of injury to the vessel itself, in the event of falling upon her anchor. The peculiarity of the plan consists in giving to the arms and flukes a freedom of motion round a pivot or fulcrum at the end of the shank, thus departing at once from the rigidity usually observed in the construction of anchors. The arms and flukes are forged wholly independent of the shank, and have a hole drilled transversely through the centre, for the reception of the iron bolt which connects them with the shank. To give a familiar illustration, the joint may be described as of that kind which connects the wires of an umbrella with the ribs, so as to give a freedom of motion round the pin or bolt as an axis. The effect of this construction is, that when one fluke enters the ground, the other necessarily falls down upon the shank, thereby avoiding the danger incident to the upward projection of a sharp point.

A paper appeared in the 'United Service Journal' for 1844, in which the effect of this swivel action was rather minutely traced. When the anchor is dropped from the vessel, it descends swiftly and strikes against the bottom of the sea with great momentum (estimated, with an anchor of ten hundredweight and a depth of twenty-four fathoms, at 45 tons). When the anchor rests fairly on the ground, its first position is with the lower peak, or tip, in contact with the lower surface of the shank, the upper peak being as far as possible from the shank, as shown in position A in the above figure. Then the slightest movement of the cable suffices to disturb this position, and to bring the lower peak into a direction fitted to penetrate the ground, as at B. This libration continues until the upper peak touches the upper surface of the shank, and the lower peak is directed almost perpendicularly: a position very favourable for penetration, which then takes place. The shank and stock then lie flat on the ground, as in C; and the anchor, if pulled in the direction of the shank, has a tendency to fix itself more firmly in the ground, by keeping the lower fluke almost perpendicular in the ground.


A


B


C

It is evident that the free movement of the arms on the end of the shank must produce great modifications in the position which the anchor assumes under varying circumstances; but the efficiency of the change must be determined by the daily tests of practical navigation. Captain Denham, of the Marine Surveyor's Department at Fleetwood, gave a report of some experiments which he had tried in 1840 on the new swivel anchor, and states the following as the results to which he had arrived:—'It is almost impossible to foul it; it bites quickly into the most stubborn ground; it holds on to the shortest stay-peak; it cannot lodge on its stock end; it presents no upper fluke to injure the vessel herself, or others, in shoal water; it cannot injure vessels' bows when hanging a'cock-bill, as merchant-vessels find a convenient practice; it is not so likely to break off an arm, or part in the shank, as anchors with fixed flukes do, because the construction of these arms can be of continuous rod-iron, and the fulcrum of leverage is so much nearer the ring, owing to the pea of the upper fluke closing upon the shank; it is a most convenient anchor for stowing inboard on a voyage, as the flukes can be easily separated and passed into the hold; it can as easily be transported by two boats when one would be distressed by the whole weight; it produces the desired effect of ground-tackle at one-twentieth less weight.' (*Unit. Serv. Journ.* March, 1840.)

In 1836 Mr. Meggitt patented an anchor in which the wide flukes, or palms, are dispensed with, the flukes being very little broader than the arms; while at the same time there is an increased width given to the crown by the addition of a triangular piece of iron. The objects of these modifications in the customary form are stated to be three in number: 1st, that the peak of the anchor, not being encumbered by so broad a fluke as usual, may be able to penetrate more readily into the ground; 2ndly, that the increased breadth at the crown may give greater strength and resistance against the draught of the cable; 3rdly, that the 'fouling' of the cable may be less likely to occur, inasmuch as the cable, if twisted round the arm, might be able readily to slip off, by virtue of the narrowness of the fluke.

About the same period another form of anchor was introduced, in which the several parts were formed of distinct pieces of iron, so that it might be stowed away with great facility, or conveyed piecemeal by a boat which could not carry the whole anchor. The arms were formed of one piece, the shanks passing through the crown; the stock was also separate and secured to the shank when required; and the whole were so adjusted as to be put together in a short space of time.

It is unnecessary to notice all the suggestions for the improvement of anchors, since these often involve points of very minor importance. We may however glance at an ingenious substitute for an anchor, which Commander Belcher used on board H.M.S. Ætna, and which affords a hint likely to be useful in emergencies. It was formed of three pigs of ballast, each weighing 56 pounds, and a pair of moveable flukes. One of the pigs of ballast formed the upper part of the shank, and was connected with the cable; the other two pigs were jointed to the lower end of the first, and moved on a pin or swivel bolt; the arms were jointed to the lower end of these two pigs, by being placed between them, and bolted through the crown. The bolt passing through the crown was long enough at each end to form a sort of stock for the anchor.

The officer just named has also devised a mode (*Naut. Mag.* vol. ii.) of weighing anchors different from that customarily in use. An open boat, brought immediately over the anchor, is fitted in the following manner:—Across the broadest part of the boat is placed a strong spar, projecting at each end two feet beyond the boat, and so confined to the gunwales of the boat as to be capable of a rotation on its axis without further shifting. A gin, or pulley, is retained exactly beneath the keel by a rope proceeding from the starboard end of the spar; while a buoy-rope, proceeding from the larboard end, passes over this pulley, and so descends to the anchor. The effect of this arrangement is, that when once the anchor is lifted from the ground, it hangs exactly beneath the keel, and thus enables the full buoyant power of the boat to be brought fairly into play. The anchor is raised by causing the rotation of the spar, by the use of levers inserted in holes in the spar. Captain Belcher states that a boat will in this way nearly support her tonnage. The Ætna's cutters could each weigh a 10 cwt. anchor; and by a modification of the plan, in which two boats are employed instead of one, a cutter of 25 feet long and a jolly-boat of 18 weighed an anchor of 50 cwt.

There has been very recently introduced a new mode of adjusting the windlass for weighing the anchors of ships. In the usual arrangement there are holes in the windlass-beam for the reception of long levers, which are inserted in one hole after another as the beam turns round. But Mr. Kendall, in his 'elbow-jointed fall purchase,' adopts a mechanical action analogous to that exhibited in a common fire-engine. A strong block of wood is firmly fixed on the deck, near the windlass-beam, and on the top of this is a pivot, or fulcrum, for the centre of a transverse lever 16 or 20 feet long (for large ships). The men stand at either end of this lever, and work it alternately up and down, in the manner of a fire-engine. From each half of the lever descends a perpendicular rod, connected at the bottom with a curiously formed jointed lever; when the rod descends, this lever catches in one of the teeth of a ratchet-wheel connected with the windlass-beam; and when the rod rises, the lever forces the beam round a portion of one revolution. Every movement produces a portion of the resultant effect: for there are two vertical rods, two jointed levers, and two ratchet-wheels; and when one of the rods is depressed, it produces a partial rotation of the windlass; whereas when it is elevated, the other rod is so acted upon as to produce working effect. There is a third ratchet-wheel, at the middle of the windlass-beam, the teeth of which receive falls or detents intended to prevent the beam from rotating in the contrary direction. The objects held in view by this invention are—to render the performance of the windlass more certain and more rapid; to give an equal purchase with a smaller number of men than usual, or a greater purchase with an equal number of men; and to strengthen the hold of the windlass in any given position.

ANCHOVY PEAR. [Grias, P. C. S.]

ANCHU'SA, a genus of plants belonging to the natural order Boraginaceæ, and to the sub-tribe Anchuseæ of that group. The calyx is 5-fid; the corolla funnel-shaped, with a straight tube, the throat being closed by prominent obtuse scales; the stamens are included, and subsessile; the fruit a nut, which is depressed. Don enumerates forty-six species belonging to this genus, which are chiefly inhabitants of the temperate parts of the earth, either on the mountains of tropical regions or the temperate zone. They are all of them rough plants, and are known, as well as the species of Lycopsis and Echium, by the common name of Bugloss. Some of the species have been used in medicine, whilst others are employed in the arts for dyeing. Two are inhabitants of Great Britain.

A. officinalis, common Alkanet or Bugloss, has lanceolate, hispid leaves, unilateral crowded spikes, ovate-lanceolate bracts, the segments of the calyx bluntish, hairy on both sides, the scales of the corolla hairy. The flowers are a deep purple. It is an inhabitant of Great Britain, on waste ground, but is a rare plant. In the south of France, Germany, and Switzerland, it is everywhere common, in uncultivated places, on old walls, and by the road side. The young plant is sometimes boiled and eaten. The roots contain a considerable quantity of gum, and when boiled yield a demulcent drink, which was once in repute as a medicine. In China this plant is used as a provocative of the eruption of small-pox. Several varieties are noted by European botanists, depending on the colour of the flowers, which are sometimes white, and on the greater or less hispid character of their leaves. Neither this nor any other species of Anchusa answers to the *Buglossus* of antient writers (Pliny, *Hist. Nat.*, lib. 25, c. 8), which possessed stimulating and exhilarating properties.

A. sempervirens, Evergreen Bugloss, has ovate leaves with lower leaves on long stalks, the peduncles axillary, each bearing two dense spikes with an intermediate flower, the segments of the calyx hairy on the outside only, the bracts minute lanceolate, scales of the corolla downy, flowers blue, salver-shaped. This plant is found on waste ground, near ruins, in Great Britain, but is rare.

A. tinctoria, Dyers' Bugloss or Alkanet, has diffuse stems, oblong hispid leaves, bracts longer than the calyx, the segments of the corolla shorter than the stamens. The corolla has a deep blood-coloured tube, with the limb deep blue. The root is woody, descending, and of a dark blood-red colour. This plant is a native of Peloponnesus, the island of Cyprus, and the deserts about Alexandria. It is cultivated in the south of France for the sake of the root, which yields a fine red colour to oils, wax, all unctuous substances, as well as to spirit of wine. Its chief use is in colouring lipsalves, ointments, &c. It is however sometimes employed for staining wood and dyeing cotton. It is also used for colouring many of the beverages sold under the name of port wine, likewise the corks used for the bottles in which this fluid is sold. The colouring-matter has been separated, and has been called by some chemists *Pseudo-alkannin*. This principle is found in greatest abundance in the external parts of the root, the inner being nearly destitute of it. An extract of this root was formerly used in medicine in hæmorrhages, but is now seldom employed.

A. angustifolia, Narrow-leaved Bugloss, has linear lanceolate hispid leaves, ovate-lanceolate bracts, 5-fid calyx, with blunt teeth. The tube of the corolla is pale purple, the limb deep blue. In gardens it attains a height of two feet; but when wild it is not more than a foot high. It grows in Italy, Germany, and Switzerland, by road sides, amongst rubbish, and on the borders of ploughed fields. It was used by Boerhaave as a medicine; but, like the order to which it belongs, its properties are too inenergetic to give it a standing-place in the Materia Medica of the present day.

In the cultivation of the species of this genus but little care is required, as they will grow in almost any soil, and are easily increased by seed. The *A. Capensis*, Cape Bugloss, requires the treatment of a greenhouse plant. Many of them are pretty annuals for the garden, as *A. paniculata*, *A. Barrelière*, &c.

ANCIENT DEMESNE. [Manor, P. C.; Soccage, P. C.]

ANCIENT LIGHTS. [Lights, P. C. S.]

ANCYLO'CERAS (D'Orb.). This fossil genus of M. D'Orbigny includes several species of Hamites (Phillips), from the Speeton clay and lower greensand.

ANDERSON, JOHN, the founder of the Andersonian Institution of Glasgow, and one of the earliest promoters of that popular instruction in science which has so greatly elevated the character of British artisans, was born in the parish of Roseneath, Dumbartonshire, in 1726. He was grandson of the Rev. John Anderson, an eminent Scotch Presbyterian minister and theological writer, and the first minister of the Ram's Horn Church, Glasgow. He was left an orphan at an early age, and was educated at Stirling by an aunt; and while there he became an officer in a burgher corps raised in February, 1746, to defend the town against the forces of the young Chevalier Stuart. He received the more advanced branches of his education in the university of Glasgow; and in 1756 he was appointed professor of Oriental languages there. This appointment does not appear to have been very congenial, but in 1760, at which time he was residing at Toulouse, he was removed to the chair of natural philosophy, to the duties of which, on his return to Glasgow, he applied himself with the utmost ardour, and, not content with the ordinary duty of lecturing, he employed himself indefatigably in studying and exemplifying the applications of science to the useful arts, visiting for this purpose the workshops of intelligent artisans, and exchanging his scientific information for their experimental knowledge. The better to carry out his views of popular education, Anderson commenced, in addition to his ordinary class, one which he styled his *anti-toga* class, for the instruction of artisans and others unable to enter upon a regular academical course, to whom he delivered familiar extempore lectures illustrated by experiments. Mechanics were allowed to attend these lectures in their working-dress.

The part taken by Anderson, in early life, in the defence of Stirling, appears to have given him a taste for military science, which he displayed in designing fortifications (which have long since been removed) to defend the town of Greenock from an anticipated attack from the French, and in his experiments upon various projectiles, and invention of a cannon in which the recoil produced by firing was stopped, or rather rendered harmless, by the condensation of air in the body of the carriage, a contrivance which, after an ineffectual attempt to introduce it to the notice of the British government, he took to Paris in 1791, and presented to the National Convention, who dignified it with the title of 'The Gift of Science to Liberty.' On this occasion Anderson was an interested spectator of, and in some cases a participator in, some of the earlier scenes of the French Revolution. He was present when Louis XVI. was brought back from Varennes on the occasion of his attempted flight from Paris, and afterwards sung 'Te Deum' with the Bishop of Paris when the king took the oath to the Constitution in the presence of an immense assemblage. Among the ingenious suggestions recorded as having emanated from Anderson was a plan, which was actually carried into effect, for conveying newspapers and other communications from France into Germany by means of small paper balloons inflated with gas, and thereby evading the vigilance of a cordon of troops employed to intercept all ordinary means of communication.

In 1786 Anderson published a popular work, entitled 'Institutes of Physics' (by a curious mistranslation of which title a writer in the 'Biographie Universelle' has converted him into a physician, and writer on *Medicine*), which passed through five editions within ten years. He also wrote many articles for periodicals, and a paper upon the Roman antiquities between the Forth and the Clyde, which was appended to General Roy's 'Military Antiquities of the Romans in Britain,' published in 1793, and also reprinted separately in 1800. He also wrote 'Essays upon War and Military Instruments,' which are said to have been translated and published in French, but of which we find no English edition referred to. Anderson closed his useful career on the 13th of January, 1796, in the seventieth year of his age, after a connection with the University of upwards of forty years, during which time the liberality of his opinions led to some disagreements with his brother-professors. He was buried at Glasgow. He was a fellow of the Royal Societies of London and Edinburgh, and of the Scottish Society of Antiquaries, and member of several other scientific bodies; and he had the academical degree of A.M. Shortly before his death he devised his whole property by will to 81 trustees, for the establishment in Glasgow of an institution to be denominated Anderson's University, for the continued provision of those facilities for the unacademical classes of his townsmen which he had so long supplied by his own personal exertions. His comprehensive design was for an institution consisting of four colleges, with nine professors each, for arts, medicine, law, and theology; but as the funds proved insufficient for so extensive a scheme, operations were commenced in 1797, on a limited scale, by the appointment of Dr. Thomas Garnett as professor of natural philosophy. His first course of lectures was attended by nearly a thousand persons, of both sexes. In the following year a professor of mathematics and geography was appointed; and, though the institution has never attained the magnitude contemplated by the founder, it has been progressively increased and extended in usefulness, and has been productive of much public benefit. Dr. Garnett was succeeded in 1799 by Dr. Birkbeck, on occasion of his removal to the Royal Institution in London, which was formed on a similar model to that established by Anderson; and Dr. Birkbeck, who introduced a new course of instruction for five hundred operative mechanics, free of all expense, was succeeded in 1804 by Dr. Ure. A portrait of Anderson was published in the third volume of the 'Glasgow Mechanics' Magazine,' which contains a memoir upon which the above sketch is chiefly founded. Fuller memoirs are also given in Chambers's 'Biographical Dictionary of Eminent Scotsmen,' and in the 'Biographical Dictionary' of the Society for the Diffusion of Useful Knowledge.

ANDRO′MEDA, a genus of plants belonging to the natural order Ericaceæ, and named after the daughter of Cepheus, who was rescued from the sea-monster by Perseus, has a 5-cleft calyx, the segments acute, simple at the base; the corolla globose with a contracted 5-toothed mouth; the stamens ten, inclosed; filaments bearded; cells of anthers short, each furnished with a single awn; the stigma truncate; the capsule dry with a loculicidal dehiscense, 5-cells and 5-valves; placenta 5-lobed, the lobes simple; the seeds elliptic, compressed, shining, with a lateral linear hilum. There are two species, with several varieties. They are shrubs; and are natives of Europe, Asia, and North America.

A. polyfolia has alternate leaves, lanceolate, with revolute margins, glaucous beneath, and terminal subumbellate flowers. This plant is common in mossy bogs in the mountainous parts of England and Ireland, and on the lowlands of Scotland, and is called by various names, as wild rosemary, poley-mountain, moorwort, marsh holy rose, &c. It is also a native, in Europe, of Russia, Sweden, Denmark, Switzerland, and Germany; in North America, of Canada and Labrador, Bay of St. Lawrence, New York and Pennsylvania. Several varieties of this species have been described, and are cultivated. A. p. latifolia is a native of North America. A. p. media, subulata, oleifolia, are European varieties. A. p. glaucophylla is a Canadian variety. A decoction of the leaves of this plant is inebriating, and is used in Siberia as an intoxicating beverage.

A. Rosmarinifolia, Rosemary-leaved marsh Andromeda, has linear, lanceolate, convex, revolute leaves, white beneath, corollas sub-globose, segments of calyx oblong, red. It has white flowers tinged with red, and is a native of Newfoundland and Labrador.

The Linnean genus Andromeda contained a large number of species, but it has been broken up by David Don and other botanists, and the genera Cassiope, Cassandra, Zenobia, Lyonia, Leucothoe, Pieris, Phyllodoce, Bryanthus, and others have been formed from it. The species of these genera have a family resemblance, and are frequently called in gardens by the old name Andromeda. Some of the species are used in medicine. The old A. ovalifolia (Pieris ovalifolia, D. Don) is a native of Nepaul, and is a poisonous plant. The A. arborea (Lyonia arborea, D. Don) is found in the valleys of the Alleghany mountains, and is called sorrel-tree on account of its leaves having an acid taste. They are made use of by hunters to alleviate thirst; and are used as an infusion in fevers. A. acuminata (Leucothoe acuminata, D. Don) is a native of the sandy swamps of Georgia and Florida. It is remarkable for its hollow stems and branches, which are used by the natives for making pipe-stems, and its wood is known by the name of pipe-stem wood.

The species of Andromeda and its allied genera are most of them hardy deciduous shrubs which thrive best in moist ground. They may be propagated by means of suckers, which are put forth abundantly. The American species may be grown from seed sown in moist earth. The soil that they prefer is peat or a sandy loam. Some of the species may be increased by cuttings planted in sand with a bell-glass over them.

(G. Don, *Gardener's Dictionary*, art. *Ericaceæ*; Burnett, *Outlines of Botany*.)

ANDROS is one of the Bahamas in the West Indies. It is situated on the western side of that part of the ocean, which extends from Providence Channel south-south-east into the main body of the Great Bahama Bank, between 24° 20′ and

25° 25′ N. lat. and between 77° 40′ and 78° E. long. It is about 30 miles long, and more than 12 miles wide on an average. In the tables of the revenue, population, &c. of the United Kingdom its area with that of Green and Grassy Keys, two small groups south of it, is stated to be 1100 square miles, or larger than that of the county of Derby. The population, in 1838, amounted to about 500 individuals, so that on the average two square miles had less than one inhabitant. The soil of this island, like that of the Bahamas in general, is sandy and of inferior quality, but when cultivated with care it produces moderate crops of cotton and provisions, which, with the produce of some coffee-plantations, are exported from the island to Nassau on the island of Providence, and thence go to Europe.

ANENCHELUM (Agassiz), a genus of fossil fishes, from the black slate of Engi.

ANETHUM GRAVEOLENS (Dill)—*Medical Properties of.* This is an umbelliferous plant, native of the south of Europe, Astrakhan, Egypt, and the Cape of Good Hope: it has either migrated or been introduced into Egypt and the Cape. It is also cultivated in England. It was in high repute among the antients, both as a medicinal and a savoury herb, being mentioned by Hippocrates and Dioscorides (*ἄνηθον* of the latter). The fruit is the part which is officinal. This consists of a diachenium formed of two flattened mericarps, on the back of which is one, and on the commissure two vittae, containing the volatile oil, on the presence and quantity of which the peculiar odour and virtues of the fruit depend. The quantity of oil varies much according to the degree of ripeness, the age, and, above all, the place of growth of the fruit. Fruits too ripe, or very long kept, yield less than those gathered before perfect maturity, or very fresh ones. Those raised in England are inferior to those from the south of Europe; the clearer and drier atmosphere of the latter favouring the elaboration of volatile oils. To obtain it, the bruised fruit is submitted to distillation with water. Two hundredweights of good fruits yield eight pounds five ounces of oil. (Pereira.) The colour is pale yellow; the specific gravity 0·881; the odour peculiar, penetrating, and much disliked by some—hence the French name of the plant, *Fenouil puant.* The taste is hot, and rather sweetish. It requires 1440 parts of water to dissolve one part of oil. It is very soluble in alcohol and æther. Hence to form the Aqua Anethi (Dill-water) the instructions of the Pharmacopœia are rarely complied with, but a portion of the oil is previously dissolved in alcohol and then with sugar diffused through distilled water, by which means a more potent agent is obtained. The oil is sometimes administered by dropping it on sugar, and so forming an oleo-saccharum.

Dill is a carminative agent of considerable power, and in most frequent use, particularly to allay the spasmodic affections of the bowels of infants, and to assist the expulsion of flatus. This practice, though attended with temporary benefit, is in the end hurtful. A much more rational plan is for the nurse who suckles the child to be most careful in her diet, to retire to rest early, and to discharge faithfully all the duties which devolve upon her as a mother. She may take the dill, when troubled with indigestion and flatus, with more safety than the infant, and also with more advantage, as, by promoting the digestion, it augments the quantity of the milk and improves its quality.

Dill-water is often made the vehicle of purgative or other medicines to prevent griping. One of the best laxatives for infants is made with equal parts of dill-water and compound decoction of aloes, to which a few drops of aromatic spirit of ammonia may be added. This is much more appropriate than the domestic doses of magnesia and rhubarb, so often given to infants, and which Dr. Reid declared to be the cause of death in one-half the children which died in London under two years of age. The insoluble nature of the woody fibre of rhubarb renders it very irritating to the sensitive stomachs of infants, to whom nothing solid should ever be given. The evils of magnesia are manifold.

ANGE′LICO. [Fiesole, Fra Giovanni da, P. C. S.]

ANGELO BUONARRUOTI. [Buonarruoti, P. C. S.]

ANGLE. As the explanation of the various ways in which this word is used lie scattered in many parts of this work, the following summary may be found convenient.

An *angle* is the opening of two lines; *rectilinear*, of two straight lines; *curvilinear*, of two curves; *mixtilinear*, of a straight line and a curve. But in truth angle always means rectilinear angle, and when a curve enters, its tangent is the straight line which is used in determining the angle.

A *right* angle is half the opening of a straight line and its continuation; an *acute* angle is that which is less than a right angle; an *obtuse* angle is that which lies between one and two right angles. *Complemental* angles are two which together make a right angle; *supplemental* angles are two which together make two right angles. Two lines which meet and make a pair of angles, one less than two right angles, are called *salient;* the other greater than two right angles, are called *re-entrant*, or *re-entering*. None but salient angles are mentioned by Euclid. For salient and re-entering (which are borrowed from fortification) *direct* and *retroflected* have sometimes been used.

The angles which two lines make with the same part of a third, on opposite sides of it, are called *alternate*. Two lines which cross one another make two pair of *vertically opposite* angles. The angles made by adjacent sides of a figure are called *internal;* those made by any sides with adjacent sides produced are *external.* When the angular point is the centre or on the circumference of a circle, the *angle* is said to be *at* the centre, or *at* the circumference. Beginners often confound the angle with the angular point.

The angle of *contingence* or of *contact* is an old notion of the opening made by two curves, or a curve and a line, which touch. In modern mathematics, when a curve is supposed to be composed of infinitely small rectilinear elements, the infinitely small acute angle made by one element with the production of the next does duty for this old angle of contingence.

A *spherical* angle is made by two circles (usually great circles) of a sphere. When the circles meet at the pole of the equator, and one of them is the meridian, the angle is an *horary* or *hour-angle;* and when neither is the meridian, the angle is frequently called *horary*. The *angle of position* of a star is that made by the circles drawn to it from the poles of the equator and ecliptic. The angle of *elevation* is the angle made by a line drawn from the eye to any object with the horizontal line which is in the same vertical plane as the first line; but when the object is below the horizon, the term is angle of *depression.* When lines are drawn from two points to a third, those two points, and also the line joining them, are said to *subtend* the angle which is made at the third point. The angle which two objects subtend at the eye is their angle of *elongation*. The *angle of the vertical* is a name given to the angle which a line drawn to the spectator's zenith makes with his radius of the earth produced: it is taken as nothing when the earth is supposed to be a perfect sphere. Angular terms, such as right ascension, longitude, &c., with which the word *angle* is not usually coupled, are not considered here. The *parallactic* angle is simply the Parallax, P. C.

When one line falls upon another, the angle of *incidence* is the acute angle which the incident line makes with the perpendicular to the other. When the incident line is thrown off again on the same side as that from which it came, the acute angle made with the perpendicular is called the angle of *reflexion;* when on the opposite side, the angle of *refraction.* These terms are nearly confined to optics.

A *dihedral* angle is the opening made by two planes: it is measured by a rectilinear angle, namely, that made by two lines drawn in the two planes perpendicular to their common intersection. But the rectilinear measure is not the same thing as the dihedral angle, though the two are often confounded: we might just as well say that the pressure of the air is the same thing as the number of inches in the barometrical column of mercury.

A *solid* angle is said to exist when three or more straight lines, not in the same plane, meet at a point. It is a complex idea, and the best notion of it as a magnitude is derived from considering it as measured by the area of the spherical triangle which subtends it.

To what we have said under the article Angle, P. C., we may add the following:—If we were to define an angle as the infinite plane space included between two straight lines which meet at a point, and are produced *ad infinitum* one way from that point, we should have a sufficient definition, subject only to the question of the propriety of making infinites a part of the elements of geometry. Some persons have arrived at the conclusion that this definition is the true and proper one: the author of 'Geometry without Axioms,' an acute writer, declares it *to be* the definition 'whether geometers know it or not.' Were it adopted, the theory of Parallels (P. C.) might be completed without difficulty; for it is easily proved that, under this definition, the three angles of a triangle are equal to two right angles. Without going so far as to say that this *is* the definition of an angle, we should recommend it to be admitted and examined as what *might be* such. Though we have a distinct notion of an angle otherwise formed, by means of finite lines, we find much advantage in the knowledge of the following truth—The infinite spaces contained between lines have among themselves all the relations which exist among the angles formed by the lines. In the same manner the solid angle might be defined as the infinite solid space contained between three planes, that is, between such parts of them as lie between three infinitely produced straight lines which meet at a point.

ANGOLE. [Ongole, P. C. S.]

ANGOULÊME, DUC DE. [Charles X., P. C. S.]

ANGUI'SCIOLA, SOFONISBA, greatly distinguished as the 'Cremonese' for her ability in portrait-painting. She was born in Cremona, of a noble family, about 1533, and learnt painting first of Bernardino Campi at Cremona, and afterwards of Bernardino Gatti at Milan.

Vasari describes some of her portraits as wonderful, they possessed so much life. Her reputation having reached the ears of Philip II. of Spain, he sent two gentlemen and two ladies of the court in 1559 to invite and to escort her to Madrid, to enter into the service of the Queen of Spain. She painted a portrait of the queen, with which Philip was so much pleased that he sat for his own, and ordered Don Carlos likewise to sit to her. For these portraits Philip settled a pension upon her of 200 dollars, and presented her, according to Cean Bermudez, with a diamond of the value of fifteen hundred ducats. By these portraits and many others Sofonisba obtained a reputation for portrait-painting which was equalled by few of her contemporaries. Pope Pius IV. requested his nuncio at Madrid to procure him a portrait of the Queen of Spain by the hand of the Cremonese. Sofonisba sent the portrait with a letter to the pope in the month of September, 1561, and his holiness paid the fair painter the extreme compliment of an autograph answer in the following month, complimenting her highly on her performance. The letter and the pope's answer are both given by Vasari.

Sofonisba was married in Madrid to a Sicilian nobleman, Don Fabrizzio di Moncada, upon which occasion Philip raised her pension to a thousand crowns, and presented her at her marriage with twelve thousand crowns as a dowry. Her pension was to be drawn from the customs of Palermo, where, after her marriage, she resided with her husband. In a few years however she became a widow, but she found a second husband in the person of Orazio Lomellino, the captain of the Genoese galley in which she returned to her own country from Palermo. They were married shortly after her return at Genoa, with the sanction of the King of Spain, who again raised her pension to fourteen hundred crowns. She painted many pictures at Genoa, by which she added to her reputation, but as she grew old she became blind. She however did not lose her cheerfulness of mind, but became the centre of an intellectual society, her house being the resort of the principal artists and men of letters and virtù in Genoa. Vandyck, who frequently visited her, is reported to have said that 'he had learnt more from the conversation of a blind old woman than from the works of all the great masters of Italy,' a report which may not be true. Walpole says that Vandyck painted her portrait at Palermo when she was in her ninety-second year, which would be about 1625, but this statement must be erroneous in two respects,—she is not known to have returned to Palermo, and she is generally supposed to have died in 1620. If Vandyck painted her portrait when she was in her ninety-second year, it must have been in Genoa, and she probably was born before 1533: the dates however are very uncertain both of her birth and death. Vandyck was in Genoa in 1619 and in 1625, and perhaps between those dates.

The works of Sofonisba betray none of that feebleness of design and modelling which is frequently apparent in the pictures of female artists, and is particularly so in the works of Angelica Kauffmann. There are several portraits of Sofonisba by her own hand: there is one at Althorp in Northamptonshire, in which she is represented playing upon a harpsichord; there are two at Genoa in possession of the Lomellini family; there is one at Florence, and another at Vienna. She had four sisters, whom she instructed in painting, and who were all accomplished in the art.

(Vasari, *Vite de' Pittori*, &c.; Soprani, *Vite de' Pittori*, &c.; Cean Bermudez, *Diccionario Historico*, &c.)

ANIMAL CHARCOAL. [Charcoal, Animal, P. C.; Carbon, P. C.]

ANIMAL FLOWERS. [Actinia, P. C.]

ANIMAL MAGNETISM. In the articles Animal Magnetism and Somnambulism, P. C., reference has been made to those phenomena which under these terms and that of *Mesmerism* have excited much public interest. It will be found from those articles that although this subject had excited much attention on the continent of Europe, in Great Britain it had obtained comparatively a small share of interest. Recently however animal magnetism has had directed towards it a great amount of attention, has been investigated by physiologists of eminence, and used as a curative agent by many medical men. In the present article we shall not attempt to analyse the facts presented by animal magnetists with a view to the rejection or adoption of any theory, but endeavour to give a fair view of its position and claims from the writings of those who have investigated its phenomena.

One of the first publications in this country on this subject was by Mr. Richard Chenevix, a fellow of the Royal Society, who published a series of papers in the 'London Medical and Physical Journal' for 1829, entitled 'On Mesmerism, improperly denominated Animal Magnetism.' He performed numerous experiments, which were witnessed by many medical men, and amongst others by Dr. Elliotson. In 1836 Mr. Colquhoun published a work on animal magnetism, entitled 'Isis Revelata,' which attracted considerable attention to the subject, and contained as an appendix a translation of a report of a second French commission appointed to investigate this subject in 1831. This was followed by the arrival of Baron Dupotet in London, who performed many experiments, some of which were witnessed by Dr. Elliotson, who immediately undertook the further investigation of the subject. The result of the experiments of Dr. Elliotson, which were published in the 'Lancet,' produced a great sensation, and phenomena which had hitherto been regarded as impossible were constantly produced. Communications were also made at this time to various medical journals of remarkable cases, and among others were some from Mr. Herbert Mayo, then professor of physiology at King's College, London. In 1840 a work was published by the Rev. Chauncy Hare Townshend, entitled 'Tracts on Mesmerism, with reasons for a dispassionate inquiry into it.' This work contained many cases and facts with regard to the phenomena of animal magnetism. In 1841 M. La Fontaine, a Frenchman, visited England, and commenced giving public lectures on mesmerism and exhibitions of its phenomena. Whilst in Manchester he attracted the attention of Mr. Braid, a surgeon residing there, who, having repeated and modified variously the original experiments of the mesmerisers, published a work on the subject in 1843, entitled 'Neurypnology, or the Rationale of the Nervous Sleep.' Since this time various public lecturers have appeared, and have created a general interest on the subject. One of the most recent productions on this subject is a series of letters in the 'Athenæum' from Miss Martineau, who attributes the cure from a long-standing ailment to the influence of animal magnetism.

The phenomena presented by persons under the influence of animal magnetism are various, as well as the modes by which the phenomena are produced. Mesmer and his followers on the Continent, and most of those who have practised mesmerism in this country, have produced its effects by placing themselves near to the individual to be mesmerised, and making downward passes with their hands over their bodies without touching them, but looking at them at the same time intently in the face. This is found to affect the individual in a space of time varying from two or three minutes to half an hour. All persons are not however susceptible of the influence, and if an effect is not produced in the course of half an hour, the effort is abandoned. Mr. Braid however, in the course of his inquiries, found that a second individual was not necessary to the successful development of mesmeric phenomena, and that by causing a person to sit still, and simply directing his attention, by means of the eyesight, to some particular object, as a lancet-case or a cork, all the effects of the passes and intense looking of the operator could be produced. This induced him to give another name, Hypnotism, to the state in which persons are thus placed.

The effects of the passes or fixed attention on persons of nervous susceptibility are various. Writers on animal magnetism distinguish many stages. The following classification is by Kluge, a German writer on the subject, and gives a tolerably correct estimate of the effects which have been observed in mesmerised individuals:—

First degree:—Called *waking*, presents no very remarkable phenomena. The intellect and the senses still retain their usual powers and susceptibility.

Second degree:—Half-sleep, or imperfect crisis. Most of the senses still remain in a state of activity, that of vision only being impaired, the eye withdrawing itself from the power of the will.

Third degree:—The magnetic or mesmeric sleep. The organs of the senses refuse to perform their respective functions, and the patient is in an unconscious state.

Fourth degree:—The perfect crisis, or simple somnambulism. In this stage the patient is said to 'wake within himself,' and his consciousness returns. He is in a state which can neither be called sleeping nor waking, but which appears to be something between the two.

Fifth degree:—Lucidity, or lucid vision. This is called in France, and mostly in this country, *Clairvoyance*; in Germany, *Hellsehen*. In this state the patient is said to obtain a clear knowledge of his own internal mental and bodily state, is enabled to calculate with accuracy the phenomena of disease which will naturally and inevitably occur, and to determine what are their most appropriate and effectual remedies. He is also said to possess the same faculty of internal inspection with regard to other persons who have been placed in mesmeric connection (*en rapport*) with him.

Sixth degree:—Universal lucidity; in German, *Allgemeine Klarheit*. In this state the lucid vision becomes greatly increased, and extends to objects whether near or at a distance.

Such are the states of the system recognised by mesmerists, and works on the subject abound with cases illustrative of each of these six degrees. However, there are many who practise mesmerism who are sceptical with regard to the real existence of the two last degrees, although such cases are recorded by the best authorities on animal magnetism.

One of the most singular statements with regard to mesmerism is its application to phrenology. It is asserted that persons in the sleep-waking state, when that region of the head is touched or pointed at by the mesmeriser which is over the seat of the supposed phrenological organs in the brain, will exhibit the mental emotions and states which are peculiar to the exercise of these organs. Thus when the organ of language is touched, the patient talks; when wit, he laughs; when benevolence, he is kind, and so forth. Such cases the attested by Dr. Elliotson, Mr. Braid, Mr. James Simpson, and others.

The mesmeric state has been applied mostly to the cure of disease, for which purpose it was used by Mesmer when it first attracted public attention. It has also been used for the purpose of producing sleep during surgical operations, as well as a means of divination for the purpose of ascertaining past and future events, as related in the case of Miss Martineau's attendant J. The class of diseases which have been cured by its means are those which are known to medical men as functional nervous diseases. Various nervous diseases, such as paralysis, epilepsy, &c., come on from changes in the structure of various organs, but these are not susceptible of benefit from the mesmeric state. It is in those cases where no structural lesion can be supposed to exist, and which often yield to sudden changes of the mind from various causes of excitement, and which frequently cease without obvious cause, that have yielded to this remedy. To this class of cases belongs that of Miss Martineau, to which we have before alluded, who has been relieved of her nervous symptoms by mesmerism, whilst an organic disease still exists. (*Report of the Case of Miss H. M.*, by Mr. Greenhow.) In the article SOMNAMBULISM, P. C., a case is given in which an operation was performed during sleep artificially induced, and many cases of a similar kind have been recently recorded.

Many theories have been propounded in order to embrace the facts of animal magnetism. Mesmer and his immediate followers attributed them to the action of a subtle fluid in the bodies of animals, which enabled them to exercise an influence on each other at a distance, just as a magnet affects iron; hence he called it animal magnetism. This hypothesis of a nervous fluid susceptible of being influenced and producing an influence more or less modified, has been adopted by most writers on Mesmerism till the appearance of Mr. Braid's experiments. The mesmeric state having been produced by Mr. Braid without any influence from a second person, he accounts for the phenomena by supposing that there is 'a derangement of the cerebro-spinal centres and of the circulatory and respiratory and muscular systems, induced by a fixed state, absolute repose of body, fixed attention, and suppressed respiration concomitant with that fixity of attention.' He further adds, that in all cases he believes 'that the whole depended on the physical and psychical condition of the patient, arising from the causes referred to, and not at all on the volition or passes of the operator throwing out a magnetic fluid or exciting into activity some mystical universal fluid or medium.'

Whilst there can be little doubt with regard to many of the facts recorded on this subject, they have been so remarkably misrepresented through the feeling of those who have observed and narrated them, that men of science, disgusted with the imposture of some and the credulity of others, have generally shunned its investigation and turned a deaf ear to what they consider the pretensions of its professors. There have been however recently recorded several instances in which mesmeric cases have been tested by unprejudiced observers, and which have led to the conclusion that in these particular cases either imposition was practised or a false conclusion had been drawn from the facts. In the case of two girls put to the test by Mr. Wakley, editor of the 'Lancet,' and recorded in that periodical for September 1, 1838, there was strong reason to believe that many of the phenomena attributed to animal magnetism were assumed at the volition of the patient. A more recent instance is recorded by Dr. John Forbes, in the same journal, for August 3, 1844, in which he tested the powers of *clairvoyance* of a French youth named Alexis. In these experiments, which were conducted before many observers, the youth entirely failed to give evidence of any extraordinary mental powers during the mesmeric state. Dr. Forbes says in his introductory remarks to his account of the experiments, 'I think it necessary to repeat here what I have stated in the notes, that mesmerism may be true, while its professors are false; that negative results must of course give way to positive ones; and that I for one am still unconvinced that *clairvoyance* has not existed, and does not exist, merely because Alexis on these occasions failed to show it.' Independent of the motive of gain which actuates some, it is admitted by mesmerists that the class of persons who are most susceptible of the influence are 'so much infected with a disposition to deceive, that as yet it is exceedingly difficult to say when, or upon what occasion, their statements are to be relied on.'

In this article we have avoided expressing an opinion, and have given only an outline of the present position of animal magnetism in this country.

(For further inquiry refer to the works quoted, and to Elliotson, *Human Physiology*, 5th edition; Lang, *Mesmerism, its History, Phenomena, and Practice*; the *Athenæum* for December, 1844; and the *Zooist*, a monthly journal which advocates animal magnetism.)

ANIMAL PHYSIOLOGY. [PHYSIOLOGY, P. C.]

ANIMAL STRENGTH. Efforts were made to express the amount of human and animal labour as early as the latter end of the seventeenth century; for, besides Borelli's treatise 'De Motu Animalium,' which was published in 1680, in the 'Mémoires de l'Académie des Sciences' for 1699, there is a paper by M. de la Hire, and, for 1703, one by Amontons, each containing observations and the results of experiments on the strength exerted by men and horses. Since those times the subject has been much studied: Daniel Bernoulli and Euler have treated it scientifically, while Desaguliers, Emerson, Smeaton, and many other mechanicians have made numerous experiments for the purpose of determining the most advantageous manner in which both human and animal strength may be employed. But to none is this branch of mechanical philosophy so much indebted as to Coulomb, who, besides obtaining more correct results from experiments made by himself and others, adopted for the expression of strength a dynamical unit by which its different degrees can be readily compared with one another. He was also the first to make a distinction between the absolute measure of strength and that which may be called the useful effect, that is to say, the part which is independent of the action expended in carrying the man or animal forward. The whole of this subject is of the highest importance, since, notwithstanding the vast use of machinery in the performance of labour, the employment of men and animals is still to an immense extent indispensable for that purpose; and consequently it is very necessary to ascertain what is the greatest quantity of useful work which may be obtained from such agents without subjecting them to a degree of fatigue which might, in time, prove injurious to their health or bodily powers.

The unit employed by Coulomb is one kilogramme (=2·2065 pounds avoirdupoise), supposed to be transported to a distance equal to one kilometre (=3280·9 feet, or 0·6214 miles English); and his expression for strength is, therefore, the product of the number of kilogrammes by the number of kilometres in the distance to which the burthen is conveyed during one working day. Other mathematicians take, for the dynamical unit, the weight of a cubic metre of water conveyed one metre: neither of these units is, however, convenient for persons among whom those weights and measures are not used; and therefore, in this article, the results of experiments have been made to correspond to a unit expressed by one pound (avoirdu.) conveyed one mile; every number expressing strength is, therefore, the product of the number of pounds by the number of miles to which it is conveyed in a day.

With respect to men, Coulomb found that when a man travels unloaded on level ground, he can walk 31 miles daily. Now, assuming the weight of a man to be 160 pounds, we have 160 × 31, or 4960, for the measure of his strength, or the quantity of action; which is consequently equivalent to that of a machine capable of carrying 4960 lbs. to a distance of one mile, or one pound to a distance of 4960 miles in one day.

He found also, from a mean of the work done by the porters of Paris, that with a burthen equal to 128 lbs. a man can walk 9·72 miles in a day; from which it follows (the weight of a man being 160 lbs.) that the quantity of action is (160+128) ×9·72, or 2799. If the weight of the man be not included, the quantity of action is 128×9·72, or 1244; and this is to be considered as the useful effect. Subtracting 2799 from 4960, we have 2161 for the measure of the action lost in consequence of the burthen; but the useful effect, which in the first case was nothing, is in the second expressed by 1244.

Now, if f represent the burthen which would prevent a man, or animal, from moving, and v the velocity with which he would move if unloaded; also, if f' be the burthen due to a velocity expressed by v'; we should have, according to Euler,

$$f : f' :: (v-0)^2 : (v-v')^2$$

or

$$f'v^2=f(v-v')^2:$$

making therefore $f'=128$, $v=31$, $v'=9·72$, as in the example above, we have 272 nearly for the value of f, or the greatest burthen, in pounds, which a man supposed to be of average strength can carry, and under which he could not move.

From the equation above we have

$$f'v' = v\left(\frac{f'^{\frac{3}{2}}}{f^{\frac{1}{2}}}+f'\right)$$

therefore, in order to find the maximum value of $f'v'$, we may make the differential of the second member equal to zero (f' being the variable), which will give $f' = \frac{4}{9}f$, or 121 lbs. This is the weight which should be placed on a man's shoulders, when it is required to produce from his labour the greatest quantity of useful effect. Making $f'= 121$, $f= 272$, and $v = 31$, in the above equation, we obtain $v' = \frac{1}{3}v$, or $v' = 10\frac{1}{3}$ miles, nearly, for the distance to which the burthen f' could be carried in one day; and $f'v'$, the quantity of action, is 1280.

Coulomb further determined that when a man ascends a convenient flight of steps unloaded, the vertical heights of all the ascents during one day being added together, were equal to 1·82 miles; the quantity of action may therefore be expressed by 160×1·82, or 291; as if the action were equivalent to that of a machine which could raise 291 lbs. to the height of one mile vertically, or one pound to the height of 291 miles during a day. When loaded with 150 lbs., the vertical height ascended was 0·494 miles: the whole quantity of action is, therefore, in this case (160 + 150)×0·494, or 153, while the useful effect is 150 × 0·494, or 74; that is, 74 pounds raised one mile vertically.

It is remarkable that, from the result of Coulomb's experiments on the power of men ascending steps, both the greatest weight which a man can carry without moving, and the weight which he should bear to render his useful effect a maximum, are nearly the same in this case as they were found to be from experiments made with burthens carried on level ground.

Coulomb has also made experiments to determine the quantity of action in the case which most generally occurs when heavy goods are carried in towns, viz. that in which a porter, having delivered his burthen, returns unloaded for another; and his conclusion is, that, in order to produce the most useful effect in this case, the greatest burthen which a man should carry on level ground is 135 lbs.; and with this he should walk 7 miles. The quantity of useful action is therefore 135 × 7, or 945.

It is said that a London porter can carry 200 lbs. on his shoulders at the rate of three miles per hour: but this action can only be continued during a short time.

The following statements of the strength of men are taken from Hachette's '*Traité des Machines*,' and from other sources; the numerical values being reduced so as to express the number of pounds carried by a man one mile per day of eight hours:—

Drawing a vessel on a canal	758459
Conveying a load (110 lbs.) in a wheel-barrow (1·018 miles per hour)	896
Drawing a small waggon on four wheels over rather unequal ground	857
Pulling horizontally, the weight being raised by a rope passing over a pulley	378
Rowing in a boat	374
Thrusting horizontally, as at a capstan . .	368
Turning a winch and axle	159
Digging with a spade	85·3
A soldier marching (12·48 miles) with his arms, &c. (60 lbs.) daily	745

With respect to the horse, the most useful way of employing his strength is to make him draw loads in a cart or waggon; but, even for such work, the estimates which have been made of the quantity of action performed daily are various. M. Hachette expresses the whole quantity of the action of a cart-horse, by terms equivalent to 309 lbs. drawn nearly 25 miles in a day; and consequently such action should be represented by 309 × 25, or 7725. But, according to Tredgold, a horse can only draw 125 lbs. at the rate of 2½ miles per hour:

which, for one day, would give 125 × 2½ × 8, or .	2500
The useful effect of a horse when walking in a circle, as in some mills, is considered as equivalent to .	800
A horse carrying a soldier with arms, &c. (= 200 lbs.) can go 25 miles in a day, which gives . .	5000
An African dromedary carrying only his rider (160 lbs.), can go between 7 and 8 miles per hour during 9 or 10 hours; which gives 160 × 7½ × 9½, or	11400
An Asiatic camel will carry burthens weighing from 500 to 800 lbs. (suppose 600) at the rate of 2½ miles per hour. This, for a day of 8 hours, gives 600 × 2½ × 8, or	12000

The velocity of a horse in walking is estimated at 5½ feet per second, or 3¾ miles per hour. In trotting, 12 feet per second, or 8⅓ miles per hour; and in galloping, 18 feet per second, or 12¼ miles per hour.

For drawing on a road, the traces of a horse should be perpendicular to the collar on his breast and shoulders, so that when he leans forward, in pulling, the traces may be nearly parallel to the road; and the height of the wheels should be determined accordingly. When, in drawing a two-wheeled carriage, a horse has to overcome an obstacle on the ground, he lifts up his fore-feet, and allows his weight to act upon his hinder feet as fulcra, till the wheels have passed over the impediment. It follows, that a certain portion of the loading in a cart should be thrown on the back of the horse, in order to increase the power which the animal employs in overcoming an obstacle; and, in ordinary circumstances, it renders a considerable inclination forward unnecessary.

When a horse is employed to turn a mill, the circle which he describes should be the greatest possible, 25 or 30 feet in diameter, both to diminish the centrifugal force, and the necessity which the animal is under of reclining from a vertical position in drawing.

ANIMAL TISSUES. [Tissues, P. C. S.]

ANKOBAR. [Abyssinia, P. C. S.]

ANNOTTO. [Arnotto, P. C.]

ANNUITIES AND ASSURANCES. We add some of the most recent information on the subject to what we have said in Reversions, P. C.

The completion of Mr. Jones's work on Annuities, in the Library of Useful Knowledge, has given computers an immense mass of tables, involving all that can be necessary as far as two lives are concerned. Barrett's method, in particular, is applied to two lives, for various rates of interest.

The 'Life Assurance and Annuity Tables,' by Edward Sang, Edinburgh, 1841, folio, though confined to one life, the Carlisle Table, and 3 per cent., is in every point of view a remarkable work. It contains the present values and premiums, or immediate means of finding them, for every variety of annuity and assurance on one life, whether for the whole life or a limited term, whether immediate or deferred, with the value of every policy at every stage, and a great mass of other tables, as those for increasing or diminishing premiums, &c. Every result has its logarithm by its side. The author set up these tables himself in type, taking precautions to insure accuracy which appear to have met with full success.

The experience of the Amicable Society for 33 years, ending April 5, 1841, was printed in quarto (for distribution among members of the corporation) by the directors at the end of that year, under the superintendance of the registrar, Mr. Galloway. Of some of the details of this investigation we shall presently speak. In 1843 was printed, for the use of those offices which contributed materials, 'Tables exhibiting the law of Mortality deduced from the combined experience of Seventeen Life Assurance Offices, embracing 83,905 policies, of which 40,616 are distinguished by denoting the sex of the lives assured, and by classing them into Town, Country, and Irish Assurances,' quarto. This table was in agitation or construction from the year 1838, and was superintended by a committee of actuaries, consisting of Messrs. Ansell, G. Davies, Downes, Gompertz, Kirkpatrick, Milne, Rainbow, and Woolhouse. The results of this undertaking, excellent both in conception and execution, are accessible to computers in general in 'A series of Tables of Annuities and Assurances calculated from a new rate of mortality amongst assured lives,' by Jenkin Jones, London, 1843, 8vo. The early history of the subject has been well given, and reference to authorities facilitated, by Mr. Edwin J. Farren, in an 'Historical Essay on the Rise and Early Progress of the Doctrine of Life Contingencies in England,' London, 1844.

The *actuaries' table* (as it ought to be called) contains the experience of the Amicable and Equitable societies, which had been previously printed, and which afforded conjointly a large majority of the policies employed. We give a summary of results, namely, the duration of life among 100 persons at quinquennial periods of age.

In the following table, columns C. and E. contain the Carlisle and Equitable tables [Mortality, P.C.]: A. is the Amicable table above noticed. All on the right of the double line comes from the actuaries' tables: in which the data are divided, as far as was practicable, into policies effected in town (London), in the country (other parts of Britain), and in Ireland. The first table, M. T. C. I., is that of males only, town, country, and Irish; F. T. C. I. the same for females; the remaining tables contain both male and female lives, T. town, C. country, I. Irish, C. T. combined town (which is explained to be the *total* experience of the Equitable and Amicable combined with the *town* experience from other quarters, the reason of which we do not see); G. I. the result of all the materials, including the Irish; G. the same not including the Irish. Thus 100 individuals at 35 years of age have among them 3100 years of life according to the Carlisle table, and 3055 according to the general result of the actuaries.

Age.	C.	E.	A.	M. T. C. I.	F. T. C. I.	M. F. T.	M. F. C.	M. F. I.	M. F. C. T.	M. F. G. I.	M. F. G.
20	4146	4167	..	3984	3586	4122	4033	3495	4155	4097	4149
25	3786	3812	3781	3663	3441	3856	3755	3194	3826	3784	3798
30	3434	3453	3368	3317	3173	3484	3420	2971	3454	3425	3443
35	3100	3093	2972	2952	2907	3112	3078	2630	3077	3055	3087
40	2761	2740	2594	2606	2636	2753	2738	2336	2720	2707	2728
45	2446	2387	2237	2263	2321	2408	2383	2030	2361	2355	2369
50	2111	2036	1899	1941	2005	2058	2048	1776	2007	2011	2018
55	1758	1699	1583	1621	1678	1725	1696	1504	1676	1683	1686
60	1434	1391	1288	1347	1378	1423	1403	1267	1368	1381	1377
65	1179	1113	1026	1087	1060	1118	1144	1019	1086	1103	1097
70	918	870	811	834	793	861	848	792	844	850	854
75	701	661	634	603	537	629	555	597	645	646	648

These tables present that general agreement with the Carlisle table which the Equitable experience first showed. It appears that the town-insured have a very little more life than the country, not more perhaps than can be very well explained by the greater difficulty of making good selection through an agent. The result of the Irish lives is startling: it is not credible that, in the middle classes of life, an Irishman of thirty years old should have five years less life in him than an Englishman of the same age; the necessary inference is, that the offices have done Irish business without sufficient precautions.

The vitality of the Carlisle table seems a little too high: but though, if the difference were serious, the offices should of course adopt their own experience, yet it does not follow that such experience better represents the state of life among the insured class. Probably those who sell or surrender their policies are the strongest and the healthiest; those who have reason to think that ill health is close at hand prefer to remain.

It appears that male *insured* life is slightly better than female, on the whole; which is contrary to all else that is known about the relative values of the two. Perhaps female lives are, more frequently than male ones, insured from fear of premonitory symptoms or hereditary tendencies. A man insures his life either for his family or to obtain an advance of money, and apprehension of speedy death has nothing to do with the disposition to insure in either case; a woman has, generally, not so many reasons, independently of forebodings, to insure. There is then probably a large proportion among women (or the friends who insure their lives) of those undiscoverable cases in which parties insuring have reason to know more about the state of the life insured than their medical attendants, as to causes of death which are not likely to act soon. We do not much like being forced upon an explanation which presumes something like concealment in so large a number of respectable persons; but some reason there must be for the fact of female insured life contradicting the usual law, namely, that, except only where their occupations are above their strength, as when employed in agriculture, women live longer than men. But it should also be remembered that there may be much due to mere casualty in the earlier parts of the above tables: there are but few policies granted to lives under thirty compared with higher ages.

The actuaries have also made from the tables of the Equitable Society an interesting investigation into the effect of selection. It is naturally to be presumed that the general experience of an office, say after 50 years of age, will not be the same as if the table were made from those who come in at the age of 50, and are then of course reputed good lives. The following is a summary of results on the point, the ages at which the parties were admitted being at the head of the column. The tabular numbers, as before, represent the number of years lived by 100 persons.

Age.	Admitted between			
	25-34.	35-44.	45-54.	55-64.
25	3695	..	..	..
30	3296	..	..	..
35	2910	3098	..	..
40	2549	2737	..	..
45	2195	2369	2419	..
50	1856	2011	2026	..
55	1533	1680	1708	1775
60	1250	1367	1393	1436
65	1015	1079	1113	1108
70	778	848	883	862
75	515	690	673	636

It thus appears that the effect of selection is most decided in young lives, and that if apparently healthy lives were substituted, in a mass of persons in all conditions of health, in the place of those who would be refused by an insurance office, the result would not add more than two years of life to each case, at any age from 35 upwards.

ANNULA'RIA (Sternberg), a genus of fossil plants with leaves in whorls, from the coal formations of Europe and America.

ANOMALI'NA (D'Orb.), one of the many genera of Foraminifera [Fossil, P. C. S.] which occur in tertiary strata.

ANOMO'PTERIS (Brongniart), a fossil genus of Ferns, found in the bunter sandstein of Sulzbad.

ANSWER. [Pleading, P. C.]

A'NTHEMIS NO'BILIS (Common or Roman Chamomile)—*Medical Properties of.* This is an indigenous plant, frequent on our commons; but the flowers used in medicine are generally obtained from cultivated plants. Of these there are two kinds, the single or semi-double, and the perfectly double. The doubling of the flowers is attended with a lessening of their virtues, as the single are more aromatic, and contain more volatile oil, which resides in the yellow tubular florets of the disk. Their excellence may be determined by the beautiful whiteness of the radiant florets, the yellowness of those of the disk, and the strength of the aroma and taste.

Those which are brown, mouldy, and faintly smelling, should be rejected. They contain a volatile oil of a beautiful blue colour, camphor? a gum resinous principle, and a small quantity of tannin.

The difference both of taste and smell, the diversity of the oil, and the absence of the camphor-like principle, show the impropriety of substituting for the Anthemis the flowers of the Matricarica Chamomilla (or Feverfew). In this genus the receptacle is naked, in the Anthemis it is paleaceous,—besides, the flowers are similar, and of an unpleasant smell. The flowers should be gathered before they fully expand. The forms of exhibition are, powder, infusion, extract, and oil.

Chamomile is an excellent bitter and tonic agent. Given in powder, or pill, or extract, with addition of a few drops of the oil, it is of great service in dyspepsia, atonic gout, and in intermittent fevers. The infusion may be made the vehicle for alkalies or acids.

The infusion when tepid is emetic, and may be given beneficially in dyspepsia, and at the commencement of catarrh, (particularly influenza,) and hooping-cough.

The decoction is an objectionable form, as it dissipates the oil. Even the infusion should be made with cold water. A most grateful aperient for weak dyspeptic patients is made by steeping senna leaves, chamomile flowers, and a very few cardamoms for ten hours in cold water, straining, and adding to the infusion any saline medicine required. The extract possesses valuable tonic properties, but in preparing it the volatile oil is dissipated, which deprives it of aroma. This may be restored to it by adding a few drops of the volatile oil. Extract of chamomile, with sulphate of quinine, and the volatile oil, furnishes a combination of immense power in improving the appetite and aiding the digestion in convalescences from acute diseases, or after an attack of gout.

Infusion of chamomile, either warm or cold, furnishes an excellent application to weak eyes, or after exposure to the wind in travelling, especially by railroads. This used early will often ward off inflammation.

A'NTHEMIS (or ANACYCLUS) PYRETHRUM—*Medical Properties of.* Pellitory of Spain grows in the south of Europe, north of Africa, and in Syria, but the root of another variety, Pyrethrum, Willd., native of Germany, is also met with. The first is called the Roman or true Pellitory, the latter the German: this is necessary to be known, as the chemical analysis varies considerably. Gautier seems to have analyzed the Roman, and found it to contain—

An acrid fixed oil (resin) . .	5
Volatile oil (a trace)	
Yellow extractive . . .	14
Gum	11
Inulin	33
Muriate of lime (a trace)	
Woody matter	35
Loss	2
	100

It is devoid of smell, and though it does not at first excite any sensation in the mouth, it is followed by a pungent taste, and flow of saliva.

Its use is confined to local affections of the mouth, whether subinflammatory or paralytic. In rigidity of the muscles of the jaw, or rheumatic pains, from exposure to currents of air, chewing this is often of great service. An infusion may be held in the mouth, also in toothache from cold. A tincture may be formed of it, which would be a useful agent in paralysis of the stomach, added to the infusion.

ANTHE'MIUS (Ἀνθέμιος), a distinguished mathematician and architect of the sixth century. He is sometimes called Anthemius Trallianus, from his birthplace Tralles in Lydia. Alexander Trallianus the celebrated physician was the brother of Anthemius, and he had three other brothers who distinguished themselves, according to Agathias. Anthemius was the most distinguished of the architects employed by Justinian at Constantinople; he began to rebuild the church of St. Sophia, after it was destroyed by the populace in 531, and it was completed after his designs by Isidorus of Miletus, after the death of Anthemius, which seems to have taken place in the year 534. The church was not finished until 537, but the dome fell in twenty years afterwards, through the shock of an earthquake; it was however again rebuilt by Isidorus, and the dome then raised was the first that was ever built upon arches and piers, and still remains; it is 108 feet in diameter, and is built of stone.

The mechanical genius of Anthemius is praised by Agathias, and he must have been distinguished also as a mathematician, as Eutocius has addressed to him his commentaries on the Conica of Apollonius Pergaeus. Halley published an edition of these conic sections, Greek and Latin, with the commentaries of Eutocius, at Oxford in 1710. M. Dupuy published in 1777, at Paris, a fragment of a work by Anthemius on mechanical paradoxes: Περὶ Παραδόξων Μηχανημάτων, with a French translation, and notes, entitled 'Fragment d'un Ouvrage Grec d'Anthemius sur des Paradoxes de Mécanique.'

(Procopius, *De Aedificiis Justiniani*, l. i. 'De Templo Sanctae Sophiae;' Agathias, *Hist.* l. v.)

ANTHIA'NUS, FU'RIUS, a Roman, from whose work on the Edict, 'Ad Edictum,' there are three excerpts in the Digest. [Justinian's Legislation, P. C.] The age in which Anthianus lived is unknown.

ANTHOLITHES (Brongniart). Some fossil plants thus designated occur in the coal formations of Shropshire and Northumberland.

ANTHOPHYLLUM (Schweigger), a fossil genus of Madrephylliœa, P. C.

ANTHOSPE'RMEÆ (from ἄνθος, flower, and σπέρμα, seed), a tribe of plants resembling Anthospermum (the Amber-tree), belonging to the natural order Cinchonaceæ. It consists of the genera Coprosma, Phyllis, Galopina, Ambraria, and Anthospermum. They possess diœcious or hermaphrodite flowers; a rotate corolla; styles separating to the base, ending in an elongated hispid or plumose stigma; the fruit consists of 2 indehiscent 1-seeded mericarps, or nuts; the albumen of the seed is fleshy. The species are small herbs or shrubs, with opposite or verticillate leaves, and small 1-3-toothed stipules, which are adnate to both sides of the petioles.

None of the species are used in the arts or medicine; the tribe is however interesting as forming a link between the opposite-leaved Cinchonaceæ and the verticillate Rubiaceæ. Although most of the Anthospermeæ have opposite leaves, yet several species of Anthospermum itself, as A. Bergiainum and A. Æthiopicum, have their leaves subverticillate. In Phyllis the leaves occur in whorls of three or four. This genus has but a single species, known by the common name of Bastard Hare's-ear. It may be cultivated, with other species of the tribe, in a mixture of loam, peat, and sand.

ANTHRACOTHE'RIUM (Cuvier), a fossil genus of Pachyderm mammals, of which many species occur in tertiary deposits, especially in the gypseous and lignitic strata of Paris and Tuscany.

ANTICLI'NAL, a term in geology which expresses the fact that, from a given line, the strata dip in opposite directions.

ANTIDICOMARIANITES (from the two Greek words *ἀντίδικος*, *adversary*, and Μαρία, *Mary*), a sect of so-called heretics, whose peculiar belief was that Mary the mother of our Saviour did not continue a virgin after his birth, as the Roman Catholic Church asserts that she did to the end of her life, but bore other children to her husband Joseph. This doctrine seems to be countenanced, not only by probability and common sense, but by the statement of St. Matthew, that Joseph knew not his wife till she had brought forth her first-born son, and by the mention in various passages of the Gospels of the brothers and sisters of Jesus. (But see what is said as to the meaning of the expression, 'the brother of Jesus,' under James, Saint, the Epistle of, P. C., vol. xiii. p. 77.) The founders or first preachers of Antidicomarianitism were Helvidius and Jovinian, two Roman theologians of the latter part of the fourth century, the latter of whom is also charged with various other heresies. The original accounts of Helvidius and Jovinian, and of their opinions, are to be found in the writings of Augustine, Jerome, and Epiphanius, who were their contemporaries.

A'NTI-MI'LO is a small island opposite the north-western part of the island of Milo, the antient Melos, in the Archipelago; it is about five miles from the harbour of Milo, and opposite to it, a little to the north-west, so that the main sea cannot be seen from the harbour. At the distance of twenty miles the island appears to be a round mountain rising out of the sea, but, on coming nearer, a peak is observed in the centre with steep acclivities forming several small capes, between which are little bays.

(Dapper, *Déscription des Isles de l'Archipel*, p. 361.) [Milo, P. C.]

ANTIPATER, LUCIUS CAELIUS. [Cœlius, P. C.]

ANTI'PHILUS, ('Αντίφιλος) a celebrated Greek painter, who lived in Egypt in the time of Ptolemy Philopator, at the close of the third century B.C. He is praised by Quintilian for the facility with which he painted, and Pliny mentions several of his works, in various styles. He painted—Hesione; Alexander, Philip, and Minerva; Bacchus; Alexander as a boy; and Cadmus and Europa; also Hippolytus and his horses frightened by the sea-monster sent against him by Neptune, a comprehensive and difficult subject: these were all in Rome in Pliny's time. Pliny also mentions the following:—Ptolemy hunting; a boy blowing a fire with its reflection upon his face and the surrounding objects; a room full of women spinning and weaving; and a Satyr looking out —he was standing with his hand over his eyes, and a panther's skin hanging from his shoulder: the last was a very celebrated picture, it was known as the *ἀποσκοπεύων*, or Looker-out. Besides the above pictures, Antiphilus was the inventor of a kind of caricatures called *Grylli*. They were a species of grotesque monsters, part man and part animal or bird, of which the Greeks and Romans appear to have been fond. Antiphilus therefore added variety of style to facility of execution. He was a native of Egypt, and his time is fixed by a circumstance connected with him mentioned by Lucian in his treatise against Calumny. Some writers have inferred that he lived in the time of Philip and Alexander from the manner in which Quintilian mentions him, and because Pliny states that he painted those princes; but their pictures are not noticed as portraits, but simply as pictures, and which may have been painted at any subsequent period. Quintilian speaks of Antiphilus as one of those painters who were distinguished during the time of Alexander and his successors, but he speaks vaguely; Ptolemy Philopator however, though the fourth of the Ptolemies, may be strictly spoken of as one of the successors of Alexander. The circumstance related by Lucian shows a black side to the character of Antiphilus. Being jealous of a painter of the name of Apelles, a citizen of Ephesus, who was then on a visit at the court of Ptolemy, Antiphilus accused him of being a participator in the conspiracy of Theodotus at Tyre. Theodotus was Egyptian governor of Cœle-Syria, and his conspiracy took place, according to Polybius, in 218 B.C. Ptolemy at first believed the accusation, and Apelles was apparently imprisoned, but upon his innocence being established, Ptolemy presented him with 100 talents, and condemned Antiphilus to be his slave, a part of the indemnification probably which the painter would not be disposed to put in force. Apelles was however not satisfied with the handsome conduct of Ptolemy, and when he returned to Ephesus he painted an unintelligible allegory of Calumny, in which the Egyptian king acted a very ridiculous part—he was represented sitting upon a throne, with the ears of Midas, or asses' ears, listening to Suspicion and Ignorance; Calumny was approaching him dragging a youth by the hair; she was preceded by Envy and followed by Deceit and Artifice; in the background were Repentance and Truth. The allegory is evidently bad; the subject is inapplicable; besides it presupposes a thorough knowledge of iconology, or allegorical personification, in the spectator. Alessandro Botticelli painted a picture from Lucian's description, but it has the mere effect of a theatrical representation; it is impossible to trace calumny in it: it is in the Imperial Gallery at Florence. The Apelles here mentioned must not be confounded with the celebrated Apelles of Cos: Lucian expressly calls him Apelles of Ephesus; in other passages where he speaks of Apelles of Cos, he says simply Apelles.

(Lucian, *De Calumniâ*; Pliny, *Hist. Nat.* xxxv. 37, 40; Quintilian, *Inst. Orator.* xii. 10, 3.)

ANTIRRHI'NUM, a genus of plants belonging to the natural order Scrophulariaceæ. This genus is the type of a section of the order to which also the genera Linaria, Anarrhinum, Maurandia, Galvesia, Lophospermum, and Rhodochiton belong. It is characterised by a 5-parted oblique calyx; a personate corolla, gibbous at the base, but with no distinct spur; the lobes of the upper lip erect, those of the lower spreading, 3-fid, with the middle segment smallest, and a bearded palate which closes the mouth; the capsule 2-celled, opening by two or three pores at the top; seeds oblong, minute, with black testa. The species are annual or perennial, rarely shrubby. The leaves are feather-veined, and entire, opposite below, and usually alternate above. Two of the species are indigenous to Great Britain. All of them produce showy flowers, and are much cultivated in gardens. Their medicinal properties are not very active.

A. majus, Great or Common Snapdragon, has lanceolate, opposite or alternate glabrous leaves, racemose flowers, ovate obtuse sepals, much shorter than the corolla, and the upper lip bifid. This plant attains a height of one or two feet, and has purplish-red or white flowers. It is found in Great Britain on old walls and chalk cliffs, especially in the neighbourhood of London, but it is undoubtedly a naturalised plant, being truly indigenous in the south of Europe and the north of Africa. In gardens a variety is often seen with double flowers. The leaves are bitter and slightly stimulant. 'Gmelin says that in Persia an excellent oil equal to that of the olive is procured by expression of the seeds of *A. majus*; and Vogel observes that the common people in many countries attribute some supernatural influence to this plant, believing it to have the power of destroying charms, and rendering maledictions of none effect.' (Burnett.)

A. Orontium, Orontium Snapdragon or Calves'-snout, has linear-lanceolate opposite or alternate leaves; the flowers loosely spiked, distant; the sepals linear and longer than the corolla. This plant appears to be truly indigenous in England and Ireland, where it occurs in dry sandy and gravelly soils. It is also a native throughout Europe, in the islands of the Mediterranean, and the north of Africa. It has been found in Virginia, but it has been probably introduced. Its leaves as well as those of other species have been used as cataplasms in indolent tumors.

Don enumerates twelve other species, many of which have been introduced into our gardens. They are pretty border-flowers, and adapted for rock-work. They are easily cultivated, and the perennial species may be increased by cuttings, and the annual raised by seeds. The species from subtropical districts will however require a frame or the greenhouse in the winter.

(Babington, *Manual of British Botany*; Don, *Gardener's Dictionary*.)

ANTONELLO DA MESSI'NA, a celebrated Italian painter, distinguished as the first Italian who painted *in oils*, as it is termed. Neither his name nor any date connected with events of his life are exactly known. He was born at Messina about the year 1414, and was instructed in painting by his father Salvatore d'Antonio; he then studied in Rome, and returned to Messina an accomplished painter for his time, and acquired considerable reputation by some works which he executed at Messina and at Palermo. In about the year 1442 he had occasion to visit Naples, where, in the possession of the king, Alfonso I., he saw a picture executed in a manner and with materials quite new to him: this was a picture of the Annunciation by Giovanni da Bruggia, as Vasari names John Van Eyck. Antonello no sooner saw this picture than he was possessed with an invincible desire to learn by what means it was painted; and having learnt the name and place of residence of the painter, he immediately set out for Flanders, where by means of presents of Italian drawings and other works of the kind he was not long in obtaining Van Eyck's secret. Antonello seems to have remained with Van Eyck until his death in 1445, when Antonello returned to Sicily for a few years; but before 1450 he was in Venice, by which time he had communicated the new method to Domenico Veneziano, who was murdered in Florence in 1464, by Andrea del Castagno, after he had obtained the secret of the new method from him. From Venice Antonello repaired to Milan, where he probably dwelt some years, and about the year 1470 he returned to and established himself at Venice. In Venice he lived upwards of 20 years in the enjoyment of the reputation of one of the most distinguished painters of his age. He died aged 79, probably in 1493, just as he was about to execute some works for the palace of the Signory of Venice. Vasari states that Antonello died aged 49, but from various circumstances this is evidently an error: he probably mistook 79 for 49 in his authority. Domenico was said to have been assassinated when Antonello was 49, which was, as near as can be ascertained, in 1464; if Antonello therefore died aged 79, we have both the dates of his birth and death, 1414 and 1493, and the last date corresponds with the year when the repairs in the palace of the Signory of Venice were completed.

Antonello appears to have made no secret of his new method of painting after his second visit to Venice, for in 1573 Bartolomeo Vivarini painted a picture in the new manner for the church of the SS. Giovanni e Paolo, and Antonello himself marked his pictures *ōō pinxit*. There is at least one so marked in the possession of a gentleman at Utrecht; it represents Christ between the two thieves, and 'Antonellus Messaneus me ōō pinxit, 1475,' is inscribed upon it; it is a small picture painted upon a panel of wild chestnut. The ōō evidently signify oleo, or in oil; a word, however, calculated to mislead, as the method of painting simply *in oil* was very old, and that of Van Eyck was not merely painting in oil; it was, according to Vasari, painting *in varnish*. Vasari says that Van Eyck, by boiling linseed, poppy, and nut oils, with other mixtures, obtained that *varnish* which he in common with every other painter in the world had long desired. From this sentence it is evident that *painting in oil* is strictly a misnomer, and it was adopted only as sufficiently descriptive in contradistinction to the then prevailing method of water-colour or à tempera painting.

Antonello's works were distinguished for tone, for brilliancy of colour, and for the excellence of their impasto, but those which remain are much darkened. In design they are similar to the works of the Bellini. Antonello's life was long, and he was industrious; the extreme scarceness therefore of his works cannot be otherwise accounted for than by supposing them to be attributed to other masters, or vaguely designated as of the school of Van Eyck, a very frequent designation in the continental galleries. There is only one picture by him in Venice—the Virgin reading in the Academy. Boschini (1733) mentions only one—A dead Christ supported by angels, in the chamber of the Council of Ten, which appears to be now in the gallery of Vienna, but how it was removed from Venice is not known; there are three in the gallery of Vienna, and there is or was a head of Christ in Devonshire House, according to Dr. Waagen. At Messina, in 1792, there were still twelve small pictures by Antonello, around an old mosaic of the Madonna, in the monastery of San Gregorio. At Munich, in the gallery of the Duke of Leuchtenberg, there is a portrait by him of Catarina Cornaro, queen of Cyprus.

(Vasari, *Vite de' Pittori*, &c., and Schorn's Notes to his German translation; Puccini, *Memorie Istorico-Critiche di Antonello degli Antoni, Pittore Messinese*, Florence, 1809; De Bast, *Messager des Sciences et des Arts*, Gand, 1824; Boisserée, *Kunstblatt*, 1826; Passavant, *Kunstreise durch England und Belgien*; Lanzi, *Storia Pittorica*, &c., vol. ii.)

APELLEANS, or APELLITES, a sect of heretics so called from their founder Apelles, who lived about the middle of the second century, and had been originally a disciple of Marcion. The belief of the Apelleans appears to have been a variation of that of the Marcionites. They are said to have, as well as the Marcionites, held the Manichæan dogma of the good and evil principles; but what principally marked them was their doctrine upon the subject of the incarnation of Jesus Christ. They said that his body was neither real, as commonly supposed, nor only apparent or shadowy, as Marcion taught; that it was formed not of flesh and blood, but of air, and that, as it had been received in his descent to the earth, so it was cast off and dissolved again into air in his ascent to heaven. Besides thus denying that Christ took his body with him to heaven, they also denied the general doctrine of the resurrection of the body. They are accused moreover of denying the authority of the Old Testament. Apelles and his heresies are mentioned by Augustine, Epiphanius, Tertullian, and Eusebius.

APEREA. [Leporidæ, P. C.]

A'PHYLLUM (*Artis*). [Aspidiaria, P. C. S.]

APIOCRINI'TES (*Miller*), a fossil genus of Crinoidea, found in the oolitic formations and in the chalk.

APLANATIC LENS (from the Greek *a*, *without*, and πλάνη, *deviation* or *aberration*) is one which should be capable of so refracting all the rays which, diverging from or converging to any one point in the axis, are incident upon it, that after being transmitted through it they may converge to or diverge from one other point in the same axis.

The spherical forms which are given to the surfaces of lenses, and the dispersions of the different coloured rays in each pencil of common light, are the causes that the rays of any one colour when incident on a lens in the circumferences of circles at different distances from the axis, and likewise the rays of different colours in any one pencil however slender, do not converge in one point; and the diffusion of the various points of convergence about the geometrical focus of the lens is the aberration which it is proposed to correct as far as possible by giving appropriate forms to the surfaces, or by combining together two or more lenses.

Writers on optics show that a curve-line by whose revolution about an axis there shall be described a surface which, being that of a refracting medium, will cause all rays incident upon it, when they diverge from or converge to one point, to be refracted so as to converge to or diverge from one point is, in its most general form, of the fourth order: but when the radiant point is at an infinite distance from the refracting surface, as when it is at a celestial body, the form of the surface, supposing the density of the refracting medium to be greater than that of the medium which surrounds it and in which are the incident rays, is proved to be that of a spheroid; and rays falling on its convexity, parallel to the major axis of the spheroid, would, within the medium, converge accurately to the focus most remote from the place of incidence. If the refracting medium were less dense than that in which are the incident rays, the surface would be that of an hyperboloid. The semi-transverse axis both of the spheroid and hyperboloid must be, to the excentricity, as the sine of the angle of incidence is to the sine of the angle of refraction: in the former case the refraction is from the surrounding medium into the spheroid; and in the latter, from the concave surface of the hyperboloid into the surrounding medium. It follows therefore that if a meniscus lens denser than the surrounding medium have its anterior surface spheroidal, and its posterior surface that of a sphere whose centre is at the further focus of the spheroid; since the rays will then suffer no refraction in passing through the posterior surface, it will be aplanatic. Also if the anterior surface of a medium be plane, so that the parallel rays incident perpendicularly on it may suffer no refraction in entering, and the other surface be part of an hyperboloid, the medium between the surfaces being denser than that which surrounds it, the plane lens thus formed will be aplanatic; the refracted rays converging to the opposite focus of the hyperbola.

The form of the expression for aberration, when parallel rays are incident on a lens having spherical surfaces, is such that the aberration cannot be made to vanish with any real values of the radii of those surfaces unless the index of refraction in the medium were equal to or less than 0·25. But there is in nature no medium which has such a refractive index; therefore, failing in making spherical lenses strictly aplanatic, and it having been found impossible, hitherto, to form them with surfaces produced by the revolutions of conic sections, mathematicians have investigated expressions for the form under which, with a given refractive index, the aberration of the focus shall be a minimum; see the article 'Light' in the Encyclopædia Metropolitana (art. 305), where the ratio between the radii of the surfaces, in this state, is given. From that ratio it is shown that, when the index of refraction is 1·5, the lens should be of the double convex form, having the radius of the posterior surface six times as long as that of the anterior surface, or that which is nearest to the radiant point.

For an investigation of the radii of the surfaces of lenses when two of them are combined together for the purpose of diminishing at the same time, as much as possible, both the chromatic and spherical aberrations, see Telescope, P. C.; and, in the treatise on light above quoted (arts. 313, 469) Sir John Herschel has given four equations involving the refractive indices, and the dispersive powers, of the two lenses with their principal focal distances, from which the four radii may be obtained consistently with the condition that the aberration shall be zero. From the equations, and with different refractive indices, there is computed a table of the radii of the lenses for the compound object-glass of a telescope as nearly aplanatic as possible, the compound focal length being 10 inches; and, by the proportions indicated, the radii for object-glasses of any other compound focal length may be found. (On the subject of aplanatic lenses for microscopes, see MICROSCOPE, P. C.)

APOSTASIAS. [METAMORPHOSIS, VEGETABLE, P. C. S.]

APOTHECARIES, COMPANY OF. The alteration which is likely to take place in the constitution of the bodies intrusted with the superintendence of medical education in this country renders it desirable to postpone the notice of one of them, the Apothecaries' Company. Under another head [SURGEONS, COLLEGE OF, P. C. S.] it is hoped that a complete view may be given of the changes alluded to, as they will most probably have been decided upon by the time that part of the work is reached.

APOTHE'CIA (from the Greek ἀποθήκη, a case, a repository), in Botany, a name given to some of the organs of reproduction in Cryptogamia. In lichens the reproductive matter appears on the surface of its frond or thallus in two forms. First, in the form of little coloured cups or lines with a hard disk surrounded by a rim, and containing tubes filled with sporules; and secondly, in the form of little heaps of pulverulent matter, which are scattered over the surface of the thallus. These last are called *soredia*; the first, *apothecia*. These organs form the principal means of distinguishing the various forms of lichens, and consequently it has been found convenient to indicate minor points in their structure by other names. Thus the apothecium, which in English is called a *shield*, has various names according to its form: *Scutellum* is a shield with an elevated rim; *Pelta*, a flat shield; *Tuberculum*, a convex shield; *Trica* or *Gyroma*, a furrowed shield; *Lirella*, a linear shield; *Globulus*, a round deciduous shield; *Pilidium*, an orbicular, hemispherical shield. The parts of the apothecium or shield have also obtained distinct names: thus *perithecium* is the inside of the shield, in which the sporules are immersed; *hypothecium* is the substance that surrounds or overlies the perithecium; *nucleus* is the disk of the shield, which contains the sporules and their cases; and *asci* are the tubes in which the sporules are contained.

Apothecia is also the name given to the cases in which the organs of reproduction of many of the Algæ are contained. The reproductive granules contained in the apothecia of both Lichens and Algæ are called by some writers *gongyli*.

APPA'RITOR, an officer employed as messenger and in other duties in ecclesiastical courts. Apparitors, says Burn, are 'so called from that principal branch in their office, which consisteth in summoning persons to appear.' The canons direct that letters citatory are not to be sent by those who have obtained them, nor by their messenger, but the judge shall send them by his own faithful messenger. It is the duty of the apparitor to call defendants into court, and to execute such commands as the judge may give him, and this duty is not to be performed by deputy. In 21 Hen. VIII. c. 5, as well as in the canons, apparitors are also called summoners, or summers. The above act restrains the number of apparitors kept by bishops, archdeacons, or their vicars or officials, or other inferior ordinaries.

The apparitors of the ecclesiastical courts are paid by fees, which in most cases amount to a very small sum annually. The emoluments of the apparitor of the Prerogative Court of Canterbury are however considerable, and in 1843 amounted to 320*l*.

Apparitor is a Roman word, and was used as a general term to signify any person who was in attendance on public functionaries (*iis apparebant*, whence the name) to execute their orders. The term accordingly includes a great variety of officers in the Roman system. Under the later Empire various magistrates and functionaries had their apparitores, whose duties and privileges are enumerated in the Justinian Code, 12, tit. 52, &c.

APPEARANCE. [PLEADING, P. C.]

APPEAL TO THE SESSIONS. [SESSIONS, P. C.]

APPENDI'NI, FRANCESCO MARIA, born near Turin in 1768, studied at Rome, where he entered the order of the Scolopj, and was after a time sent to fill the chair of rhetoric in the college of his order at Ragusa, a town which then maintained a close connexion with Italy. He became a great proficient in the Slavonian language, and he published a grammar of the Illyric language, that is to say, of the Dalmatian dialect of the Slavonian, and several treatises on the same subject. But his principal work concerns the history of his adopted country Ragusa, and it gives a very interesting account of that now almost forgotten little state, which governed itself for centuries as a republic, and cultivated the arts and retained the manners of civilized Europe on a narrow nook of land on a barbarous coast, surrounded and yet respected by the Ottoman power: 'Notizie istorico-critiche sulle Antichità, Storia, e Letteratura dei Ragusei,' 2 vols. 4to. 1802-3. In the second volume the author gives notices of those natives of Ragusa who have written works in Italian, Latin, or Slavonian.

When Napoleon took military possession of Ragusa, and subverted that antient republic, as he had subverted the republics of Venice, Genoa, and Lucca in Italy, Appendini was retained as rector of the college of Ragusa. After the Austrians had superseded the French in 1814, Appendini was commissioned by the imperial government to establish a school for teachers at Zara, with the view of providing masters for the various schools of Dalmatia. Consequently he removed from Ragusa to Zara, where, after remaining several years, he died in 1837, and was buried with great honour. He was much regretted both at Zara and Ragusa as a very useful and enlightened educator of youth, in a country which stood particularly in need of such.

(Tipaldo, *Biografia degli Italiani Illustri del Secolo XVIII. e dei Contemporanei.*)

APPIA'NI, ANDRE'A, probably the best fresco painter of the eighteenth century, was born at Milan in 1754. After visiting and studying in the principal cities of Italy, he chose Correggio for his model. From 1795 until 1813, he worked with great applause at Milan: but in the latter year he was compelled to desist from his labours by a stroke of apoplexy; a second attack of which, in 1817 or 1818, caused his death.

Appiani was Napoleon's principal painter in Italy, for which office he received an annual pension of 6000 francs. He was a knight of the Iron Crown, and a member of the Legion of Honour. He however died in poverty, having lost his pension in consequence of the Restoration in 1814.

His principal frescoes are in the church of Santa Maria Vergine, and in the royal palace of Milan; the latter have been engraved by Rosaspina. He was also an excellent painter in oils: there is a portrait of Napoleon by him, which has been engraved by Bartolozzi.

FRANCESCO APPIANI, another distinguished fresco painter of the eighteenth century, was born at Ancona in 1702. He was employed by Benedict XIII. at Rome, but he lived chiefly at Perugia, where he continued to paint until his ninetieth year and his death in 1792; a degree of vigour, except in the cases of Spinello Aretino and Titian, perhaps without a parallel. He painted, according to Lanzi, many pictures for England.

(Lamberti, *Descrizione dei Dipinti a buon Fresco eseguiti dal S. A. Appiani*, Milan, 1809; Lanzi, *Storia Pittorica*, &c.)

APPIA'NO, D', an Italian family of the middle ages, which rose to the rank of sovereign princes. Jacopo d'Appiano was, in the latter part of the fourteenth century, the confidential secretary and friend of Pietro Gambacorta, the then chief magistrate of Pisa, who appointed him chancellor of that republic. He conspired however against his benefactor, and had him killed, together with his sons, A.D. 1392. D'Appiano then assumed the title of Lord of Pisa, being supported in his usurpation by Gian Galeazzo Visconti, Duke of Milan, who needed the assistance of Pisa against the Florentines. Jacopo d'Appiano died in 1398, and was succeeded by his son Gherardo, who, mistrusting his own capabilities to retain possession of the power usurped by his father, sold Pisa to the Duke Visconti for 200,000 florins, reserving for himself the sovereignty of Piombino on the sea-coast, and of the island of Elba opposite. He assumed the title of Prince of Piombino, which his descendants retained for two centuries after. When Cosmo I. became grand-duke of Tuscany, he coveted the possession of Piombino, but Jacopo V. d'Appiano, the then prince of that state, in order to escape from annoyance, placed himself under the protection of Charles V. as a feudatory of the empire. His son Jacopo VI. died in 1585, leaving no legitimate offspring; but his natural son Alessandro d'Appiano, who had been legitimated by the emperor, succeeded to the principality on his admitting a Spanish garrison within the town of Piombino. Spain was then the paramount power in Italy. Alessandro was murdered in 1589, with the connivance of his wife Isabella de Mendoça, and of her paramour the Spanish commandant of the garrison. The state of Piombino remained for some time after in the occupation of the Spaniards. In 1619 the Aulic Council adjudged it to the house of Mendoça as being the next heirs, from whom the Italian house of Ludovisi purchased the fief, which afterwards passed by inheritance into the house of Buoncompagni of Rome, who kept it till the French revolutionary invasion. Bonaparte, on his assuming the imperial crown, bestowed the principality of Piombino on his brother-in-law Felix Bacciocchi.

(Tronci, *Memorie Istoriche di Pisa;* Botta, *Storia d' Italia.*)

APPOINTMENT. [Trust and Trustee, P. C.]

APPORTIONMENT. Apportionment of rent, &c. is a term of law signifying the dividing of a rent, annuity, or other payment recurring at fixed periods, and may be either among several persons entitled to the rent, or between the person entitled to the rent and the person or persons liable to the payment of it.

A rent issuing out of land may be apportioned in two ways; one by granting the reversion of part of the land out of which the rent issues, the other by granting part of the rent to one person and part to another. When rent is reserved upon a lease, and the lessor disposes of part of the lands in reversion, either by will or deed, the rent is apportionable, provided the lessee concur. But the lessee is not bound by any apportionment made without his consent. If the lessor or a stranger recovers any part of the land, or the lessor enters for a forfeiture upon part thereof, or the lessee surrenders a part to the lessor, the rent will be apportioned in respect to the part so recovered or surrendered and the part remaining in the hands of the lessee.

When a lessee aliens a part of the land comprised in his lease, the alienee is liable in an action of covenant for a proportional part of the rent reserved on the lease, the covenant for payment of rent being one which runs with the land; and therefore as respects him there is an apportionment of the rent. The alienation of a part of the lands does not however, any more than an assignment of the whole, discharge the original lessee from his liability upon his express personal covenant for payment of the whole rent. The right of distress for the whole rent upon every part of the land of course remains unaffected by the assignment, unless, as is sometimes done in the case of building leases, the original grantor agrees to restrict his right of distress on the lands aliened to a proportionate part of the rent.

If a man having a rent-charge issuing out of lands, purchases any part of them, the rent-charge is extinct as to the whole; but if part of the land out of which the rent issues descends upon the owner of the rent-charge, the rent will be apportioned. And this will also be the case upon a partition of the lands out of which the rent issues. If a grantee of a rent-charge release all his right in part of the land charged, he extinguishes the whole rent; but if a grantee of a rent-charge release part of the rent to the grantor, the residue will remain charged on the land, for here the grantee deals with the rent only, not with the land. On the principles here stated a difficulty arises on the sale of part of lands subject to a rent-charge. Where the party entitled to the rent is willing to release the land to be sold, the mode sometimes adopted is for the owner of the rent-charge to assign it to a trustee upon trust, to receive it exclusively out of the lands intended to remain charged. Another mode is for the annuitant to join in the conveyance of the lands sold and to add a proviso that the other lands shall continue liable. This plan however is open to the objection that as the proviso operates as a new grant, the rent-charge becomes liable to the incumbrances of the owner of the land created before the conveyance. A third mode, sometimes adopted, is that of the owner of the rent-charge covenanting not to distrain on the lands sold, but it seems doubtful whether such a covenant does not operate as a release of the rent-charge. If the owner of the rent-charge will not concur, the only plan seems to be for the vendor to covenant with the purchaser that the lands not sold shall be exclusively liable, and give an indemnity by demise or otherwise against the rent-charge. It seems that the technical rule of law which is productive of so much inconvenience ought to be altered.

By the common law, if a lessor tenant for life died within the half-year at the end of which rent was due upon a lease not made in execution of a power, and which therefore determined on the death of the tenant for life, the half year's rent could not be apportioned, and was therefore lost both to the representatives of the lessor and to the remainder-man or reversioner, upon whom the lease was not binding.

To remedy this evil it was provided by the stat. 11 Geo. II. c. 19, § 15, that where a lessor tenant for life died before the rent-day, his executors might recover from the tenant a proportionate part of the rent then growing due, making all just allowances. But as this statute was construed to apply only to persons strictly tenants for life, and had no application to the case of a lease made by a tenant in fee or by a tenant in tail under a power, if in either of these cases the lessor died in the interval between two periods of the rent being due, the whole rent went, according to the rule of the common law, to the heir or remainder-man, and there could be no apportionment in favour of the executor. The law has now been altered by the stat. 4 & 5 Wm. IV. c. 22, the object of which is to apply the principle of equitable apportionment to all property which consists in periodical and fixed money payments.

By the first section it is declared that rents reserved on leases determining on the death of the person making them (though not strictly tenant for life), or on the death of the tenant *pur autre vie*, shall be considered as within the provisions of the above-mentioned stat. 11 Geo. II. c. 19, § 15.

By the 2nd section it is enacted that from the passing of the act all rents service reserved on any lease by a tenant in fee, or for any life interest, or by any lease granted under any power (and which leases shall have been granted after the passing of the act), and all rents-charge and other rents, annuities, pensions, dividends, moduses, compositions, and all other payments of every description in the United Kingdom of Great Britain and Ireland made payable or coming due at fixed periods under any instrument that shall be executed after the passing of the act (or being a will or testamentary instrument) that shall come into operation after the passing of the act, shall be apportioned so and in such manner that on the death of any person interested in any such rents, annuities, pensions, dividends, moduses, compositions, or other payments, as aforesaid, or in the estate, fund, office, or benefice from or in respect of which the same shall be issuing or derived, or on the determination by any other means whatsoever of the interest of any such person, he or she, and his or her executors, administrators, or assigns, shall be entitled to a proportion of such rents, annuities, pensions, dividends, moduses, compositions, and other payments, according to the time which shall have elapsed from the commencement or last period of payment thereof respectively (as the case may be), including the day of the death of such person or of the determination of his or her interest, all just allowances and deductions in respect of charges on such rents, annuities, pensions, dividends, moduses, compositions and other payments being made; and that every such person, his or her executors, administrators, or assigns, should have such and the same remedies at law and in equity for recovering such apportioned parts of the said rents, annuities, pensions, dividends, moduses, compositions, and other payments, when the entire portions of which such apportioned parts shall form part shall become due and payable, and not before, as he, she, or they would have had for recovering and obtaining such entire rents, annuities, pensions, dividends, moduses, compositions, and other payments if entitled thereto, but so that persons liable to pay rents reserved by any lease or demise, and the lands, tenements, and hereditaments comprised therein shall not be resorted to for such apportioned parts specifically as aforesaid, but the entire rents of which such portions shall form a part shall be received and recovered by the person or persons who, if the act had not passed, would have been entitled to such entire rents; and such portions shall be recoverable from such person or persons by the parties entitled to the same under the act in any action or suit at law or in equity. It seems doubtful whether the above enactment will apply to the case of an annuity payable at certain periods and determinable at the death of the grantor, because if the annuity cease by the death of the grantor on any day before that of payment, the 'entire portion' can never become payable. It is advisable therefore to retain the usual apportionment clause in the grants of such annuities.

The 3rd and last section provides that the act is not to apply to cases in which it shall be expressly stipulated that no apportionment shall take place, nor to annual sums made payable on policies of assurance of any description.

Rights of common are apportionable in certain cases. Common of pasture where it is appendant may be apportioned either where the commoner purchases a part of the land in which he has the right of common, or upon an alienation of part of the land to which the right is appendant. In the case of common of pasture appurtenant, there will be apportionment in the second case, but not in the first. Common of estovers or piscary cannot be apportioned, neither can the rights of horsebote, haybote, &c. be appendant to the freehold.

Conditions in general cannot be apportioned by the act of the parties, though they may where a division of the estate is caused by the act of law or by the act and wrong of a lessee upon condition.

(Upon the subject of Apportionment see Cruise, *Dig.* vol. ii. 36, vol. iii. 72, 302 *et seq.*)

APPROPRIATION. [Advowson, P. C.; Benefice, P. C.]

APPROPRIATION. [Payment, P. C. S.]

APSENDE'SIA (Lamx.), a genus of Polypiaria, from the great oolite near Bath.

A'PTYCHUS (Von Meyer), one of the generic names of a singular fossil, supposed to be the remains of a conchiferous mollusk, or the opercular shell of a cephalopod. Its other names are Trigonellites, Ichthyosiagonites, and Lepadites. The species belong to the ammonitiferous strata, and specimens sometimes occur (as at Solenhofen) in the last chamber of the Ammonites. The structure is fibrous.

AQUIFOLIA'CEÆ (from 'aqua,' water, and 'folium,' leaf), a natural order of plants belonging to Lindley's polycarpous group of polypetalous Exogens. The species consist of trees or shrubs, with alternate or opposite coriaceous leaves. The flowers are small, axillary, solitary, or fascicled. The sepals 4-6, imbricated in æstivation; the corolla 4- or 5-parted, hypogynous, imbricated in æstivation; the stamens inserted into the corolla alternate with its segments, filaments erect, anthers adnate; no disk: the ovary fleshy, superior, somewhat truncate, with from 2 to 6 cells; ovules solitary, pendulous from a cup-shaped funiculus; stigma subsessile, lobed; the fruit fleshy, indehiscent, with from 2 to 6 stones; the seed suspended, nearly sessile, with large fleshy albumen, and a small 2-lobed embryo lying next the hilum, with minute cotyledons and superior radicle. (Lindley.)

This order, which is named after the Ilex aquifolium, the common holly [Ilex, P. C.], was included by Jussieu in Rhamnaceæ. It has however been well characterized by Brongniart, in his memoir upon Rhamneous plants, under the name Ilicineæ. Lindley, in his 'Natural System,' includes the following genera in this order:—

Cassine.
Hartogia.
Curtisia.
Skimmia.
? Monetia.
Myginda.
Ilex.
Botryceras.
Nemopanthes.
? Desfontainia.
Prinos.
Winterlia.
Macoucoua.
Lepta.

This order differs from Celastraceæ, in which it is often included as a section, in the form of its calyx and corolla, in the insertion of the stamens, and in the structure of the ovary and fruit. It agrees closely with Ebenaceæ, from which, according to Brongniart, it only differs in possessing hermaphrodite flowers and stamens equal in number to the segments of the corolla.

This order has but one representative in Europe, the common holly (Ilex aquifolium). The great bulk of the species are found in North and South America; some are found at the Cape of Good Hope.

The useful plants of this order are found in the genera Ilex, Myginda, and Prinos. Ilex is remarkable for yielding in one of its species, I. Paraguensis, the alkaloid *theine*, the same principle that is found in the Thea Chinensis. [Tea, Paraguay, P. C.; Ilex, P. C.]

Myginda has a small 4-cleft calyx, a deeply 4-cleft corolla, four stamens inserted in the base of the corolla, a short style crowned by four stigmas, and a 1-celled 1-seeded drupe. This genus was named after Francis von Mygind, a German botanist.

M. uragoga has ovate or cordate leaves, subsessile, acuminate, serrated, pubescent; the corymbs twice trifid. It is a native of South America, near Carthagena. It has small, dark, shining, red flowers, and bears a red soft fruit about the size of a pea. It is called by the Spaniards *Yerva de Maravedi*, and a decoction of the root is used as a diuretic. *M. Gongonha*, a native of Brazil, in the provinces of St. Paul and Minas Geraes, has also the reputation of being a powerful diuretic, and its roots are used in infusion or decoction by the natives.

Prinos.—Calyx 6-toothed; corolla 6-cleft; stamens 6, inserted in the tube of the corolla; the drupe containing six 1-seeded nuts. The species resemble those of the holly; hence its name from the Greek for the holly, πρῖνος.

P. verticillatus, whorled Winterberry, has oval leaves, acuminate, serrate, deciduous, pubescent beneath; the fascicles of male flowers axillary, umbelliform; the female ones aggregate. It is a native of North America, from Canada to Virginia, in sandy wet woods, and on the borders of swamps. The flowers are white, and the berries are of a crimson red. The bark is bitter, and has been substituted for Cinchona bark in the treatment of fever. It is said to act as an antiseptic, and is used in America as an application to gangrenous sores, and also in infusion or decoction, as a lotion in cutaneous disorders.

P. glaber, has evergreen, cuneate-lanceolate, smooth, shining leaves, a little toothed at the apex, and axillary 3-flowered pedicels. This is a low handsome shrub, with white flowers and a black fruit; hence it is called, in Jersey, ink-berries. It is a native of North America, from Canada to Florida. Its leaves are said to be a good substitute for those of the Paraguay tea-plant, and are used for making tea.

There are several other species of Prinos, some of which are hardy, and well adapted for shrubberies. They will thrive in most light soils, but do best in peat. They may be propagated by laying down the shoots or by seeds. The stove species should be grown in a mixture of loam and peat, and cuttings will root freely in sand, under a hand-glass. Most of the species of Aquifoliaceous plants may be cultivated in the same manner.

(Don, *Gardener's Dictionary*; Burnett, *Outlines of Botany*; Lindley, *Natural System.*)

A'QUILA, JULIUS, a Roman jurist, whose period is uncertain. He is one of the jurists who were used for the compilation of the Digest [Justinian's Legislation, P. C.]; but the Digest contains only two excerpts from him, both of which belong to his 'Book of Answers'—'Liber Responsorum' (*Dig.* 26, tit. 7, s. 34; tit. 10, s. 12). He is called Gallus Aquila in the Florentine Index.

AQUILARIA'CEÆ, a small natural order of plants belonging to Lindley's tubiferous groups of incomplete Exogens. The species are trees with smooth branches and a tough bark. The leaves are alternate, entire, seated on short stalks without stipules, and when full-grown are smooth and shiny, with very fine veins running together into a marginal vein just within the margin. The calyx is turbinate or tubular, limb 5-cleft, segments spreading, persistent, with an imbricated æstivation, the orifice furnished with 5- or 10-bearded scales (metamorphosed stamens). The stamens are 5 or 10 in number; when 5, they are opposite the segments of the calyx; the filaments are short or absent, smooth, inserted into the orifice of the calyx a little lower down than the scales, except in cases where they are united to the tube of the calyx; the anthers are narrow, oblong, attached by their back below the middle, 2-celled, opening internally and lengthwise; the ovary is superior, sessile, or stipitate, downy, compressed, 1-celled, having internally, upon each flattened side, a linear prominent placenta resembling a dissepiment, hence spuriously 2-celled, with a very narrow partition; ovules two, of which one is suspended from each placenta, tapering downwards; the style is either absent or conical and thread-shaped; the stigma is simple and large; the fruit is a capsule, pear-shaped, compressed, sessile, or stipitate, 1-celled, 2-valved, the valves bearing in the middle the placentæ, which almost touch each other. One seed is mostly borne on each placenta (one is sometimes abortive); the seed rises up by aid of a funiculus, originating near the apex of the placenta, and is furnished with a tail-like aril, which descends straight from the hilum to the bottom of the capsule; the radicle is straight and superior, the albumen is absent, and the cotyledons thick, fleshy, and hemispherical.

This order, which consists at present of only three genera, was constituted by Robert Brown, who regarded it as having so close an affinity with Chailletaceæ as to see no objection to making it a section of that order. He also pointed out its relation to Thymelaceæ, in which he is followed by Lindley, who says, 'Aquilariaceæ chiefly differ from Thymelaceæ in their dehiscent fruit, and probably also in the direction of their radicle. In both orders the ovary is superior and 1-celled; both have similar scale-like bodies at the orifice of the calyx, and no petals; both suspended ovules, a single style, and capitate stigma.' De Candolle places the order between Chailletaceæ and Terebintaceæ.

All the species of Aquilariaceæ are natives of the East Indies.

The three genera of this order are thus defined:—

1. *Aquilaria.* Perigone 5-cleft, urceolus 10-lobed, stamens 10, anthers versatile, style none, seeds covered by a spongy substance.

2. *Ophiospermum*. Perigone 6-parted, urceolus 10-lobed, stamens 10, anthers adnate, seed furnished with a wing.

3. *Gyrinops*. Perigone tubular, toothless; seed furnished with a spongy, awl-shaped, triquetrous tail.

Of the last two genera little is known. One species of each has been described. There are three species of Aquilaria.

A. Malaccensis, the *Bois d'Aigle*, or Eagle-wood, has ovate, abruptly acuminated leaves. It is a native of Malacca, and produces a whitish yellow wood. This is the A. ovata of some botanists. *A. Agallochum* is a native of the East Indies, where it is called *Ugoor*, or *Ugooroo*, by the natives, and *Lignum-aloes*, or Aloe-wood, by the Europeans. The wood has a fine scent, and is supposed to be the *Calambac*, or *Agallochum*, of the antients.

A. secundaria is another species which also yields a scented wood, and has been known in the Materia Medica, and used in perfumery, under the names of Agallochum, Lignum-aloes, and Aloe-wood. In a healthy state this wood is said to be white and inodorous; but it is subject to the attacks of disease, which causes the secretion of a resinous matter, and the wood then becomes coloured, and gives out a powerful scent. This secretion resembles camphor in many of its properties, and has a bitter flavour: hence the name of the tree. In medicine it is recommended in the same diseases as the fetid resins and volatile oils, and does not seem to possess peculiar properties; so that it is not used as a medicine in Europe. The Cochin-Chinese are said to make their paper from the bark of this or some kindred species of Aquilaria. These trees must not be confounded with the *Aloexylon Agallochum*, or aloes-wood, which is a tree belonging to the natural order Leguminosæ, and which also yields a scented wood used by the Chinese in medicine and perfumery.

(Don, *Gardener's Dictionary*; Lindley, *Natural System*; Royle, *Illustrations*.)

ARA'BIA. The war of Mehmed 'Ali, pasha of Egypt, against the Wahhábís, the occupation of Aden by the British, and their friendly connexions with the Imám of Muscat, have greatly contributed to increase our knowledge of Arabia. In consequence of those events the attention of Europe has been directed more eagerly towards that country, and as the Red Sea now once more offers a passage from Europe to India, we may hope that one of the most interesting portions of the globe will soon become better known. The natives of Arabia have always shown hostile feelings towards Europeans. These feelings may have increased among a few tribes, but generally speaking they have diminished. The intercourse of the British with the Arabs will probably prepare the way for Arabic translations or abridgements of European works on scientific subjects, especially natural philosophy, chemistry, medicine, mathematics, navigation, and generally subjects of practical importance, and thus the Arabs may learn to know Europeans, and we may become better acquainted with them. The coasts of Arabia are now accurately known, except some parts of the south-eastern shore, on the Indian Sea, but even on these we know the position of the principal ports. The splendid chart of the Red Sea by Commander R. Moresby and Lieutenant Carless, in two immense sheets; the chart of the south-east coast of Arabia by Commander Haines, assisted by Lieutenants Wellsted, Sanders, Jardine, Shepherd, &c., and the chart of the Gulf of Persia by Commander Barnes Brucks, in two great sheets, ought to be studied by all those who wish to make themselves acquainted with the approaches to the most important country that lies between Europe and India. A person will be greatly assisted if he studies those charts with the aid of Horsburgh's 'India Directory,' London, 1836, 4to. The best map of Arabia is that of Berghaus, Gotha, 1835. In some places this map is too crowded, so that in spite of the minuteness of the engraving the eye is unable to detect the features of the country. This defect is less owing to the number of places and names than to the amount of hydrographical and orographical delineation, and we find the same defects in other maps of that distinguished geographer, as for instance in his map of China. From the extreme nicety with which the details are executed, an inexperienced person might be induced to believe that what he sees is as accurate as it is neat, but this is not generally the case. In making maps minuteness of execution should always represent minute accuracy of knowledge.

If the map of Arabia is half turned so that the western side shall be nearest to the spectator, the eye will traverse the country from west to east, in the direction of the parallels, and not from south to north, in the direction of the meridians, in which line the general construction of the maps leads us to examine them. On viewing Arabia from the Red Sea we perceive an immense range of mountains stretching from north-west to south-east, nearly parallel to the coast of the Red Sea, and generally not far from it. In 21° 20′ N. lat., 41° 16′ E. long., north of the town of Táyef, and at almost equal distances from Mount Sinai and the Straits of Báb-el-Mandeb, a chain detaches itself from that range, and runs north-east towards the Persian Gulf, and it becomes gradually lower. This is the Jebel-'A'red or Jebel-'Imaríyeh: it runs at right angles to the great range along the shore, and is the latitudinal axis of the peninsula, which it divides into two great portions, the one north-west of it, the other south-east. The northern portion is divided into two by the Jebel-Shammár, commonly called El-Jebel, or The Mountain, a chain stretching from east to west between 28° and 29° N. lat., and probably connected with Mount Sinai by intermediate chains, such as the Jebel-Ajám and the Jebel-Salámí, the position of which however we do not precisely know. Jebel-Shammár is said to be as high as Mount Lebanon. The portion north of Jebel-Shammár comprehends antient Arabia Petraea in the west, and the greater part of antient Arabia Deserta in the east; the most elevated parts are the tracts north of Mount Sinai, and east of the chains of Palestine and Syria, whence the ground slopes towards the northern corner of the Persian Gulf. The tract north of Jebel-Shammár is a sandy desert, intersected by some fertile wádís, or valleys, with running water, or only a few wells and moist spots where water may be obtained by digging, and where a few palm-trees protect the traveller against the scorching sun. Lying between Palestine and Syria in the west, the Euphrates in the east, and the more fertile districts of Arabia in the south, it is traversed by several high roads. Through the north-eastern part leads the road from Haleb to the Euphrates and thence to Baghdád, by Taíbeh and the Wádí-Suáb; and from west to east it is traversed by the road from Damascus to Baghdád through the oasis of Palmyra and the Wádí-Haurán, a valley watered in winter by a considerable river which flows in the direction of the Euphrates. The tract which is traversed by these roads is generally considered to belong to Syria, although it has the Arabian character, and is inhabited by genuine Arab tribes. The road from Baghdád to Aneízeh, and thence to Mecca and other parts of central Arabia, crosses the highest portion of Jebel-Shammár. The road from Damascus to Jebel-Shammár, and thence to the interior of Arabia, goes in a south-east direction, following the sinuosities of the Wádí-Aráb-es-Sirhán for above 150 miles, and traversing the fertile plain of Jóf and the desert plain of Ed-Dhahí or Taús before it reaches El-Shammár. Two western roads lead from Damascus and Jerusalem to the Gulf of Akabá and to Medina. In the direction from the Dead Sea to Jóf is a continuation of wádís, but we have no information as to their fertility: they seem to be connected with the Wádí-Aráb-es-Sirhán by transverse valleys. The country thus described is called by the native tribes Badíah, 'the wilderness,' or Barr-el-Aráb, 'the desert of the Arabs:' it is not very elevated, mostly level, traversed by chains, and intersected by valleys, of which we have only vague notices. This observation however does not apply to the group of Mount Sinai.

The portion south of Jebel-Shammár extends east as far as the Persian Gulf, and is bordered in the south-east by the Jebel-'A'red, and on the west by the great range mentioned above, so that the tract between this range and the coast does not belong to it. The country is a high table-land inclining towards the north-east, or the corner of the Persian Gulf. In 25° N. lat., 46° E. long., a chain of mountains, the Jebel-Túeík, detaches itself from the Jebel-'A'red, stretching north-west in the direction of the Jebel-Shammár. The tract west of the Jebel-Túeík, an irregular square, is much more elevated than the portion east of it, which loses the character of a table-land in proportion as the traveller approaches the Persian Gulf, in the immediate neighbourhood of which the country is low and sandy.

The immense inland tract south of the Jebel-'A'red is, generally speaking, unknown. It is probably a table-land as high as the tract north of that chain, and its inclination is likewise towards the Persian Gulf, the direction of the slope being north-east. In its southern portion a lofty chain, connected with the range along the Red Sea by a high tract and some ridges of hills, stretches parallel to the coast of the Indian sea in a north-east direction, separating the elevated lands in the interior from the coast country. This chain also is at right angles to the range along the Red Sea, and is consequently parallel to the Jebel-'A'red. From its most eastern part a chain branches north-west, at right angles, and its direction is parallel to that of Jebel 'Túeik mentioned above. This branch chain crosses the peninsular country of 'Omán.

The divisions made by the Arabs correspond to the geographical character of the country. The greater and most elevated part of the interior is called Nejd, or 'high-land,' and extends north as far as 29° N. lat. Its southern limits are unknown, but it apparently extends as far as a line drawn from the point where the 25th parallel cuts the Arabian coast on the Persian Gulf, to the point where the 20th parallel cuts the coast on the Red Sea. The inland tract south of this line is generally called El-Ahkaf, or the 'country of the sand-hills.' The narrow tract between Nejd and El-Ahkaf on one side, and the Red Sea on the other side, is called Hejás in the north and Yemen in the south. The countries designated by these names comprehend also the eastern slopes of the great range to a considerable distance in the interior. The same is the case with Hadhramaút, Mahrá, or Shéher, and 'Omán, the three provinces which border on the Indian Ocean; and the province of El-Hassá extends likewise over the low tracts along the Persian Gulf and the adjoining highlands in the west.

The northern commencement of the great western range is the lofty peak of Mount Sinai. A deep inlet, the gulf of A'kabá, separates it from a high chain stretching along the eastern shore of the gulf, and thence south-east along the Red Sea as far as Yámbó. The bold and craggy summits generally press close upon the shore. It has no general name. Along the gulf are the Jebel-Asháb and the Jebel-Tibús, the latter 6000 feet high: south of them are the Jebel-Aínúnah, Jebel-Antár, and lastly Jebel-Radúá, between the southern part of which and of the coast is a low and sandy tract; but its northern and western parts tower above the shore, and are known by the names of Jebel-Nábt, Jebel-Lambam, and Jebel-Hasání. Jebel-Sh'ar, at the foot of which lies the sea town of Móílah, is between 6000 and 8000 feet high, and, with two other peaks in the neighbourhood, is visible from 60 to 80 miles. Móílah lies in 27° 40′ N. lat. Six miles north-west of it is Rás-Selah, a high promontory, which on Lord Valentia's Chart of the Red Sea is nearly 40′ south of Móílah; and this error has been copied by many mapmakers. The prevalent rock of the whole chain is porphyry, rising with craggy serrated summits above a base of sandstone. Yámbó, the port of Medina, lies on the northern side of a bay forming a spacious, deep, and safe harbour. It is the Iambia of the antients, and known in the history of geography ever since Ptolemy availed himself of its situation opposite to Berenice in Egypt, for fixing it as a base for his measurements in Arabia. He placed Berenice in 23° 50′ N. lat., which is correct within a few minutes, which error however affected the position of Iambia, which he fixed in 24° N. lat. But here also his error is less than 10′, but perhaps as much as 6′, the mean latitude of Yámbó being 24° 6′. The direction of the great range from Jebel-Radúá, as far as the promontory Rás-el-hat-bah, in 22° 3′ N. lat., continues parallel to the coast, but is at some distance from it. The tract between it and the sea is however mountainous, being traversed by portions of the great range, and terminating abruptly towards the coast, from which it is separated in some places by narrow sandy tracts, while in others it forms bold promontories along the coast. Such is the Rás-el-hat-bah, the last of a chain of steep isolated mountains stretching along the sea, and called Jebel-Klefá. The names of the great range from north to south are—Jebel-Safrá, which contains lofty peaks visible from the sea; Jebel-Sobh, or Subah, 4500 feet high; Jebel-Ayúb; and Jebel-Rahah. In the latitude of Rás-el-hat-bah the range takes an eastern direction, and afterwards running south, forms a bend which surrounds the high tract of Mecca, which is about 100 miles wide from west to east. This crescent-shaped bend, the Jebel-Kórá-Kharah, is the highest portion of the whole range, and with regard to the orographical features of the peninsula, one of the most important points; the others are Mount Sinai, the southernmost portion of the Yemen mountains, and the mountains of 'Omán. The axis of Arabia, the Jebel-A'red, begins here, as above mentioned. Jebel-Kórá-Kharah rises above a plateau of great elevation, and several of its peaks, among which Jebel-Gezán, or Ghazúán, as Edrísi writes it, is the highest, are said to be covered with eternal snow. The town of Táyef stands at the western foot of Mount Ghazúán; and although the immediate neighbourhood and the deeper valleys produce the choicest fruits, especially excellent raisins, the surrounding plateaus are so high that the water will freeze in the summer nights. From the highest peaks being always covered with snow in 21° N. lat., we may conclude that the elevation is from 15,000 to 18,000 feet. From Táyef the range continues its south-eastern direction as far as a point about 19° 21′ N. lat., where it forms two branches, one stretching south, and lowering gradually till it reaches the coast of the Red Sea in about 18° N. lat., and the other south-south-east. Their direction consequently diverges a little. Between the two chains is a deep valley running from the north, where it is highest, towards the south, where it becomes broader, till it widens into an open plain. This valley is called the Tehmana, or perhaps Tehámah of A'sír, and it lies between the province of A'sír in the east and the lowland (Tehámah) of Kónfodah in the west. One of the most important mountain-passes of this range leads through the valley, and is the high road from Kónfodah to A'sír, and farther on to the interior of Arabia. The point where the two chains originate seems to be a plateau of great elevation; the road from Kónfodah leads over it, and is crossed here by another high road leading from the lowland of Hejáz to the north-eastern part of Yemen (A'sír), through which the Egyptian army penetrated into A'sír in 1836. The same point is the natural boundary between Hejáz and Yemen, and the limit between the range of Hejáz in the north and the range of Yemen in the south.

We resume the description of the coast from Rás-el-hat-bah southwards. The tract round Mecca is traversed by several offsets from the great range, which contain fertile valleys and plains between them, in one of which Mecca is situated. Jídda, the harbour of Mecca, has a good port, but the entrance is dangerous, on account of coral cliffs and shoals, which are common along the northern portion of the coast also, but are nowhere so numerous as on the coast south of Jídda. The coast near Jídda is low, bordered by sand-hills in the east, and it maintains this character for a great distance; the range of Hejáz is seldom visible from the sea. Halí is the last maritime town of Hejáz, and the tract north of it is called the Tehámah (or the lowland) of Hejáz. Where the great range enters Yemen it is called Jebel-Bení-Seíd, or the mountain of the tribe of Seid, which is of volcanic origin. East of it is the province of A'sír, which was first made known to Europeans by Jomard, who compared the accounts of the traveller Tamisier, several French officers in the Egyptian service, and the sheikh A'rís, an intelligent and well-informed native of A'sír. It is a country traversed by considerable streams, with fertile valleys, and inhabited by a numerous and warlike population, whom Mehmed A'li was unable to subdue. The range south of A'sír is called by the natives Jebel, or the Mountain; but portions of it are known by the names of Jebel-Orrá, Jebel-Shähhará, Jebel-Wóredá, Jebel-Hofásh, Jebel-Harras, Jebel-Sumárá, Jebel-Sábber, and Jebel-Yáfaí, the most southern extremity, which is above 7000 feet high. The town of San'á stands on a plateau east of the great range, which is about 4000 feet above the sea, and the peaks west of it are much higher. The whole of the Yemen mountains have a rugged aspect, and they are cut by deep valleys, over which steep granite and porphyry rocks raise their craggy summits. The valleys are well watered and fertile, and the whole is well cultivated; the terraces and slopes are generally covered with coffee-plantations, and the plateaus with corn-fields. The lowland, or Tehámah, has generally a fertile soil, but a barren aspect, except in the rainy season, when it is watered by the mountain torrents, which dry up under the scorching sun of summer. There are however many sandy tracts which remain uncultivated. South of Loheíá, the large bay of Loheíá penetrates into the land, and forms an excellent road, bordered on the south by a peninsula, the west point of which is called Rás-Isráel, and separated from the sea by the long island of Kamerán. The passes between the island and the continent are divided into several smaller channels by coral islands, the depth of which is six and ten fathoms. Between Rás-Isráel and Rás-Katáb, in the south, is another open bay, nearly as large as that of Loheíá. North-west of Rás-Isráel is the small island of Jebel-Tár or Tór, also called Shebán and Jebel-Daúhán, or Smoke Hill, a name which it derives from a volcano which, though nearly extinct, still smokes.

Cape Báb-el-Mándeb, that is, the 'gate of danger,' the most south-western point of Arabia, and of all Asia, lies in 12° 40′ N. lat., 41° 11′ 30″ E. long., and rises abruptly over the low coast, at the extremity of a small tongue of land. The width of the straits of Báo-el-Mándeb, between the cape and the coast of Abyssinia, is about 14 miles; the island of Perún, or Mehun, divides it into the great or western channel, which is 10¼ miles wide, and in the middle above 100 fathoms deep, and the little or eastern channel, which is 3 miles wide, and never less than 13 fathoms deep.

The great range stretching from Southern Yemen north-east to 'Omán is very imperfectly known. From Jebel-Yáfaí a chain stretches east near the coast, rising by several terraces to a height of above 5000 feet, and it continues in that direction under the names of Jebel-Hamarí, and Jebel-Ghoráb, which are in the country of Hadhramaút, parts of which have been visited by Wellsted and Haines. The tract north-west of these ranges, in the direction of San'á, is a sandy plateau traversed by some ridges of hills, and intersected by wádís of no great fertility. The interior of Hadhramaút was entirely unknown to Europeans until it was lately visited by the Baron de Wrede, a German gentleman, whose account has been published in the fourteenth volume of the 'Journal of the Royal Geographical Society of London' (1844). The baron having been robbed of most of his papers by order of the Sultân of Seíf, the account is very short; but his description corresponds generally with the accounts of Edrísi, Abú-l-fedá, Hájí-Khálfah, and other Eastern geographers. Starting from Makallá, he traversed in a north-western direction a mountainous tract, rising in terraces, and crowned by granitic rocks with craggy summits about 2000 feet high. On the fourth day he traversed Mount Sidara, 4000 feet high: it appears to be situated about 60 miles from the coast. On the fifth day he ascended a high yellowish plateau about 8000 feet high, the east part of which was overtowered by the summit of the colossal Kar-Scban.

The plateau extended as far as the eye could reach from west to north-east. Iron-sandstone was observed on the whole plateau, overlaid by a yellow and hard sandstone of a fine granular texture; and the plain was traversed by ridges of hills with conical summits, and intersected by deep and narrow ravines (wádís), through which the rain-water flows into the lower regions. On the ninth day the traveller reached the Wádí-Dóán, the chief object of his search, which, from its commencement about 130 miles north-west from Makallá, stretches, according to all appearance (the baron does not give its direction), east, south-east, and south, till it reaches the sea near Sähüt, a small village about 140 miles north-west from Makallá. The baron was only allowed to visit the upper part of this celebrated valley, which has different names in different places. Following the opinion of Niebuhr, our best geographers have put the Wádí-Dóán 350 miles north-east of Makallá, in the unknown desert north of the country of Shéher, though Seetzen observed that it was only a branch of the upper part of the valley of Hadhramaút, which, according to the same traveller, begins five journeys from Makallá. Seetzen's further description of the valley of Hadhramaút corresponds with that which Baron de Wrede gives of the Wadí-Dóán; and as both agree that the Wádí-Dóán, properly speaking, is a branch of a greater valley, the valley of Hadhramaút of Seetzen, and the Wádí-Dóán, in a more extensive sense, of the baron, we conclude that in this case Niebuhr and those who followed him are wrong. The difference in the journeys from Makallá, the beginning of the Wádí-Dóán, is no absolute difference of distance, since the baron made the way in eight and a half short journeys, each of less than six hours; while the five journeys of Seetzen might be longer journeys. From Khoreibeh, a town in the Wádí-Dóán, the baron travelled south-west to the Wádí-Webbene, which is the northern part of a long valley bearing the successive appellations of Wádí-Hagger, Wádí-Giswuel, and Wádí-Mefah or Maifaah, under which name it reaches the sea near Bir-el-Häsi. This is the Wádí-Meifah which was visited by Wellsted on his tour to Nakab-el-Hájar. Near Hota, a town in the Wádí-Hagger, the valley is watered by a continually running stream that rises four journeys north-west from that town, and of course continues its course through the lower parts of the valley. This stream comes apparently from the neighbourhood of the Wádí-Máreb, and is perhaps the same by which this fertile valley is watered, and which supplied the famous reservoir of Saba or Máreb. We thus see that the country of Hadhramaút is traversed by two long rivers, one originating not far from Wádí-Máreb, and running south-east and south for a distance of about 150 or 160 miles; and the other, the river of Dóán, flowing east, south-east, and south for nearly 300 miles. But neither of them reaches the sea, which is the case with nearly all the rivers in Arabia; and it may be doubted if they flow during all seasons, though it is possible that they never dry up entirely in all places. From Khoreibeh the baron travelled six good journeys north-west and west to Sava, in the Wádí-Rachie (Rakhí), which we presume to be in 17° N. lat., 46° 12′ E. long., or thereabouts: no accurate computation is possible. This Wádí runs north eight journeys. A six hours' journey north-west brought the traveller to the edge of the desert El-Ahkaf, called Bahr-el-Saffi, one of the most extraordinary tracts on the surface of the globe. It is an immense sandy plain, about 1000 feet below the level of the high land (from which the baron descended), and strewed with numberless undulating hills, without any trace of vegetation. There are many spots of dazzling whiteness, which contain deep chasms filled to the brim with powder-like sand. The traveller, having thrown a plummet of about one pound weight attached to a cord of sixty fathoms into one of these sand-gulfs, which was about two miles long and nearly as broad, saw it sinking with diminishing velocity for about five minutes, when the end of the cord disappeared in the chasm. The baron says he made the experiment in the most northern chasm, from which we must conclude that Bahr-el-Saffi, that is, the tract containing such chasms, stretches south from the spot where he reached the border of El-Ahkaf. He also says that Bahr-el-Saffi is the border of El-Ahkaf, stretching from the spot where he reached it to Kubr-el-Húd, a distance of eight journeys; and as, according to his statement, Kubr-el-Húd lies in the lower part of Wádí-Dóán, towards the sea, Bahr-el-Saffi designates as well the edge of El-Ahkaf, north of that extensive wádí, as the spot where the sand-gulfs are. He further says that Bahr-el-Saffi is inaccessible in its whole extent towards Kubr-el-Húd; but this is contradicted by his own words; for as it begins one journey north-west from Sava, and thence stretches east, and as the Wádí-Rachie begins at Sava, and thence stretches north, it is evident that Bahr-el-Saffi is traversed from south to north by the Wádí-Rachie, and is consequently accessible. It is extremely difficult to combine all the accounts of the baron, and to construct a map of the country explored by him. The desert between Hadhramaút and Middle Yemen, where the sand-gulfs are, is called Sahid, or Dhahir, by the Arabian geographers. Bahr-el-Saffi, or the sea of Saffi (perhaps Barr-el-Saffi, the desert of Saffi), is said to be called so on account of Saffi, an Arabian king, having perished there with his army in his attempt to march through it. His fate reminds us of Aelius Gallus, who, on his retreat from the interior of Arabia towards the sea, seems to have passed some distance north-west from the spot where King Saffi perished. (Strabo, p. 780, &c. Cas.; Jomard, in Mengin, cited below, p. 383, &c.)

The whole country east of Hadhramaút as far as 'Omán is entirely unknown to us, though the greater part of the coast has been surveyed. Parallel chains of mountains run along the coast, pressing in some parts upon the sea, and separated from it in others by narrow sandy tracts. Makallá lies in 14° 31′ N. lat., 46° 50′ 30″ E. long., in the corner of a fine bay, and at the foot of a high and barren mountain. Rás-Tartak is a bold promontory, in 15° 37′ 30″ N. lat., 49° 58′ E. long., visible at the distance of 26 leagues from the sea. Ras-Morebát, a low cape east of Rás-Tartak, is in 16° 55′ N. lat., 52° 31′ 35″ E. long., according to Capt. Owen. East of it a high tract borders on the sea, being a terrace leading to lofty and steep chains, which stretch in the same direction, and are visible from the sea at the distance of 20 leagues. Their height has been estimated at 5000 feet. The interior has the name of Shéher, and is inhabited by the tribe of Mahrah, whence it is generally, though erroneously, called Mahrah. The language of this tribe has always been, and still is, very different from the Arabic, being probably derived from the antient Hamiaritic language. The inland tract of Shéher is described as an awful desert, but the mountainous tract along the coast is fertile, and in many places the mountains are covered with forests, a rare circumstance on this coast. At Rás-Tartak the coast turns north, keeping that direction about 60 miles, when it resumes its north-eastern direction as far as Rás-Morebát; thence it runs north-east and north about 90 miles; and again running east about 60 miles, encompasses the Gulf of (Júna-l-) Hashish, or Kuria-Muria, which is the name of a group of islands situated at its entrance. The eastern termination of this bay is Rás-Kanselí. Here the coast describes another curve, forming the bay of Saugra, which is terminated to the east by the lofty promontory Rás-Madraka, in 17° 58′ N. lat., 55° 34′ 15″ E. long. From this point the direction of the coast is north and north-east, but its details are not known. Opposite it lies the long island of Masserah, the eastern coast of which has been surveyed. The coast terminates to the north-east with Rás-Jíns, a high promontory, backed by a chain of lofty mountains, in 22° 26′ N. lat., 57° 35′ E. long. A little north of it, in 22° 23′ 12″ N. lat., 57° 32″ E. long., is Rás-el-Hád, a low point, where Bahr-'Omán begins, or the part of the Indian Sea which lies between the coast of 'Omán and the coast of Beloochistan. From Rás-el-Hád the coast of 'Omán turns west and north-west in two crescents: one of them, which is small, lies between that cape and Rás-Heírán, near Muscat; the other, which has a chord of 240 miles, and advances to the north as far as 26° 21′ N. lat., 56° 35′ E. long. (in the map of Berghaus), when it terminates with Rás-Musendom. The Straits of Ormus, between this cape and the coast of Persia, are about 32 miles wide at the narrowest part. The coast of 'Omán is generally low, being a narrow 'tehámah,' backed by lofty chains of hills. Near Muscat rocks tower above the sea. Jebel-Huther, in the south-east, is said to be 6000 feet high; and its north-west continuation, Jebel-Akdar, has an equal elevation: a peak which is south-west of this chain is still higher. Still farther west begins the sandy table-land. Part of this tract is called El-Tehabet; it is unknown to us: it is said to be inhabited by a tribe called Zaraká, whence comes the word Saracens. 'Omán is generally a fertile well-cultivated tract, though containing sandy districts, as we see from the description of Wellsted.

At Rás-Musendom the coast suddenly turns south-west, and continues in that direction for above 200 miles along the Persian Gulf; the peninsular extremity of Arabia, between that gulf and the Gulf of 'Omán, is about 170 miles broad at its basis, and nearly as long from south to north. From the western commencement of the peninsula the coast runs west for near 200 miles, and then north for 140 miles, as far as Rás-Anfir, forming an immense bay, the shores of which are generally flat, with an irregular outline, intersected by numerous creeks and small bays, and lined by numerous islands and coral cliffs. Pirates have always infested this dangerous coast, and they are not yet entirely destroyed, in spite of the vigilance of the officers of the British navy. From Cape Anfir the coast again runs south, which direction it keeps for about 80 miles, and resuming its former north-western direction, forms a deep bay, the Gulf of Bahreín, in the middle of which lies the large island of Bahreín, noted for pearl fisheries. The coast round this gulf is indented by many smaller bays and creeks, which have good and safe anchorage, and the whole tract is one of the most frequented of Arabia. A little south of Rás-Tanorá, lying at the north-western extremity of the gulf, is the town of El-Katif, in a fertile and well cultivated tract, bordered on the west by the desert, and noted as a commercial port. It lies in 26° 29′ 30″ N. lat., 47° 41′ 30″ E. long., and is well fortified and defended by a Turkish garrison, the commander of which depends upon the Pasha of Basrah. The town of A′njír or Aíndar, once in the possession of the Wahhábís, who carried on a great trade between Persia and El-Derá'iyeh, is supposed to be in the innermost corner of the gulf, which is here called the bay of El-wáh. From Rás-Tanorá the coast runs in a curve north-west, north, and north-east, up to the Shat-el-Aráb, forming a great number of small bays, which are dangerous to approach on account of coral reefs and shoals. The tract along this coast, or the northern part of El-Hassá, is flat and covered with sand to a great extent, but it also contains many fertile and well cultivated districts.

The interior between El-Katif and El-Derá'iyeh, has been made known to us by Captain Sadlier, the first European who traversed Arabia from one coast to the other; and the tract from El-Derá'iyeh to Medína was seen by the same traveller and the French officers who accompanied the expedition of Ibráhim Pasha against El-Derá'iyeh, the former capital of the Wahhábís. But all that we know of this tract is either confined to the routes or is derived from the description of the natives. The country rises in terraces from the Persian Gulf towards the interior. The first terrace begins about 100 miles westward from the coast, where Sadlier felt a cooler atmosphere, but the ascent is gradual. The country is generally barren, being a rocky soil covered with pebbles or sand, and partly hilly, partly level. There seem to be a few more fertile tracts at some distance from the common road. The second terrace begins in the neighbourhood of Derá'iyeh and Mánfuhah, where the high land is cut by fertile valleys covered with date-trees; the plateaus afford excellent pasture-grounds for horses. Derá'iyeh, though destroyed by the Egyptians, is a place of importance and has always had a large trade, being a central position, and connected by great roads with all the provinces of Arabia. West and south-west of this town are the highest portions of the central table-land of Nejd. The common road to Medína has a north-western direction to Aneízeh, where it joins the high road from Baghdád and Damascus. The position of Aneízeh is as important as that of Derá'iyeh; it is in the province El-Kasím, at nearly equal distances from the Persian Gulf and the Red Sea, west of Jebel-Tueík, south of Jebel-Shammár, and north-west of the province El-'A′red, in which Derá'iyeh is situated; the tract between this province and El-Kasím is the province of El-Wóshem. The road from Aneízeh to Medína runs westward across chains of sand-hills stretching from south to north, thence across other barren hills called Jebel-T'ayeh and Jebel-Maúyeh, as far as Henákíyeh (Heníkah) in the neighbourhood of Jebel-'Ohod, a mountain of red granite, whence it turns south-south-west to Medína and passes through a desert which is a stony plain traversed by chains of barren rocks and sand-hills. Water is not scarce, but there are few villages, and the cultivation of the more fertile tracts is neglected, probably in consequence of the Wahhabí war. Henákíyeh is placed in Houghton's map 36 miles north-east of Medína, in 25° 22′ N. lat., 36° 55′ E. long. The account of Sadlier of this part of his route is very incomplete. In the map belonging to Burckhardt's Travels, Henákíyeh lies in 25° 35′ N. lat., 38° 35′ E. long.; and in Jomard's map of Nejd, in 25° 58′ N. lat., 38° 20′ E. long.; Berghaus computes it to be in 26° 9′ N. lat., 38° E. long., 75 miles north-north-east from Medína, and he seems to be more correct than the others; Houghton is apparently wrong. A glance at the map will show that the position of Henákíyeh is of great importance; the road from Aneízeh to that town is evidently the high road to Medína as well as to the upper part of the Red Sea; the former branches from that place south, the latter continues in its western direction.

The axis of Arabia, the range of El-'A′red or Jebel-'Imaríyeh, begins, as above mentioned, in the environs of Táyef, where it is connected with Mount Korá-Kharah, which is part of the Hejáz chain, by the lofty peak of Gazúán and its offsets. It stretches north-east as far as Derá'iyeh. We know it only from the descriptions of the natives and some Arabic writers, but D'Anville placed it in his map of Arabia. Its north-western declivities are steep, white rocks rising like a gigantic wall, along the foot of which runs the road from Derá'iyeh to Mecca mentioned by Edrísi, and which is marked with its stations on most of our maps. In the south-east this chain borders on a sandy table-land, and it seems that the great gap which, according to Ritter's opinion, traverses the peninsula from the west in the direction of Derá'iyeh, runs across that table-land at some distance south-west of the chain of El-'A′red. There is another road, first mentioned by Baron von Hammer, who derived his knowledge from Eastern sources, which leads from Derá'iyeh to Mecca by Meráb, Shár, Jenánij, Merkab, Menkhaná, 'Ablah, Sekíyeh, and Dhat-'Ark, where it joins the northern road: it runs south-east of, and generally parallel to, the chain of El-'A′red. But whether those places are situated on the table-land between the chain and the supposed gap, or in the gap or valley, we cannot determine. The road is not mentioned in any of our maps. The town of Deríyeh, which is known to us by the descriptions of the natives as being situated in or near the western part of Mount El-'A′red (it is in the map of Berghaus), is most probably on that road which continues from that place south-west to Mecca, while another road, which has a southern direction, traverses the fertile and well cultivated district of El-Bakarrá, and leads to 'Asír and the other districts of Northern Yemen. The province of 'Asír is traversed from west to east by four considerable streams which unite in its eastern part and form the river Bísheh, which, according to a brief account lately published by Jomard, continues its eastern course towards the Wádí-Dówásir, a distance of about 200 miles. Jomard thinks that the river Aftán, which according to the Arabian geographers traverses the province of El-Hassá from west to east, and empties itself into the Persian Gulf somewhere below El-Katif, is the continuation of the river Bísheh. The stream in the valley of Derá'iyeh flows into the Wádí-Aftán, and we can trace this Wádí still farther to the west. Niebuhr observed that there was no perennial stream in the Wádí-Aftán, nor has Captain Sadlier, who twice crossed the line in which the Aftán was supposed to flow, observed anything like a river in that tract. On the other hand, it is difficult to explain where the river Bísheh finally flows to. Its direction is certainly north-east, and the natives say that it enters the Persian Gulf. The difficulty seems to be solved by supposing that it flows into some lake, and such is the lake Salome, which, according to the account published by Jomard,* is east of the Wádí-Dówásir, and into which the river Bísheh flows after having watered that Wádí. It is said to disappear at some places, and to re-appear farther down—a phenomenon observed in other rivers. The same account, which is derived from trustworthy natives, also says that the Bísheh, after having traversed the lake, continues its eastern course and empties itself into the Persian Gulf. It would be presumptuous to reject these accounts altogether, since they corroborate each other, and are confirmed by the authority of Arabian geographers to whom we trust in many other cases. But we owe the same respect to the evidence of Sadlier also. It is the writer's opinion that the lake Salome receives the river Bísheh, but that owing to the evaporation the lake has no outlet except when its waters rise in consequence of extraordinary rains or snowfalls in the mountains of Asír and on the range of El-'A'red. If this is admitted, there will be no difficulty in assuming that the surplus water flows through the Wádí-Aftán to the Persian Gulf. Such rains or snowfalls may be rare phenomena, and the Wádí-Aftán may remain dry for many years, especially in the lower part, where the climate is intolerably hot, and the sand soon covers the beds of the rivers if it is not carried away by a constantly running stream. Such may have been the case when Sadlier crossed the line of the Aftán without perceiving any trace of a river. The Bísheh probably flows in the gap above referred to. The length of the Wádí-Rachie, mentioned by the Baron von Wrede, is eight journeys: it joins the Wádí-Kasr: it runs apparently as far north as the Wádí-Dówásir, and its stream flows probably into the Bísheh; but the Wádí-Rachie is partly filled with sand, and a constantly running stream is questionable. In Jomard's map of Asír there is another river, the Tárabeh, which originates in the elevated tract near Táyef, and flows north-east, but does not join the Bísheh. This river seems to run towards El-Bakkará and joins the Bísheh perhaps farther east. In Berghaus' map these streams are laid down in a very indistinct way: the eye can neither discover whence they come, nor whither they run, nor how they are connected. The position of the Wádí-Dówásir must be understood to be in 19° N. lat., which is the latitude of the northern part of Asír. So it is in the map of Berghaus.

The remaining part of the interior of Arabia, between Yemen and 'Omán, Nejd and Hadhramaút, is a tract of which we have no knowledge. It is generally believed to be a desert, and has been represented as such by the natives, although in the Jíhán-numá of Háji-Khalfah it is only described as an interrupted wilderness, inhabited in some places, so that the traveller is always sure to sleep at night in a human dwelling. It is called El-Ahkaf, because it contains many barren tracts covered with sand-hills, but this term is frequently employed by the Arabian geographers in their description of other parts of Arabia. The unknown part of Southern Arabia begins at the Wádí-Rachie, in the west, in about 46° 20′ E. long. That meridian forms its limit as far as 20° N. lat., in the north-eastern corner of the Wádí-Afláj. A line drawn from that spot north-west to the eastern boundaries of El-Bakkará mentioned above; thence north-east along the range of El-'Ared as far as the meridian of Derá'iyeh; thence south-east to a point in 24° N. lat., 47° E. long., and thence east to the frontiers of 'Omán, forms its northern boundaries. Its eastern boundaries are 'Omán, and its southern the coast as far as the Wádí-Doán, which they follow north-west as far as the Wádí-Rachie. The terrific descriptions which the Arabs give of this tract are as exaggerated as their praises of the beauty of the oases, which are generally only a valley watered by a little stream overhung by a few date-trees and bushes. The Arabs understand each other very well when they speak in hyperboles. Niebuhr once heard an Arab speak of an animal 'with the head of a horse, the breast of a lion, the feet of a camel, the body of a snake, the tail of a scorpion, and horns with a maiden's (meaning long) hair.' By this he meant not some antediluvian monster, but—a grasshopper (locusta). It is just so with the descriptions of the deserts, which in the south of Arabia are certainly not more dangerous than in the north, where they have been and still are traversed by many Europeans. Edrísi says that El-Ahkaf is traversed in its whole length from 'Omán to Mecca by a road on which he mentions four stations; and a modern traveller (Buckingham, *Travels in Mesopotamia*, p. 47, 48) met with a pilgrim who told him that this road is still frequented, but leads through barren tracts inhabited by a warlike population. Another road was formerly known between 'Omán and Dówásir, where there was a fair frequented by people from all parts of Arabia, and even of India. Burckhardt mentions a road from Southern Nejd, through the Wádí-Jebrín, to Hadhramaút, which is frequented in summer. This road must cross the Bahr-el-Saffi (the northern and western barrier of Hadhramaút), and that dreadful spot is consequently accessible not only through the Wádí-Rachie, but through the Nejd road also, though of course we do not mean the sand-gulfs. It is said that an English gentleman has lately started for Southern Arabia, with a view of traversing it in its whole width across El-Ahkaf, and there is little doubt that he will effect his purpose unless prevented by the natives. The whole tract seems to be inhabited by Beduins or Nomadic Arabs, and there is little chance of finding towns or many fixed settlements. The maps attached to the editions of Ptolemy have induced many to believe that he was acquainted with a number of towns in the tract which is now called El-Ahkaf; and Jomard, excited by hopes of 'making conquests in the desert,' thinks that if we knew all Arabia, our maps of the country would differ little from that of Ptolemy. This is not at all likely. Ptolemy had certainly a more extensive knowledge of Arabia than any other antient or modern geographer, but his knowledge was not accurate, and if we should succeed in bringing his confused ideas into harmony with the reality, it is more probable that his map would be like ours than that ours should be like his. The writer has in his possession a vast number of extracts from Arabic geographers and historians who have never or seldom been made use of for geographical purposes, their works being still in MSS.; but little benefit is to be derived from them for 'conquests in El-Ahkaf.' One of them, Ibn-Khordádbeh, filled the office of postmaster under the earlier khalifs, and his geographical work (MS.) is full of interesting details, routes, stations, wells, wadis, &c., but the little that he knows of El-Ahkaf is of so vague a character as to be useless for a map. One of the greatest difficulties in using the Eastern geographers is to determine the length of their journeys, and although modern travellers are more attentive, they are not all so careful as Niebuhr. Travellers in Arabia use either asses, camels, or horses. Asses are generally used in the mountainous districts of Yemen and Hadhramaút, and their speed is about 1750 double or Roman steps (five feet) in half an hour, as Niebuhr states. Nine hours are a good journey, and the distance performed in that time would be a trifle more or less than thirty miles, making 3·33 miles an hour. This is good travelling for shorter distances, but for longer distances the time as well as the number of miles would be too much, as we see from Captain Sadlier's Itinerary, which shows an average of only 2·21 miles an hour. Camels travel about one-fourth quicker than asses, especially when alone or with other camels, but caravans always travel slow. Light camels will run for many days at the rate of 50 miles a day, and the statement of Edrísi that the enormous distance from (the confines of) 'Omán to Mecca, nearly 1200 miles, is performed in 21 journeys, might be true, though none but a Beduin courier could support the fatigue of such a journey. The distances given by the Arabs are seldom real distances: they generally mean to say that when *they* travelled to such or such a place, they were so many days on their way, but whether they travelled in a straight line or by a circuitous road is another question.

(Niebuhr, *Reise-Beschreibung nach Arabien und andern Ländern*; Seetzen, in the 28th vol. of Zach, *Monathliche Correspondenz*; Burckhardt, *Travels in Arabia*; Jomard, in Mengin, *Histoire Sommaire de l'Egypte*; Jomard, *Déscription du Nejd*; Berghaus, *Geo-Hydrographisches Memoir zur Erklärung, &c. der General-Karte von Arabia und dem Nil-Lande*; Hammer, in *Wiener Jahrbücher der Literatur*, vol. xciii.; the Sources quoted in the text.)

ARA'BIA PETRAE'A ('Αραβία ἡ Πετραία), the north-western corner of Arabia, was so called from its principal town Petra, where the king of the Nabathaei resided in the time of Augustus. Its limits to the west and north-west were the Sinus Heroopolites, now Bahr Súes, or the Gulf of Súes, and Lower Egypt; to the north Judaea; to the east, Arabia Deserta; and to the south, Arabia Felix. In all these directions the limits were not fixed. The most conspicuous part was the peninsular tract round Mount Sinái, separated from the eastern part of Arabia Petraea by the Sinus Aelanites, now Bahr Akaba. The name of Arabia Petraea is not very antient, and even that of the town Petra seems to have been unknown before the time of Alexander the Great; the country however is mentioned in the Scriptures as being connected with the earliest history of the Jews. Ishmael, the chief of the tribe of the Ishmaelitae, and the supposed ancestor of the Arabs, had his abode in Arabia Petraea. (Genesis xxv. 18.) Other tribes mentioned in the Scriptures are the Ammonitae, Moabitae, Madianitae, Amalekitae, Hagareni, and Edomitae or Idumaei, who inhabited the tract bordering on Judaea, which was called Idumaea. In the time of the Romans, the Nabathaei or Nabataei were the ruling nation in Arabia Petraea, and are said to have derived their name from Nabajoth, the eldest son of Ishmael, and are consequently the same tribe as the Ishmaelitae of the Scriptures. In the time of Augustus the Nabathaei possessed the northern part of Arabia Felix also. The name of Arabia Petraea is not mentioned by Strabo, who calls the country ἡ Ἀραβία τῶν Ναβαταίων, the Nabataean Arabia. Trajan conquered this country, and united it to Palestine; it was afterwards called Palaestina Tertia, and thus Stephanus Byzantinus (v. Πέτρα) says that the town of Petra was situated in the Third Palestine. [Petra, P. C.] King Baldwin I. conquered part of the country, and caused its principal town, Krac, to be called Mont Royal. The antient writers mention several towns in Arabia Petraea, among which Petra is first in rank: it stood in the Wádi-Músa, about half-way between the Dead Sea and the Gulf of Akaba, and it was also called Rekem. [Arabia, P. C. and P. C. S.]

---

* In 'Documens et Observations sur le cours du Bahr-el-Abiad et sur quelques autres points de Géographie.'

(Cellarius, *Notitiae Orbis Antiqui*, iii. 14; D'Anville, *Antient Geography*, vol. ii. pp. 437-443.)

ARA'CHNIDA (Fossil) occur in the coal formation of Shropshire. (Prestwich.)

ARÆOMETER (from the Greek *ἀραιός*, *light* or *thin*, and *μέτρον*, a *measure*) is an instrument employed for the purpose of ascertaining the specific gravities of fluids, generally such as are less dense than water, but capable of being used also to determine those of any fluids, and even of solid bodies. It differs but little from an hydrometer, and in its simplest state it was merely a glass ball, hollow, and having attached to it a graduated stem also of glass: a weight was applied below the ball in order that the instrument might float in a vertical position when partly immersed in a liquid; and the different depths to which it sunk in different fluids were indications of the relative densities of the fluids, the volume of a cylindrical portion between any two graduations on the stem being some known part of the whole volume of the instrument.

But an instrument of this kind was soon found to be very defective; for when immersed in different fluids, the elevations of these about the stem, in consequence of capillary action, were unequal, and thus the difference between two immersed volumes could not be correctly estimated. Fahrenheit improved it by forming at the top of the stem a small cup to receive weights, by which, when the instrument was placed in the fluid, it could be sunk down till a permanent mark on the stem was at the level of the fluid surface: the weight of the instrument itself, with that of the objects in the cup, were together, of course, equal to the weight of the fluid displaced by the immersed part; and the difference between the weights in the cups, when the mark was successively at the surfaces of two different fluids, allowed a nearly correct estimate to be made of the difference between the specific gravities of the fluids.

Various changes have since been made in the construction of the instrument; and the best form is probably that which was given to it by Nicholson, and which bears his name. It consists of a hollow cylinder, or sphere, of copper, from each extremity of which proceeds a stem; that which, when the instrument is in a vertical position, is uppermost is a wire of hardened steel about 1-40th inch in diameter, and, like Fahrenheit's instrument, it carries at its top a small cup in which weights may be placed: to the lower stem, which is short, is attached a stirrup carrying a cup in which may be placed a solid body whose specific gravity it may be required to determine. The instrument is so adjusted that, if a weight equal to 1000 grains be placed in the upper vessel, the whole will sink in distilled water at a temperature expressed by 60 degrees of Fahrenheit's thermometer, till a mark made on the stem is on a level with the fluid surface. When the specific gravity of a fluid lighter than water is to be determined, the instrument is plunged into the fluid and weights are placed in the upper vessel till the mark on the stem is at the surface; then, if w in grains, be the weight of the instrument when unloaded, and w' the weight placed in the cup as just said: also if s be the specific gravity of distilled water, and s' that of the fluid in which the instrument is placed, we have, by hydrostatics,

$$w + 1000 : w + w' :: s : s';$$

whence s' may be found.

To obtain the specific gravity of a solid which does not imbibe water: after placing the instrument in distilled water let the body be laid in the upper vessel, and weights, in grains, added till the mark on the stem is at the level of the surface; these weights being subtracted from 1000 grains, leave the weight of the body in air: then placing the body in the lower vessel, let other weights be added in the upper one till the mark on the stem is again at the surface of the water; these additional weights will express the loss which the body sustains by being immersed in water. Consequently if w'' be the weight of the body in air, w''' the loss just mentioned, s the specific gravity of the water, and s'' that of the body, we have by hydrostatics,

$$w''' : w'' :: s : s'';$$

whence s'' may be found.

If the substance whose specific gravity is required be, like wood, capable of imbibing water during the experiment, it should be left in the lower vessel, while under water, till the instrument is stationary, when the additional weights in the upper vessel will express the weight of the displaced water together with that which is imbibed; then, having dried the surface, let the substance be placed in the upper vessel and weighed in air as at first: the difference between this weight and that which was found before the substance was put in the water is the weight of the water imbibed; and this must of course be subtracted from the observed weight of the substance in water, previously to substituting the values of the terms in the proportion. The theory of the aræometer and hydrometer is given in Gregory's 'Mechanics,' vol. i. art. 406, &c.

For fluids of greater specific gravity than water, such as the concentrated acids, an instrument of the like kind which was invented by Guyton de Morveau, and is designated 'Gravimeter,' may be used. It is made of glass, with an upper and lower cup, in the former of which may be placed a constant weight, and in the lower a glass ball containing mercury. The weight of this body in air is made exactly equal to the constant weight together with the weight of a body of distilled water equal in volume to the ball containing the mercury. It is evident therefore that in the water this last object will be exactly equivalent to the constant weight, supposing the latter to be placed in the upper vessel; so that, in use, its weight is expressed by the number of grains in the constant weight, and at the same time it serves as ballast, allowing, on the instrument being plunged in a fluid more dense than water, a weight to be placed in the upper vessel much greater than that which could be otherwise introduced consistently with the preservation of the vertical equilibrium.

Now the constant weight being that which, in distilled water at the standard temperature, sinks the instrument till the mark on its stem is at the level of the surface; the weight of the instrument without the ball of mercury, together with the constant weight, is the weight of a volume of the water equal to that of the immersed part including the ball; and when the instrument is introduced in a heavier fluid, its weight together with the constant weight and as many grains as will depress the mark to the surface, will be the weight of an equal volume of the fluid. Consequently the former weight is to the latter as the specific gravity of the water is to the required specific gravity of the fluid; which last is thus found.

ARANJAA, in P. C., is a misprint for *Aranea*. [Arachnida, P. C.]

ARAUCARITES (Presl), a genus of fossil plants found in the lias of Lyme Regis.

ARAXES. [Aras, P. C.]

ARCADE. In addition to its proper technical meaning, this term has of late acquired a different signification among us as the popular name for what the Parisians more properly designate a 'passage' or galerie, viz. an alley lined on each side with shops, and roofed over so as to be in fact a sort of 'in-door' street, entirely protected from the weather, and of uniform design throughout in its architecture. So far, an arcade answers to the idea of a bazaar, the chief distinction between the two being that the latter has not so much of street character about it, but consists either of a single spacious hall or separate rooms, fitted up with counters and stands, and may therefore be likened to a single large shop occupied by a number of different dealers, whereas in an arcade the shops are quite distinct from each other, and enclosed in front with windows after the usual manner; and they have besides dwelling accommodation, kitchen, &c. beneath, and a chamber over them, with the addition sometimes of an entresol. Another distinction is that an arcade serves as a public thoroughfare for foot-passengers. As to such a place being a very great public convenience there can be but one opinion,—as in dirty or wet weather, when the advantages attending such mode of building make themselves felt very sensibly. The Burlington Arcade, which was the first place of the kind in London, has indeed little more than its convenience as a thoroughfare and promenade for foot-passengers to recommend it, inasmuch as it makes no pretensions to elegance of design, nor has it anything in accordance with the title bestowed on it, it being neither arcaded in any way nor arched over. The Lowther Arcade in the Strand (erected 1831) manifests very great improvement upon that first specimen, for it is really a very handsome and tasteful piece of architecture; the side elevations are divided by pilasters into compartments, each of which contains a shop-front, with an ornamented triple window over it, and above that a semicircular one in the arched head of the compartment. On the plan, each of these divisions is covered by a pendentive dome with a circular skylight; and these numerous domes and their arches produce a singularly pleasing perspective effect. The same may be said of the Royal Arcade at Newcastle, erected a few years later, inasmuch as it is the same design, with only some slight alterations—and those not for the better in the side compartments; yet where, while so little has been done, there is such ample scope for variety, this mere repetition might have been avoided. Another provincial structure of the same class does however furnish us with an example of something decidedly different, and marked by one striking peculiarity in regard to its plan: the Victoria Arcade at Ryde in the Isle of Wight, completed in 1836, after the designs of Mr. W. Westmacott, consists of two avenues or galleries crossing each other, with a rotunda at their intersection. This circular part of the plan is disposed in eight compartments, placed alternately, viz. four with shops, and the others open to the avenues. This space, which has a fountain in the centre of it, is covered with a flattish dome with a single row of large panels, but the avenues are not arched. Although in point of architecture this example is exceedingly plain, the general combination is highly effective and pleasing, and also suggestive of many other ideas. The central avenue of Covent-Garden Market also affords an example of what, though not so called, may be classed as an arcade, inasmuch as it is a covered street of shops; and it is referred to as exhibiting a very different character from the preceding ones, it being totally devoid of decoration, yet possessing much architectural expression in its upper part on account of its open timber roof, and the 'clerestory' formed by openings which are left unglazed in the upper part of each side; consequently the light is admitted laterally, though from above, therefore with a different effect from that attending lanterns or skylights. In regard to degree of architectural adornment this example ought to be placed first, as being of far more primitive character than the others, and without the least attempt at decoration of any kind. In the new Exeter Change, on the contrary (erected 1843-4, by Mr. Sydney Smirke), decoration of quite a novel kind, for this country at least, is introduced, there being no previous application of it, in any such place, if we except the Pantheon Bazaar in Oxford Street;—namely, polychromic embellishment, which is there applied both on the upper part of the walls (in ornaments and pannels between the windows over the shops) and on the cove of the ceiling. The plafond of the latter may be said to be open, it being merely glazed so as to form a continuous skylight over the avenue, which circumstance constitutes a strong point of difference between this and all the preceding examples. No less difference is there in several other respects; the whole place has more the appearance of a hall or gallery than of a place of thoroughfare and business. Besides that it is of short proportions, the length being only about five times the width, it is more enclosed, therefore has more of in-door character, for instead of being open at the ends, or entered immediately from the street, it has a vestibule at each end, both of them polygonal in plan, yet not exactly alike, the one being a hexagon, the other a heptagon, which are ingeniously adopted in order to obviate the difficulty of site, viz. the oblique position of the 'passage' between the two streets which it connects. It is perhaps to such difficulty alone that we are indebted for a novelty of plan and ensemble, that without it would not have been sought for. These vestibules greatly enhance the effect of the avenue itself, inasmuch as they render it by contrast loftier than it would otherwise appear, in consequence of their being only half as high. In the Pantechnicon near Belgrave Square is a 'passage' of the kind, which although of plain is of pleasing character, and has a peculiar air of spaciousness and cheerfulness. Among the Parisian arcades, the Passage Colbert is one of the most striking, both for its extent and architectural display, towards which last its Rotunda contributes in no small degree.

ARCA'DIUS CHARI'SIUS, AURELIUS. [Charisius, P. C. S.]

ARCHES, COURT OF. At the time when the former article under this head was written (P. C.), it was expected that the Court of Arches would have been affected by a general measure for the reform of the ecclesiastical courts; but the attempts which have been made to accomplish this object have not hitherto been successful, and more than one bill for consolidating the jurisdiction and improving the practice of these courts has been abandoned. In the session of 1844 a bill was brought into the House of Commons 'For facilitating Appeals to the Court of Arches.' The preamble stated that it 'would tend to the saving of expense, and to the better administration of justice, if either litigant party in any contested suit in any ecclesiastical court, either in the province of Canterbury or in the province of York, had the right to remove such suit into the Arches Court of Canterbury;' but this bill did not pass into a law. In the same session a bill was brought forward in the House of Lords relating to the ecclesiastical courts generally, which, among other things, provided for the consolidation of the Court of Arches with the Prerogative Court of Canterbury, by transferring the jurisdiction of the latter court to the Court of Arches; but this bill was not carried. By 3 & 4 Vict. c. 65, the dean of Arches is empowered to sit as assistant to or in place of the judge of the Court of Admiralty. [Admiralty, Court of, P. C. S.] Advocates admitted in the Arches Court of Canterbury are admitted to be advocates of the High Court of Admiralty of England.

A Parliamentary Paper (No. 327) printed during the session of 1844 contains some information respecting the practice of the Court of Arches. There are no bye-laws, regulations, or resolutions made by proctors of the Arches or Prerogative Courts of Canterbury relating to the articling of clerks to proctors, or to the admission of proctors. The articling of clerks and admission of proctors are regulated by a statute of the archbishop of Canterbury, bearing date the 30th of June, 1696. By this statute, the number of proctors having then increased to forty, it was, among other things, ordained that there should be thirty-four proctors *exercent* in the Arches Court, each of whom should have power and privilege to take clerks apprentices, and that the remaining proctors should be esteemed and called supernumeraries, who should not have power to take such clerks until they should have succeeded into the number of the thirty-four; and that no proctor should take any clerk apprentice until he should have continued *exercent* in the Arches Court five years; that the term of service of a clerk should be seven years; and that no proctor having one such clerk should be capable of taking another at the same time, until the first should have served five years. It is in practice required that a proctor shall have been five years on the list of the thirty-four seniors before being allowed to take an articled clerk. There are two rules observed with respect to the qualification of articled clerks which are not contained in the annexed statute: one, by which the age of the clerk is required to be fourteen, and not above eighteen years; and the other, that such clerk should not have been a stipendiary writing-clerk. The above rule with respect to age has, under particular circumstances, been occasionally dispensed with by the judge. The date of and authority for these two rules are not known.

The ordinances and decrees of Sir Richard Rains, Judge of the Prerogative Court, mentioned in the statute as made in 1686, do not appear to have been registered. It is conceived that they must have been rules and regulations to be observed in the conduct of suits, and not to the articling of clerks on admission of proctors, which acts are done only before the official principal of the Arches Court, or his surrogate, and are registered in the Arches Court. According to the present rules, a candidate for admission as an advocate is required to deliver into the office of the vicar-general of the province of Canterbury a certificate of his having taken the degree of Doctor of Civil Law, signed by the registrar of the university to which he belongs. A petition, praying that in consideration of such qualification the candidate may be admitted an advocate, is then presented to the archbishop, who issues his fiat for the admission of the applicant, directed to his vicar-general, who thereupon causes a rescript or commission to be prepared, addressed to the official principal of the Arches Court of Canterbury, empowering and requiring him to admit the candidate an advocate of that court. This commission contains a proviso that the person to be admitted shall not practise for one whole year from the date of his admission. The candidate is admitted on one of the regular sessions of the Arches Court; the rescript of the archbishop being first read, and the oaths of allegiance and supremacy, with two other oaths, being taken. This admission in the Arches Court qualifies the person for practising in any of the other ecclesiastical courts of Doctors' Commons. The present number of advocates is twenty-four.

The court of the province of York which corresponds to the Court of Arches is called the Chancery Court of York. The number of advocates practising in this court has never exceeded four. They are admitted by fiat of the archbishop, directed to his chancellor, and have power to practise in all the courts of the archbishop; but it is not necessary that they should be Doctors of Civil Law. (*Parliamentary Paper*, 282, Sess. 1844.)

ARCHIMEDEAN SCREW. [Screw Propeller, P. C. S.]

ARCOGRAPH. [Cyclograph, P. C. S.]

ARD, LOCH, is a lake in Scotland, in the county of Perth, and in the parish of Aberfoyle: it lies south of Loch Katteran, or Katrine, from which it is separated by huge mountain masses, the summit of which, known as Ben Venu, rises to more than 3000 feet above the sea. On the west the lake is also enclosed by high mountains. Ben Lomond, which rises 3197 feet above the sea, is only about four miles distant. Between the two mountain-masses lies Loch Chon, where the river Forth originates. It runs in a narrow valley to Loch Ard, which is about two miles long, and on an average less than half a mile wide. To the south and east of the lake are hills, descending towards its shores with a moderately gentle slope. Where the river leaves the lake there is a small cataract, below which it runs through a narrow valley, called the Laggan, to a more level country.

(Sinclair, *Statistical Account of Scotland.*)

ARDWICK LIMESTONE, a calcareous bed or series of beds containing shells and fish remains, in the upper part of the coal formations of Manchester and Lebetwood. There is a coal-bed above it at Manchester.

ARETI'NO, SPINELLO, one of the most distinguished of the early Italian painters, was born at Arezzo in 1316. He derived his surname from his birth-place, a common circumstance in those times. His father, Luca Spinelli, was a Florentine, who settled at Arezzo when the Ghibellines were expelled from Florence. Aretino was the pupil of Jacopo del Casentino, whom however he surpassed even as a boy. He obtained a reputation very early by some frescoes illustrating the life of San Niccolo, which he executed in a new church of that saint, built at Arezzo by Dardano Acciajuoli, expressly for the occasion of a council to be held there by Pope Eugene IV. This church was destroyed by fire in the time of Vasari. The frescoes however which Aretino painted in it procured him an invitation from Baroni Capelli, a citizen of Florence, to paint the principal chapel of Santa Maria Maggiore, with subjects from the life of the Virgin, and of Sant' Antonio Abate. He executed many works also for the Abbot Don Jacopo, some frescoes in the monastery of San Miniato, near Florence, which still remain; others in the monastery of San Bernardo, at Arezzo; and others in distemper, in the monastery of Monte Oliveto near Florence. He executed also six of the series of frescoes illustrating the life of San Ranieri, in the Campo Santo at Pisa, which Vasari reckons among his best works; scarcely anything of them now remains, but there are prints of them in Lasinio's 'Pitture a Fresco del Campo Santo di Pisa.' There is a church at Arezzo which derived its name from a picture of the Madonna and infant Christ by Spinello; it was in the old Duomo, or cathedral, and when that church was pulled down, the fresco was cut out of the wall, and placed in a small church, which was thenceforth called the Madonna del Duomo, taking the name of the picture.

The principal works of Spinello are not mentioned by Vasari; they are in the town-hall of Siena, and are from the life of Pope Alexander III. Rumohr describes them in his 'Italian Researches.' Aretino was still painting them in 1408, which probably was the year of his death. Vasari says he died about 1400, aged 92; and assuming, upon this authority, that he died aged 92, in 1408, he was born, as mentioned above, in 1316. Vasari accounts for his death in a very singular manner: he says that in a fresco of Michael and the fallen Angels in the church of the brothers of Sant' Angelo at Arezzo, Spinello had painted the archfiend so hideous, that he appeared to Spinello in a dream, and asked him where he had seen him so ugly as he had had the audacity to paint him, which vision, says Vasari, frightened the painter to death. As however these works were painted about 1393, the vision was not so fatal to him. There is a print of the picture in Lasinio's old Florentine paintings. Aretino excelled in expression, and, in the opinion of Vasari, was a better painter than Giotto, and equal to him in design. His sons Forzore and Parri Spinelli placed a tablet to his memory with a very laudatory inscription, in the church of Sant' Agostino at Arezzo; but it has long since disappeared. Forzore was a jeweller; Parri became a very distinguished painter.

(Vasari, *Vite de' Pittori*, &c., and the Notes to Schorn's German translation; Rumohr, *Italienische Forschungen.*)

ARFE, the name of two very distinguished Spanish silversmiths, and the designers and constructors of several of the most costly tabernacles which do or did adorn the cathedrals of Spain.

Henrique de Arfe, the elder, and the grandfather of the other, Juan de Arfe, made, between 1506 and 1524, the silver tabernacles of the cathedrals of Leon, Cordova, and Toledo. The last, which is a Gothic design, and hexagonal, is ornamented with 260 small statues, besides bas-reliefs and other embellishments; it weighs rather more than 5292 ounces. It was gilded by Francisco Merino in 1599. The tabernacle also of the Benedictine monastery of Sahagun, was made by Henrique de Arfe, besides a great many crucifixes and other articles used in Roman worship.

The grandson, Juan de Arfe y Villafane, was born at Leon in 1535; his father Antonio, likewise a silversmith of ability, was his instructor. He is the artist of three of the finest tabernacles in Spain—those of Avila, Seville, and Osmas. That of Seville is the largest and most costly in Spain; it is 12 feet high, and its whole weight in 1668 was rather more than 17,397 ounces. It was completed in 1587, and Arfe himself published an account of it. If he was paid for this tabernacle as he was for that of Avila, reckoning a ducat as two Spanish dollars, he received for it 52,191 dollars, supposing its weight was not increased by some alterations which were made by Juan de Segura in 1668. He made also tabernacles for the cathedrals of Burgos and Valladolid, and one for the church of St. Martin at Madrid. Arfe was much employed by Philip II. and Philip III.; the former appointed him assayer of the Mint of Segovia. The date of his death is not known, but it was subsequent to 1590, for about that time he made the tabernacle of Osmas, in which he was assisted by his son-in-law Lesmes Fernandez del Moral. He was both engraver and writer; he wrote two works connected with the theory of his profession—'Quilatador de Oro, Plata, y Piedras,' Valladolid, 1572; and 'Varia Commensuracion para la Escultura y Arquitectura,' Seville, 1585. Of his engravings are mentioned the illustrations of the 'Caballero Determinado,' translated by Hernando de Acuña from the French of M. Olivier, and printed at Salamanca in 1573; also a portrait in lead of Alonso de Ercilla, in the first edition of his 'Araucana.'

(Ponz, *Viage de España*, &c.; Cean Bermudez, *Diccionario Historico*, &c.)

ARGES (Goldfuss). (Paradoxides bimucronatus of Murchison.)

ARI'STEAS. [Septuagint, P. S.]

ARJONA, MANUEL DE, born June 12, 1761, commenced his studies at the university of Osuna, his native town, and afterwards completed them at that of Seville, where he took his degrees in civil and canon law. Jurisprudence however did not become his professional pursuit, for he entered the church, and was made canon penitentiary in the cathedral of Cordova, and one of the chapter of the chapel royal of San Ferdinand at Seville. It was in this last capacity that he accompanied the Archbishop of Seville to Rome in 1797, when he received from Pius VII. the honorary appointment of one of his private chaplains. To scholastic erudition and classical learning Arjona joined an acquaintance with general literature, and distinguished himself by his efforts to promote a taste for such studies among his countrymen. He was one of the most active and influential members of the Academia de Letres Humanas at Seville, which institution could boast of many of the most intelligent individuals of that period. Although he is chiefly known by his poetical productions, a great number of other literary compositions were found among his papers after his death (July 25, 1820), including several on ecclesiastical history and canon law: among others, his 'Historia de la Iglesia Betica.'

(Quintana, *Tesoro del Parnaso Español.*)

ARKANSAS, which was a territory of the United States of America when the article in P. C. was written, was admitted into the Union as an independent State by an Act of Congress in 1836. The constitution was formed by a convention of delegates, which met on the 1st of January, 1836, and the election of governor, and other officers of the State, was commenced on the 1st of August, 1836.

The Senate consists of not less than 17 members, nor more than 33 (the number in 1844 was 25); the House of Representatives, of not less than 54 members, nor more than 100 (the number in 1844 was 75). Members of the Senate are elected for four years; members of the House of Representatives, for two years. The General Assembly meets every two years. Every white male citizen of the United States, who has been a citizen of the State of Arkansas for six months, is qualified to be an elector. All elections are by open voting. The governor holds office for four years, but is not eligible more than eight years in any period of twelve years. His salary is 2000 dollars per annum.

The judicial power is vested in a supreme court, a circuit court, county courts, and justices of the peace. The supreme Court consists of a chief justice, with a salary of 1800 dollars, and two associate justices, one of whom has a salary of 1800 dollars, the other of 1500 dollars. The judges are elected for eight years, by the General Assembly, by a joint vote of both Houses. The supreme court has appellate jurisdiction only, except in particular cases pointed out by the constitution.

The circuit court consists of seven judges, who are elected by the General Assembly for four years: each judge has his circuit, and a salary of 1000 dollars is paid to some of the judges, and 1200 dollars to others. The circuit court has original jurisdiction in all criminal cases not otherwise provided for by law; and exclusive original jurisdiction of all crimes amounting to felony at the common law; and original jurisdiction in all civil cases not cognizable before justices of the peace; and original jurisdiction in all matters of contract, where the sum in dispute is over 100 dollars.

Justices of the peace are elected by the people, and their term of office is two years. Judges of the county courts are chosen by the justices of the peace.

Slaves cannot be emancipated by the legislature without the consent of their owners. In all trials they have counsel assigned by the court for their defence, a fair trial by jury, and, if convicted, the same punishment as would have been inflicted on a white man. A debtor cannot be imprisoned except where there is strong presumption of fraud. Lotteries are prohibited.

The population of Arkansas in 1820 was 14,273, of whom 1617 were slaves; in 1830 it was 30,388, of whom 4576 were slaves; in 1840 it was 97,574, of whom 19,935 were slaves and 465 coloured freemen. The proportion therefore of whites to slaves was, in 1820, as 1 to ·127; in 1830, as 1 to ·177; and in 1840, as 1 to ·256; so that the proportion of slaves, which in 1820 was rather more than one-eighth, had risen, in 1840, to rather more than one-fourth. In 1840 the number of inhabitants to a square mile was 1·7; in 1830 it was only ·2. In comparison with the other states, Arkansas is the fifth in size, and the twenty-fifth in amount of population. It contains no town of 2000 inhabitants: it sends one representative to Congress, and has three votes in the election of the president. The state debt in 1842 was 2,676,000 dollars, which had been contracted for banking purposes.

Little Rock, the seat of government of Arkansas, is 1068 miles south-west from Washington, the capital of the United States. A few of the houses are of brick, the rest of wood. The population is less than 1000; but it has three cheap weekly newspapers.

(*American Almanac*, 1837, 1844, 1845; Featherstonhaugh's *Excursion through the Slave States.*)

ARLAUD, JACQUES ANTOINE, a very distinguished miniature painter, born at Geneva in 1668. He acquired a great reputation at Paris and at London. In Paris he was the instructor of the Regent Duke of Orleans, and had apartments in the palace of St. Cloud. He came to England in 1721, with letters of introduction to the Prince of Wales, afterwards George II., and returned in 1729 to his own country with a fortune of 200,000 francs: he died at Geneva, in 1743, and bequeathed many books, works of art, medals, and various curiosities to the library of that place. Part of his bequest were some pieces of a drawing of a Leda, which he made in Paris, said to have been copied from a basso-rilievo by Michelangelo. It appears to have been a wonderful performance, and was originally executed for the duke de la Force for 12,000 francs, but when it was finished he was unable to pay for it, and it remained in Arlaud's possession; he would not part with it, but he copied it for an Englishman for 600*l*. Arlaud cut up the original in a fit of piety, says Walpole. He destroyed it in 1738, but he cut it up anatomically, distributing the parts in various directions. Arland was originally educated for the church; he was a man of general acquirements, and was well versed in languages. While in this country he formed a friendship with Sir Isaac Newton, who corresponded with him after his retirement to Geneva. Among the miniatures which he painted in London was one of the celebrated duke of Marlborough. He painted also one of the Pretender's sisters, upon which Count Hamilton wrote a poem, which is in the fourth volume of his works. There is also an ode on Arlaud's Leda in the third volume of the Works of M. de Bar, Amsterdam, 1750.

(Descamps, *La Vie des Peintres Flamand*, &c.; Ebel, *Anleitung auf die nützlichste und genussvollste Art die Schweitz zu bereisen*; Walpole, *Anecdotes of Painting in England.*)

ARMAGH OBSERVATORY. The Observatory of Armagh was endowed and founded in 1791 by Archbishop Robinson, the great benefactor and improver of that city. He however died before it was finished; and it was neglected by his immediate successor, till the present primate, Lord John George Beresford, completed and surpassed the original design. It stands north-east of the town, on an eminence of compact clay, raised about 100 feet above the surrounding land, whose subjacent rock is mountain limestone. At the north horizon the ground rises about 3′, at a great distance; but to the south at six miles a hill has 25′ altitude.

From the centre of the dwelling-house a tower rises 40 feet, in which a large equatorial, by Troughton, is placed, under a revolving dome 15 feet in diameter, on an insulated pillar. This, which for many years was the only available instrument, was conceived, by its illustrious maker, to be capable of supplying the place of a transit and a meridian circle. In this he was of course mistaken; yet it will appear, by a reference to Mr. Pond's description of the Westbury circle (where results of its observations are given), that it was not inferior to any instrument then existing. Its hour-circle of 50 inches diameter, and declination-circle of 42, are divided to 5′ by dots, and read each by a pair of microscopes. Unfortunately the telescope has but 2¾ inches aperture, and therefore too little optical power for some of the most important uses of an equatorial. The clock is by Crossthwaite, with ruby pallets, and a gridiron pendulum.

At the east of the house, but connected with it, are,

1. A calculating-room, containing the observatory library, a mean-time clock by Skelton, with gridiron pendulum, and a machine for polishing specula, on Lord Rosse's principles, adequate to one of 30 inches aperture.

2. The transit-room, 19 feet by 13, with an observing aperture (or chase) of three, contains a transit instrument, by Thomas Jones, of 63 inches focal length and 3·8 aperture. This is constructed with tension bars on Troughton's plan; but is peculiar in the arrangement of its Ys, which have bearings, 1·5 inches long, faced with quartz, and have not even marked the pivots, after the constant use of 16 years. The counterpoises have been retained; but by their construction are prevented from disturbing the meridian plane of the instrument. Besides the usual circles at the eye end of the telescope, it has one of 10 inches diameter on the axis, which shows polar distance, and is now exclusively used. The level is by the Ertels of Munich, and of admirable quality. The transit clock is by Earnshaw, and may be reckoned unique; as the similar one, which he made for the late Mr. Larkins, is said to have disappeared. It is jewelled with singular profusion, and its case made as nearly air-tight as varnished mahogany and joints screwed up with waxed cloth admit; to which probably it is owing, that after 50 years its wheelwork exhibits no trace of wear. It is even wound up through a valve. It moving weight is 3 lbs., and its original pendulum was a gridiron weighing 21; but, as it was not completely compensated for temperature, this was changed for a mercurial

one of the same weight by the late Mr. Sharpe, in 1830, and at the same time barometer-tubes were applied, to correct for the varying density of the atmosphere. Its performance is now so good, that its predicted rate will *probably* not differ more from its observed than one-thirtieth of a second.

3. A tower contains the magnificent zenith sector, made by the younger Sisson, but divided by Bird, which belonged to the private observatory of George III. in Richmond Park, and was presented to the Primate by her Majesty, along with several other of its instruments. It turns freely in an insulated cast-iron framing, for the purpose of reversion, and is in perfect preservation, and of most beautiful workmanship; but, from an injudicious combination of wood and brass in its structure, does not keep its adjustments: this defect however is about to be remedied. The telescope has 4½ inches aperture: the arc, 6° on each side of the zenith, and 12 feet radius, is divided to 5′ by dots. In the upper story of this tower, under a sliding roof, is also placed a journeyman timepiece, and a triple 3½ feet achromatic provided with wire, and divided object-glass micrometers.

4. The circle-room, 15 feet by 13, has a mural circle by Thomas Jones, 56 inches diameter, and bearing a telescope similar to the transit. It is divided on the face next the pier, on an alloy of gold, and is read by twelve achromatic microscopes, so large that the observer's eye is 35 inches from the divisions, a size chosen to prevent their *runs* from changing with temperature. The illumination of them, as well as of the clock (by Earnshaw), and of the spider lines in the telescope, is effected by a single light placed in the centre of a circular frame bearing reflectors; and the movements of the instrument are produced without touching the circle. Unusual pains were taken by the artist to ensure the accuracy of every part; the steel pivots of 6½ and 2½ inches diameter were turned with a point of diamond, and the graduation has been verified with extreme care. In this room are also a 10 feet Newtonian, made specially by Sir W. Herschel for George III., and one of 2 feet focal length and 6 inches aperture by Short, in excellent preservation, which can be used in any of the three forms. These are, when employed, moved to an adjoining terrace. It has also a barometer by Newman, similar to the standard one of the Royal Society; and the external thermometer, and other meteorological instruments, are at a northern window in the passage to the eastern dome.

5. This, also of 15 feet diameter, contains a large reflector equatorially mounted by Mr. Grubb of Dublin. It is 15 inches aperture and 112 focal length. It is Cassegrainian, with the higher powers; but for sweeping and observing comets the Newtonian form is preferred, as giving a wider field. This, with a power of 115, is 38′; on good nights the Cassegrain acts well with 700. Both have wire micrometers provided with means of illuminating the lines in a dark field. Though the moving parts of this huge instrument (which, with the transit and circle, were the gift of the present Primate) weigh half a ton, it moves with remarkable facility and steadiness; and, besides the usual tangent movements, has one in right ascension, by clockwork, provided with Mr. Grubb's regulator, which, under favourable circumstances, has kept a star *on the wire* for the entire hour during which it goes. The axes of the equatorial are cast-iron, and its circles of 9 and 10 inches diameter are divided to 15′. The hour circle has only two verniers, but the other has a pair of micrometer microscopes, by which it can identify a star with a probability of about four seconds. The finder of the telescope is a fine achromatic of 7 feet focus and 3·3 aperture, with powers from 10 to 300, the latter serving to try the favourable state of the air before uncovering the reflector, and also to make observations for finding the instrumental errors, as the large speculum cannot be prevented from shifting a little on reversing.

All the illuminations required about these instruments are derived from gas-light; the products of combustion are conducted through the roof, and the eyes of the observer are screened from all direct light.

The observatory is directed by an astronomer nominated by the Primate, and subject, under an Act of Parliament, to a board of visitors, consisting of his Grace, the dean and chapter of the cathedral, and four elected governors. He has an assistant of his own appointment, and there is a small fund for maintaining the buildings and instruments, but, unfortunately, none for publishing the observations.

The constants of the observatory are, as far as they have yet been determined,

Latitude	54° 21′ 12·7″ north.
Longitude	0h. 26m. 35·5s. west.
Height above base-plane of Ordnance Survey	211·0 feet.
Magnetic variation, Sept. 16, 1833 .	28° 37′ west.
——— Dip, Jan. 1, 1837 . .	70° 40′
——— Intensity	1·0242
Mean temperature	47·76°
Mean barometric pressure . . .	29·669

ARMIN, ROBERT, a favourite comic actor and small author, was a contemporary of Shakspere, and a member of the same company of players. Armin was a pupil of the famous actor Tarleton, who died in 1588: he was in Scotland on one of the visits paid to that country by the English actors: he was one of the players licensed by King James on his accession to the English throne in 1603; and the latest publication that is certainly his appeared in 1609. In the first folio of Shakspere he is named as one of the actors who had played in the great poet's dramas: and an expression of his own, elsewhere, indicates that he was one of those (though certainly not the first) who performed the part of Dogberry. Armin wrote recommendatory prefaces and similar addresses for several pamphlets of his day. His own principal or only works were the following:—1, 'The Italian Taylor and his Boy,' 1609 (re-printed 1810), a novel of Straparola, rendered into doggrel English verse; 2, 'A Nest of Ninnies,' 1608 (re-printed, with a notice of the author, for the Shakspere Society, 1842), which is a collection of anecdotes of fools and jesters, philosophised in the worst taste of the writer's times; 3, 'The History of the Two Maids of Moreclacke,' a drama, printed in 1609.

ARNI'CA, a genus of plants belonging to the natural order Compositæ, the tribe Vernoniaceæ, the sub-tribe Senecioneæ, and the division Eusenecioneæ. It has a cylindrical involucre with equal 2-rowed scales; the flowers of the disk hermaphrodite, tubular, the limb 5-toothed, the stigmas thickened above, and terminated with a conical pubescent apex, the flowers of the ray female bearing degenerated stamens, or with only the rudiments of an anther; the achenium winged and striated; the receptacle naked; the pappus hairy. One species of this genus grows in Europe, the A. montana, and is known by the common name of leopard's-bane. It has oblong-obovate, nearly entire, 5-nerved radical leaves, a few-flowered stem, with villose or glandulose pubescent peduncles and involucres. This plant is not found in the British Isles, but is abundant in the meadows and forests of mountainous districts in the middle and north of Europe, and also on the Alps. It blossoms in June and July.

This plant was at one time admitted into all the British Pharmacopœias, but at the present time is only retained in the Dublin. It does not appear ever to have been much used in this country, and perhaps never sufficiently to refute or confirm the strong recommendations of it by German writers. In Germany all parts of the plant are used, the flowers, leaves, and root. The whole plant, but especially the root, possesses a peculiar aromatic but not pleasant odour, and a nauseous taste. The plant has been examined by various chemists, and in every part there has been found an acrid resin and a volatile oil. In combination with these Chevallier and Lassaigne found in the flowers an acrid bitter principle, which they have called Arnicine, and the root contains a considerable quantity of tannin. In large doses it produces inflammation of the alimentary canal and coma. In small doses it acts as a general stimulant, increasing the pulsations of the heart, and acting as a diaphoretic and diuretic. It is used in Germany in cases of low fever, also in nervous diseases, in amenorrhœa and adynamic diseases generally. The root by means of its tannin acts as a tonic on the system. The root is given in powder in the dose of about ten grains, three times a day, or in infusion. The flowers are used in infusion, in the proportion of one drachm of the flowers to eighty of boiling water, of which two ounces may be given at a dose. In making this infusion care should be taken that the pappus be prevented from getting into it by means of straining through a linen bag. The German Pharmacopœias contain several preparations of arnica, amongst others a tincture, an extract, an essence of the flowers, and a vinegar (acetum arnicæ). Amongst homœopathic practitioners the tincture is applied to wounds and bruises, and other external uses, and infinitesimal doses of this substance are recommended, according to their practice, in many severe diseases.

(Bischoff, *Medicinisch-pharmaceutische Botanik*, 1844; Christison's *Dispensatory*.)

ARNOLD, THOMAS, D.D. The events in the life of this able man and distinguished schoolmaster are comparatively few. Thomas Arnold was born at Cowes, in the Isle of

Wight, June 13, 1795. His father, William Arnold, was collector of the customs in that place, where the family, originally from Lowestoff in Suffolk, had resided for two generations. His education when a child was under the direction of his aunt. At the age of eight he was sent to Warminster, and four years afterwards to Winchester College. As a boy he was remarkably shy and indolent, a character which presented a strong contrast to the frankness and activity of his subsequent life. At school his favourite pursuits were history and poetry. Having written a play, and a long poem after the manner of Scott, he was called Poet Arnold, to distinguish him from another boy of the same name. In 1811, in his sixteenth year, he was removed to Oxford, having obtained a scholarship in Corpus Christi College. Here, stimulated by the love of the real, which was one of the prominent features of his character, he devoted his attention chiefly to the philosophers and historians of antiquity, among whom his favourite authors were Aristotle and Thucydides. He is represented by those who knew him to have been at this time fond of discussion and vehement in argument; fearless in advancing his opinions, and stiff in maintaining them; extremely liberal in his views, which he held with a firm conviction of their truth, but which often startled the Church and State Tories by whom he was surrounded. With this intellectual boldness and independence, he combined no arrogance or conceit; but a disposition so generous and affectionate, that those who differed most widely from him in opinion never failed to respect and love him, many of whom continued his friends to the latest period of his life. In 1814 he took a first class degree, and the year after was elected Fellow of Oriel College. In 1815 and 1817 he was chancellor's prizeman for the Latin and English essays. Having overcome certain scruples respecting some points in the Thirty-nine Articles, with which he appears to have been harassed about the time he graduated, he was ordained deacon in 1818, and priest in 1828, when he undertook the chaplaincy of Rugby School. In 1820 he married Mary, youngest daughter of the Rev. J. Penrose, rector of Fledborough, Notts, having in the previous year settled at Laleham, near Staines, where he employed himself in the preparation of seven or eight young men for the universities. Here a great and decisive change came over his character. The indolence and restlessness by which his early years had been marked, entirely disappeared, and he acquired those settled, serious, earnest views of the nature and purpose of life, which actuated him ever after. It was this 'intense earnestness' which gave him so much power over his pupils, and which roused every one who came within the sphere of his influence to the consciousness that they had powers to cultivate, duties to discharge, and a mission to accomplish. The time which was not occupied with his pupils was devoted to collecting materials for his edition of Thucydides, writing articles on Roman history for the 'Encyclopædia Metropolitana,' and preparing the way for his History of Rome, which he did not live to finish.

In August, 1828, he entered upon his duties as head master of Rugby School, to which he had recently been elected. Here his great talents for instruction and the management of young men acquired a suitable sphere for their activity. The result was soon apparent, not only in the eminence which Rugby rapidly obtained, but in the beneficial change which, by its example, was impressed upon other institutions of a similar nature. Dr. Arnold retained the old classical basis of tuition, but gave it breadth by connecting it with other departments of learning; inspired it with life and vigour by the practical views to which he directed it; and imparted to it elevation and dignity by what had heretofore been wanting in public schools—the introduction of a high moral and Christian element: so that Rugby became in the true sense of the word the seat of an enlightened and Christian education. He treated his pupils with the affection of a friend and the courtesy due to gentlemen, as well as with the authority of a master. As he could not come into frequent personal contact with every one among them, he governed the school, and made his influence felt through the whole of it, by means of the sixth form, or highest class of boys. To add to their authority, and for the sake of maintaining order and government among the boys themselves, he kept up the system of fagging; but he stripped it of its repulsive features and invested it with a moral force, by making it the ground of a solemn responsibility on the part of those who exercised the power. His views on this subject will be found in the 'Journal of Education,' 1834-5, to which there is a Reply by Professor Long, the editor of that work.

In this occupation he spent the last fourteen years of his life; and during that period, though so diligently engaged in his own proper duties, took the deepest interest in all the public events and political questions of the time. He was one of the most decided opponents of the Oxford new school of theology. His idea of a Christian church was first given in his pamphlet on Church Reform, which he was induced to publish in 1833, in consequence of the apprehensions he entertained of the danger which then threatened the establishment. His theory is much the same as Hooker's, that the church and state are identical—that a church is a Christian state. His views on this subject are again stated in his Fragment on the Church recently published; in which he hits the key-stone of the Tractarian heresy, in attacking what he considers to be their false notions of the Christian priesthood.

In 1835 the office of a Fellowship in the Senate of the new London University was offered to Dr. Arnold by Mr. Spring Rice, the Chancellor of the Exchequer, and the office was accepted. Dr. Arnold at first consented to join the University 'without insisting on a Scriptural examination, on the alleged ground of fact, that such an examination was not practicable on account of the objections of different classes of Christians, and on the hope, which he distinctly expressed, that the Christian character of the University might be secured without it.' But he subsequently became convinced that 'the Scriptural examination was both practicable and all but indispensable, and he gave notice of his intention of recommending the introduction of the Scriptures as a part of the classical examination for every degree.' In December, 1837, he succeeded in carrying a resolution 'that, as a general rule, the candidates for the degree of Bachelor of Arts shall pass an examination either in one of the Four Gospels or the Acts of the Apostles in the original Greek, and also in Scripture History.' In consequence of the remonstrances from various bodies of Dissenters and from the Council of University College, London, and partly in consequence of the strong representation of the Secretary of State (Lord John Russell), through whom an appeal had been made by the remonstrants to the law officers of the Crown, a larger meeting of the Senate of the University of London was held, in February, 1838, in which the former motion was overruled, and in its place it was resolved, 'that examination in the Hebrew text of the Old Testament, and in the Greek text of the New, and on Scripture History, shall be instituted in this University; and that all candidates for degrees in arts may, if they think proper, undergo such examination.' The Senate immediately proceeded to institute a voluntary examination, with prizes, in the texts of the Old and New Testaments and in Scripture History. Dr. Arnold finally withdrew from the Senate of the London University, in November, 1838, being led, 'after the fullest consideration and inquiry, to the conclusion that the voluntary examination would not be satisfactory' (Letter to the Earl of Burlington, Stanley's *Life of Arnold*, ii. p. 126), or, as he expresses himself in another passage of the same letter, would not 'satisfy, either practically or in theory, those principles which appeared to him indispensable.' The history of this transaction is given at length in Stanley's 'Life of Arnold' (ii. p. 10, &c.), and Dr. Arnold's views and opinions appear from various letters in the same volume (pp. 13, 83, 91, 94, 107, 126). The history of the London University is given in P. C. [UNIVERSITY OF LONDON], and the various documents about the examination on religious subjects in that university are contained in the Parliamentary Papers (No. 598) relative to the University of London, printed by order of the House of Commons in 1840 (pp. 26, 27).

Dr. Arnold's mind was early directed to the social condition of the working classes of this country; and many efforts were made, and a variety of plans devised by him, not only for improving it, but for directing the attention of the public to a subject of so much importance. For this purpose he gave lectures at the Rugby Mechanics' Institute, started a newspaper in 1831 expressly for the use of the lower orders, and in the same year, and also in 1832, wrote letters in the 'Sheffield Courant' and subsequently in the 'Herts Reformer.' He was one of the first to perceive the necessity of introducing a moral element into the measures intended for the social benefit of the masses; without which the extension of the franchise would be useless, if not pernicious.

The Whigs, to which party he was more nearly assimilated in opinion than to any other, offered him some preferment which he did not accept. The year before his death, however, he was appointed by Lord Melbourne to the regius-professorship of modern history at Oxford—an appointment which gave him the most lively satisfaction. But he lived to deliver only his introductory course of lectures. When at the very summit of his reputation as a teacher, and at the time when the odium in which, for the liberality of his religious and political opinions, his name had been held by men of his own profession was fast disappearing, and the grandeur of his character was every day becoming more manifest and more distinctly understood, he was seized with a fatal disease, which carried him off in a few hours. He died on the 12th of June, 1842, at the close of the half-year, of spasm at the heart, and was buried in the chapel at Rugby. If he had lived another day he would have entered upon his 48th year. He left a widow, with five sons and four daughters. It is intended to found scholarships to his honour, bearing his name, the means for which have been already raised.

His correspondence is the best record of his life, and affords the most vivid representation of his character. It presents us with the progressive development of his mind and views, till the one reaches the vigour and the other the comprehensiveness for which at length they became distinguished. He combined the intellectual and the moral in a degree and with a harmony rarely found. The most strongly marked feature of his intellect was the strength and clearness of his conceptions. It seemed like the possession of an inward light, so intense that it penetrated on the instant every subject laid before him, and enabled him to grasp it with the vividness of sense and the force of reality. Hence what was said of his religious impressions may be used to characterize his intellectual operations:—'He knew what others only believed; he saw what others only talked about.' Hence also perhaps arose in a great measure the vehemence with which he opposed views and notions contrary to his own. Of his moral nature, honesty and fearlessness, earnestness and love of truth and justice, were the prominent qualities. And though these were calculated to give an aspect of sternness to the outline of his character, yet they were tempered with an expansive benevolence, and combined with a tenderness of disposition, which rendered him an object of the most devoted attachment to all about him. It was said by one who knew him well, that 'he loved his family as if he had no friends, his friends as if he had no family, and his country as if he had neither family nor friends.'

His great work, and the one by which he will be remembered, are his three volumes of Roman History, comprehending the period between the origin of the state and the end of the Second Punic War. To these another volume is to be added, comprising his contributions to the 'Encyclopædia Metropolitana,' and carrying on the History to the time of Trajan. In the Notes and Dissertations to his edition of Thucydides, he has given a social and political as well as a critical interest to his author. History and divinity—man and man's relation to God—were his favourite studies. In both he preferred the practical to the theoretical. His five volumes of sermons demonstrate with what earnestness and devotion he laboured to bring religion into the daily concerns of men, and to invest every act of life with a Christian character.

His remaining productions are—a volume of Lectures on Modern History, delivered at Oxford; pamphlets on a variety of subjects; articles in several reviews; together with a posthumous tract on the Church. To these it is understood that a volume of Essays will be added.

(Stanley, *Life and Correspondence of Dr. Arnold*, 4th ed.)

ARREST [Arrest, P. C.] With regard to arrest on Mesne Process, the law has been materially altered by the statute 1 & 2 Vict. c. 110, §§ 2, 3, 4, 5, 6. Since that statute all civil actions, except the three real actions which still exist, must be commenced by Writ of Summons, and no defendant can be arrested before a judgment has been obtained against him, unless it be shown by the affidavit of the plaintiff, or of some other person, to the satisfaction of a judge of one of the superior courts, that such plaintiff has a cause of action against the defendant to the amount of 20*l*. or upwards, or has sustained damage to that amount, and that there is probable cause for believing that the defendant is about to quit England unless he be forthwith apprehended. The judge is then authorised to issue a writ of Capias against such defendant; the proceedings upon such writ are the same as they were under the writ of Capias, which formerly was used as the commencement of all personal actions which were commenced in the superior courts of common law, when the object was to arrest a person or hold him to bail. [Capias, P. C.]

This application to the judge may be made and the defendant arrested at any time after the commencement of the action and before final judgment shall have been obtained therein.

The statute 7 & 8 Vict. c. 96, has also effected a very important alteration in arrest on final process or in execution. The 57th section enacts that no person shall be taken or charged in execution upon any judgment obtained in any of her majesty's superior courts, or in any county court, court of requests, or other inferior court, in any action for the recovery of any debt wherein the sum recovered shall not exceed the sum of 20*l*. exclusive of the costs recovered by such judgment.

And the 58th section has a retrospective effect, empowering all persons in execution at the time of the passing of the act on any judgment in any action of debt, wherein the debt, exclusive of the costs, did not exceed 20*l*., to apply to a judge to be forthwith discharged out of custody; the judgment however is still to remain in force after the discharge of the debtor, and the creditors may have their remedy by execution against his property and effects.

Certain personages were from the earliest times privileged from arrest or civil process; either entirely so, or temporarily. A list of them is given in Blackstone's *Comm.* vol. iii. Lee's ed. note 23.

ARREST OF JUDGMENT. After an action at law has been carried through all the stages previous to the judgment, and the plaintiff has up to this point been successful, the defendant may still move in arrest of judgment: that is, he may pray the court to withhold or arrest the judgment from the plaintiff, on the ground that there is some error appearing on the face of the record, which vitiates the proceedings. In consequence of such error, on whatever part of the record it may arise, from the commencement of the suit to this period, the court is bound to arrest the judgment. The error must be such as is apparent on the record: and generally speaking, it must not be an error in a mere point of form. This was formerly otherwise; but certain statutes have been passed at different periods, called the statues of jeofails and amendments, by the effect of which judgments at the present day cannot, in general, be arrested for any merely formal objection. (The statutes of jeofails and amendments are 14 Ed. III. c. 6; 9 Hen. V. c. 4; 4 Hen. VI. c. 3; 8 Hen. VI. c. 12, 15; 32 Hen. VIII. c. 30; 18 Eliz. c. 14; 21 Jac. I. c. 13; 16 & 17 Car. II. c. 8; 4 & 5 Ann. c. 16; 9 Ann. c. 20; 5 Geo. I. c. 13.)

For further information on this matter, see Blackstone's *Comm.* iii. ch. 24; Stephen *On Pleading*; Comvn's *Dig.*, tit. 'Pleader,' § 48.)

ARRESTMENT in the law of Scotland is a process by which a creditor may attach money or moveable property which a third party holds for behoof of his debtor. It bears a general resemblance to foreign attachment by the custom of London. [Attachment, Foreign, P.C., p. 50.] The person who uses it is called the arrestor; he in whose hands it is used is called the arrestee, and the debtor is called the common debtor. It is of two kinds, arrestment in execution and arrestment in security. The former can proceed only on the decree of a court, on a deed which contains a clause of registration for execution, or on one of those documents, such as bills of exchange and promissory notes, which by the practice of Scotland are placed in the same position as deeds having a clause of registration. Arrestment in security is generally an incidental procedure in an action for the constitution of a debt; but it may be obtained from the Bill Chamber of the Court of Session on cause shown, as a method of constituting a security for a debt not yet due. This latter class of arrestments is under the equitable control of the judge who issues it; and it is a general principle that it cannot be obtained unless the claimant show that circumstances have occurred which have a tendency to make his chance of payment less than it was at the time when he entered into the engagement with his debtor. An arrestment may be recalled on it being shown that it should not have been issued, and an arrestment in security may be 'loosed' on the debtor finding security for the payment of his debt. An arrestment in execution expires on the lapse of three years from the date of its execution, and an arrestment in security, on the lapse of three years from the day when the debt becomes due. In the meantime, the person in whose hands the process is used, is liable in damages if he part with the property arrested, but it cannot be attached after he has parted with it, in the hands of a *bonâ fide* holder. The arrestment is made effectual for the payment of the debt by an action of Forthcoming, in which the common debtor is cited. It concludes for payment of the money if the arrestment be laid on money, or for their sale for behoof of th creditor, if it be laid on other moveable goods. The arrestee may plead against the arrestor whatever defence he might have had against the common debtor. The authority of the local courts was enlarged in regard to arrestments, and the process was generally regulated, by the 1 & 2 Vict. c. 114. The practice on this subject will be found in Darling's 'Powers and Duties of Messengers-at-Arms.'

ARRIA'ZA, JUAN BAUTISTA, one of the most noted modern Spanish poets, was born at Madrid in 1770. After his first studies at the seminary of nobles in that capital, he entered the military college at Segovia, and on quitting it began to serve in the navy; but owing to some disorder which produced an incurable defect of vision he was obliged to renounce that career in 1798, previously to which he had displayed his literary talents in a poem on the last Duke of Alba (1796), and an anonymous volume of poetry, entitled 'Primicias,' 1797. Upon giving up the naval profession, he came to England in quality of secretary to the Spanish embassy, and while in this country he completed his 'Emilia,' a poem of the didactic descriptive class, chiefly with reference to the fine arts and their influence (published at Madrid, 1803). After spending about two years at Paris, he returned home in 1807, just before the breaking out of the revolution in Spain, when taking an active part in politics, he declared himself a decided and uncompromising supporter of legitimate monarchy, and the staunch opponent of the Afrancesados, and of the Cortes, whom he attacked in his literary as well as in his political capacity, both in verse and prose, first in his 'Poesias Patrioticas,' wherein he adjured his countrymen to maintain their national independence; next in his 'Discursos Politicos.' This zeal in behalf of monarchy and legitimacy did not pass unrewarded by Ferdinand VII., who bestowed on him various marks of favour, and among other appointments that of secretary of council; also a post in the ministry for foreign affairs. He died at Madrid in 1837.

As a poet Arriaza stands very high among contemporary Spanish authors, especially in point of popularity, for six editions of his poems, exclusive of a Paris one, appeared in his lifetime. Much of their success is no doubt to be attributed to the public sympathy which they excited by strongly appealing to feelings of patriotism; yet independently of such interest they are remarkable for felicity of style and beauty of versification.

(*Conv.-Lexicon der Gegenwart; Ochoa, Apuntes.*)

ART-UNIONS. In the Report issued in 1836 by a Select Committee of the House of Commons, which had been appointed in the preceding year 'to inquire into the best means of extending a knowledge of the arts, and of the principles of design, among the people (especially the manufacturing population) of the country,' and 'to inquire into the constitution, management, and effects of institutions connected with the arts,' it is observed that among exhibitions connected with the encouragement of art, the attention of the Committee had been called to the institutions established in Germany under the name of 'Kunst-Vereine,' and which were even then being introduced into this country. 'These associations, for the purchase of pictures to be distributed by lot,' observe the Committee, 'form one of the many instances in the present age of the advantages of combination. The smallness of the contribution required brings together a large mass of subscribers, many of whom without such a system of association would never have been patrons of the arts.' The Committee further remark that the Germans Waagen and Von Klenze, two of the witnesses examined by them, highly estimated the advantages conferred on the arts by such associations, which, according to Waagen, were introduced into Prussia about the year 1825, under the patronage of the king and his minister Von Humboldt.

Down to the time at which this Report was published, such associations had made comparatively little progress in this country; but shortly after its appearance a number of gentlemen, among whom were Mr. Ewart, the chairman of the Select Committee referred to, and four other members of parliament, established a society under the name of 'The Art-Union of London,' which immediately obtained considerable support, and which has since increased to a magnitude far greater than that of any kindred association. The professed objects of this institution are 'to aid in extending the love of the Arts of Design within the United Kingdom, and to give encouragement to Artists beyond that afforded by the patronage of individuals;' and the mode in which these objects are attained is briefly as follows:—Every member of the association subscribes annually the sum of 21*s*. or upwards, those who choose to subscribe two, three, four, five, or more times that amount being considered to hold a proportionate number of shares in the prospective benefits; and, on the closing of the annual subscription-list, which takes place early in the spring, the Committee of management set apart a portion of the aggregate sum for the purpose of engraving and printing some work of art, a copy of which is given to every subscriber for each guinea subscribed. By the combination of a very great number of persons to subscribe for this one work of art, and the avoidance of risk, incidental expenses, and publisher's profits, this print, though at least equal to what would be charged a guinea in the ordinary course of trade, is supplied to the subscribers at so small a cost as to leave by far the greater part of the sum subscribed, as a fund applicable to the purchase of pictures, sculpture, and other works of art. This sum is divided by the committee into several portions, or prizes, ranging from 10*l*. to 400*l*., and on the day appointed for the annual meeting of the society these prizes are distributed among the subscribers by a process resembling the drawing of a lottery, which gives an equal chance for every guinea subscribed. The prizeholders are then allowed to select works of art to the value of their respective prizes from any of the five annual exhibitions of works of art in the metropolis, for the current year, which works, when selected by the prizeholders, are purchased and paid for by the committee, who, at the close of the exhibitions, collect the pictures and sculptures together, and exhibit them gratuitously for some weeks, first to the subscribers and their friends, and afterwards to the public. When the selected works fall short of the amount of the prize, the difference is carried by the committee to the Reserved Fund of the association, and when they exceed it, the difference is paid by the prizeholder. A portion of the funds is also applied to the offering of premiums for original designs, and the production of bronzes and medals. The amount of subscriptions in the first year, which closed in 1837, was 489*l*. 6*s*., but it has increased so rapidly that the last Report, that for 1844, shows a subscription of 14,848*l*. 1*s*., of which 8590*l*. was set apart for the purchase of works of art, being divided into 258 prizes of various amounts, in addition to which every subscriber has received a series of 22 outline illustrations of the 'Pilgrim's Progress,' the result of premiums offered by the society, and will also, on its completion, receive an impression of a line engraving by a first-rate artist from a landscape by Stanfield. The annual exhibition of prizes, or selected pictures, affords another important means of fostering a national love of art; that of the year 1843 was open for four weeks, during which it was visited by nearly 200,000 persons.

The success of the 'Art-Union of London' has given rise to many similar associations, one of which has for its object the promotion of the fine arts in Ireland. In this, and some others, the works of art are selected by the committee themselves, and afterwards divided by lot. The popularity of the Art-Unions, properly so called, has also brought into operation several lotteries for the disposal of works of art, in which, notwithstanding the adoption of a similar course of proceeding, the principle is essentially different, such being considered by many persons as mere revivals of a species of gambling speculation which has long been illegal in this country; and, notwithstanding the opinions of some eminent counsel in favour of the legality of Art-Unions, the difficulty of dissociating them from lotteries unquestionably illegal, led government to issue a notice in April, 1844, which had the effect of suspending their operations for some months. A parliamentary committee was subsequently appointed to inquire into the subject, with a view to placing them on a safe and permanent basis, and so rendering them as subservient as possible 'to the improvement and diffusion of art through the different classes of the community;' but, as the investigations of this Committee could not be brought to a close in time for introducing a bill for their regulation in the session of 1844, a short act was passed to indemnify the managers against such penalties as they might be considered subject to, for one year, so as to allow their proceedings to be immediately resumed, and the money then in hand to be expended before the close of the exhibitions for the year; and it is understood that early in the present session (1845) a bill will be introduced to carry out the objects for which the Committee was appointed.

ARTEMI'SIA ABSINTHIUM (WORMWOOD)—*Medical Properties of.* This indigenous perennial plant is met with on waste places, but what is required for medical use is mostly cultivated. The upper part of the stem, with the leaves, and unexpanded flowers, should be collected, for these parts possess the peculiar aroma, with a strong bitter taste; while the lower part of the stem is merely aromatic, and devoid of bitterness. (Geiger.) It imparts its properties to water, to alcohol, and to fermented liquids. The medicinal forms of it are—the watery infusion (best made with cold water) and the extract: but the domestic preparations are numerous; these are made either by digesting it with alcohol, to form a tincture, or by distilling it with spirits—that obtained in this last way from Switzerland is termed 'Eau d'absinthe, and is a favourite liqueur, which becomes milky on the addition of water; it is also steeped in wines (Wermuth), or even rendered a constituent of the wine at the time of fermenting it (WINES, P. C., vol. xxvii. p. 465), or drunk in small quantity while using any of the sweet wines, such as Tokay. This practice may have been derived from the antients, most of whose wines were very rich and luscious, and who used wormwood, both before and after taking wine, to counteract the effects. (Paulus Aegineta.) In the west of England it is frequently steeped in cider, to be drunk by persons disposed to calculous complaints: a most judicious proceeding. Elsewhere it is steeped in ale. In the north of Europe it is used as a substitute for hops in the preparation of beer, and is nearly as good, as a little of it will preserve either beer or weak wines when ready to turn. The analysis by Heyne of 100 parts of the dried plant gave as its composition—volatile oil ?, bitter extractive 4·0, gummy mucilage 15·1, resin soluble in aether 8·6, resin insoluble in aether 3·4. The rest consists of woody fibre, water, and loss. Braconnot analyzed the watery extract, and found—volatile oil 0·15, green resin 0·60, bitter resin 0·233, albumen 1·250, starch 0·133, azotized matter 1·333, bitter azotized matter 3·0, woody fibre 10·833, absinthate of potash 0·333, sulphate of potash and chloride of potassium, traces; water 61·2. Recently a peculiar principle termed *Santonine*, crystallizable, colourless, and almost tasteless, and stated to possess very valuable anthelmintic properties, has been obtained from several species of artimesia, particularly Art. Contra, but whether it exists in A. Absinthium is undetermined. (*The Chemist*, vol. v. pp. 86, 91.) The so-called salt of wormwood is merely the impure carbonate of potash, obtained from the incineration of this plant, which is very rich in alkaline salt.

Wormwood possesses the properties common to aromatic bitters, but it seems to possess also some peculiar ones rendering it worthy of more attention than it receives—neglect of indigenous remedies being prevalent in all ages. The bitter principle is readily absorbed, so that the flesh of animals fed upon it becomes manifestly bitter; some have alleged that a narcotic power exists in it, and that the milk of cows, or of nurses, to whom wormwood is given, is noxious to infants. This is not clearly proved, nor is it certain that ale in which wormwood has been steeped (purl) is more heady than other ale. Absinthium greatly increases the appetite, and promotes digestion, particularly in torpid systems and debilitated constitutions. Those who, by excess, have impaired their stomachs, have recourse to wormwood to renovate their powers. Hence the demand among gourmands for the spirituous preparations, such as the Crême d'Absinthe. Where there is much gastric irritation or vascular excitement this is most improper. An infusion (made with cold water) may be given to consumptive patients, if no inflammatory state of stomach exists, with very great advantage, especially if aromatic sulphuric acid be added.

ARTHRO'PTERUS, a fossil fish from the lias near Bristol. (Agassiz.)

ARTICLES (Ecclesiastical Law). [ALLEGATION, ECCLESIASTICAL, P. C. S.]

ARTICLES OF THE PEACE, a term applied to a recognizance or obligation to the king, entered on record, and taken in some court by some judicial officer, whereby the parties acknowledge themselves to be indebted to the crown in the sum required, with condition to be void and of none effect if the party shall appear in court on such a day, and in the mean time shall keep the peace. (Blackstone, *Comm.* iv. ch. 18; Burn's *Justice*.)

ARTICLES OF WAR. [MUTINY ACT, P. C.]

ARTIFICIAL HORIZON is generally a cylindrical cup about three inches in diameter, or a rectangular trough, either of them about half an inch deep and containing quicksilver. A circular plate of glass, whose surfaces should be accurately parallel to one another, is laid on the surface of the quicksilver in the cylindrical cup, but the trough is usually covered by a roof with two inclined planes, each of which is a frame carrying a plate of glass with parallel surfaces. By these means the wind is prevented from agitating the fluid.

The surface of the quicksilver being considered as a plane perpendicular to a diameter of the earth, or rather to a normal, at the place of the observer, is parallel to the rational horizon of that place; and consequently the angle between the plane of the quicksilver and a visual ray from the object to that plane, when corrected for refraction and parallax, is equal to the angular elevation of the object above the true horizon of the place.

Artificial horizons of the kind just mentioned are generally used on land for the purpose of obtaining the altitude of a celestial body by means of an octant, sextant, or reflecting circle, either held in the hands or supported on a small pillar; occasionally also it is employed to obtain the angular elevation of a terrestrial object, as the top of a tower, a mountain, &c. The rays of light from the object, falling on the quicksilver, are reflected from thence to the eye of the observer; and, by the laws of reflexion, the angles made with the reflecting surface by the incident and reflected rays are equal to one another; hence the reflected image of the object appears as much below the horizon, or surface of the quicksilver, as the object itself is above it; and on bringing, by the motion of the index of the sextant, the direct and reflected images to coincide, the angle read on the arc will, the eye being very near the quicksilver, be equal to twice the angle of elevation.

In a regular observatory, the trough containing the quicksilver is, sometimes, several feet long, in order to avoid as much as possible the necessity of changing its place according to the distance of the celestial body from the zenith.

When the atmosphere is very calm, water under a glass-roof may be used instead of quicksilver, but almost the least agitation of the air is sufficient to disturb the reflected image.

On a journey the conveyance of quicksilver is often inconvenient; and therefore scientific travellers have attempted to use, as an artificial horizon, a circular plate of polished metal, or a dark glass, from which light may be reflected as from a mirror. The horizontality of such an instrument is ascertained by means of a spirit-level placed upon it, and the adjustment is effected by three screws which pass through the frame of the mirror at equal distances from one another.

Since, with the usual reflecting instruments, double altitudes exceeding about 120 degrees cannot be observed, the artificial horizon just described would be useless, if the altitude of the object were greater than 60 degrees; they can however be employed with instruments similar to those invented by Captains Fitzroy and Beechey, by which angles exceeding 180 degrees may be observed.

The artificial horizons permit very accurate observations to be made on land, but it is evident that they cannot be used at sea, even though well suspended in jimbals, on account of the unsteady motion of the ship; and some means of enabling a seaman to observe correctly the altitudes of celestial bodies when the sea-line is invisible, or but faintly seen through the vapours near the horizon, is still a desideratum.

It is known however that when a conical or a cylindrical body terminating at the lower extremity in a point is caused to revolve rapidly on its axis, that axis soon takes, and for at least half an hour maintains, a vertical position; and efforts have been made to employ such a body, having a mirror on its upper surface, as an artificial horizon on board a ship. A 'Nautical Top,' as it was called, was proposed by a Mr. Serson, and is described in the 'Philosophical Transactions' for 1750; but, on being tried at sea, its irregularity was found to be great, and the contrivance was abandoned. The late Mr. Troughton however, in 1818, made considerable improvements on the original construction, but his success was not such as to render the machine available. He made the *top* at first cylindrical, but he afterwards gave it the form of a frustum of a cone; the reflecting plane formed the upper surface, and immediately under this was a stem terminating below in a steel point, which rested on the concave surface of a small steel cup. A rapid motion was communicated to the machine by a series of wheels, of which the first was turned by means of a handle on its circumference.

The only contrivance which appears likely to serve the purpose of an artificial horizon at sea is a spirit-level applied to the face of an octant or sextant; and an instrument of this kind was proposed and executed by Troughton. The spirit-level, in a brass tube, was placed between the index and horizon glasses; and, through a perforation in the tube, the observer could see in the horizon-glass the reflected image of the bubble of air: a line was traced on the horizon-glass, and a contact of the limb, or centre, of the celestial body was to be made on this line at the instant that the latter appeared to bisect the reflected image of the bubble. The arc passed over by the index would then express the altitude of the celestial body above the horizon. Instruments very similar to this have been executed by Mr. Robinson, and, for merely nautical observations, they possess sufficient accuracy; the altitudes obtained with them being within two or three minutes of their true values.

ARTILLERY, APPLICATION OF. [Tactics, P. C.]

ARTI'SIA (Presl). This name is equivalent to Sternbergia, P. C. S. At present the opinion prevails that this is an internal portion of another plant, and not a palm-stem, as once conjectured. Coal formation.

ARTOTYRITES. [Communion, P. C.]

ARZOBISPO, YSLAS DEL, sometimes called Bonin Islands, are a group of islands in the Pacific, situated south of the Japanese island of Niphon, between 26° 30′ and 27° 45′ N. lat. and 141° and 143° E. long., but this group has not yet been well examined, and it is supposed that it extends a little farther to the south. It consists of three clusters of islands, extending nearly due south and north. The northern cluster is composed of numerous small islands and pointed rocks, and has much broken ground about it, so that it can only be approached with great caution. This cluster is called Parry's Group. The middle, or Peel's Group, consists of three islands of moderate size. The largest, Peel's Island, is four miles and a half long. The whole group occupies nine miles in length. The southern group is called Baily's Group. The islands are of volcanic origin and surrounded by deep water. They rise from the water's edge with a steep ascent, but not to a great elevation. Between the mountain-masses are small valleys, almost every one of which contains a stream of water. The declivities of the mountains to the very top are clothed with large forest-trees, among which the Areca oleracea and fan-palms are most conspicuous. The shores of the small bays, which are numerous, are lined with ledges and coral reefs. During the winter the wind is from the north and north-west, and is attended with rains and gales; in summer it blows from south and south-east, and the weather is fine, but even then the air is moist, and the islands at sunrise are involved in dense fogs. The animals are—vampires of a large size, herons, plovers, snipes, rails, wood-pigeons, the common black crow, and some smaller birds. There are several kinds of fish, and sharks are very numerous; there are also crayfish and other shell-fish. Green turtles are so numerous as to cover nearly the flat sandy beeches of the small inlets: they weigh from 300 to 400 pounds. Captain Beechey found there two English sailors, who had grown pumpkins, water-melons, potatoes, sweet potatoes, and fricoli beans; they had also planted some cocoa-nut trees, and kept hogs and pigeons. It appears that the islands were discovered by the Spaniards, but it is not known at what time. The whalers in the Pacific go from time to time there to take in water, and get a supply of fresh provisions by killing turtles. It does not appear that these islands have ever been regularly settled by any nation. On the western side of Peel's Island is a small but good harbour, called Lloyd's Harbour; it is surrounded by high hills, and is apparently the crater of an extinct volcano. On the eastern side of the same island is Fitton Bay, which is rather large, but open to the south-east, so as to be unsafe during the south-eastern winds, which prevail in summer.

(Beechey, *Narrative of a Voyage to the Pacific.*)

A'SAPHUS (Brongniart), a very extensive genus of fossil Crustacea (Trilobites), most abundant in the lower Palæozoic strata. Asaphus Buchii marks the Cambrian or lower Silurian, as A. caudatus is frequent in the upper Silurian beds.

ASCA'RIDES. [Entozoa, P. C.]

ASCLE'PIAS, a genus of plants, the type of the natural order Asclepiadeæ. [Asclepiadeæ, P. C.] Many of the species possess powerful medicinal qualities, and hence the name of the genus from Æsculapius (Asclepios), the god of medicine. The genus is characterised by possessing a reflexed 5-parted corolla; a 5-leaved corona seated on the upper part of the tube of the filaments; the leaflets cucullate, having a horn-formed process protruding from the bottom; the anthers terminated by a membrane; pollen masses compressed, fixed by the tapering tops, pendulous; the stigma depressed; the follicles smooth; the seeds coarse. Most of the species are North American herbs, with opposite, alternate, or verticillate leaves.

A. Syriaca, Syrian Swallow-wort, has simple stems with lanceolate oblong or oval leaves, gradually acute, and tomentose beneath; drooping umbels. Lamarck states that the native country of this plant is Syria and Egypt. The nectaries or leaflets of the corona, like some other species of Asclepias, act as fly-traps. The sap of this plant is white, and contains a considerable quantity of caoutchouc. It has been recommended as an expectorant. The seeds are covered with down, which it was at one time proposed to spin into textures for wearing apparel; it is however more adapted for stuffing mattresses and pillows.

A. Curassavica, Bastard Ipecacuanha, has a simple stem, with oblong-lanceolate glabrous leaves tapering at both ends; umbels erect, solitary, lateral. It is a native of Curaçoa, Essequibo, Cumana, and Trinidad. Its roots are frequently sent to England as Ipecacuanha. The juice in the West Indies is reputed to be anthelmintic and styptic. The root dried and powdered acts as an emetic, but not so efficaciously as the root of the true Ipecacuanha (*Cephaelis Ipecacuanha*). The roots of *A. prolifera* are also emetic.

A. tuberosa, Tuberous Swallow-wort, has suberect stems, very hairy, and branched at top; scattered oblong-lanceolate, hairy leaves; umbels disposed in a terminal sub-corymb. It is a native of North America, in stony places and sandy fields. The roots are famed for diaphoretic properties, and in Virginia it is used for this purpose in inflammatory diseases, more particularly in pleuritis and dysentery. The *A. decumbens* of some authors is probably only a variety of this species, and has the same properties.

Many other species of this genus are used as medicines in the countries where they grow. The buds of *A. stipitacea* are eaten by the shepherds of Arabia after the manner of asparagus in this country. The whole plant of *A. aphylla* may be eaten. *A. gigantea*, an East Indian species, is very poisonous. It kills cattle which eat it, but it is used in Hindu medicine in typhus fever. The milky sap of *A. lactifera* is quite innocuous, and is drunk in India as a wholesome food; whilst, on the other hand, the milk of *A. laniflora* and *A. procera*, is acrid and irritating. The juice of *A. laniflora* is used with butter and lard as an ointment for itch, and that of *A. procera* is applied to hides for removing the hair before tanning. The *A. asthmatica* and *A. vincetoxicum* have both active properties, and are now included under the genus Cynanchum. [Cynanchum, P. C. S.]

Many of the species of Asclepias are handsome border flowers, and worthy of cultivation. They thrive well in peat earth, or a light rich soil of any kind. They may be propagated by dividing the root in the spring, or by sowing the seed. Many of the species will require protection at the roots during severe winters. The tropical and sub-tropical species require the ordinary treatment of other stove and greenhouse plants.

(Don, *Gardener's Dictionary*; Burnett, *Outlines of Botany.*)

ASH. [Fraxinus, P. C.]

ASPEN. [Salicaceæ, P. C.]

ASPERGILLUS. [Byssoideæ, P. C. S.]

ASPHALTE. The use of street-pavements formed of asphaltic or bituminous compounds, and especially of that commonly known as the asphalte, or asphaltic mastic of Seyssel, which was introduced into this country by Mr. Claridge, under a patent obtained in 1837, is briefly alluded to in the article Road (P. C. vol. xx. p. 36); but the progress which such pavements have made in public favour within the last few years has been less than might have been anticipated, doubtless owing, in some degree, to the use of inferior materials of similar character, and to failures arising from circumstances which nothing but experience could point out. While however comparatively little has been done in the application of asphalte to street-pavements, it has been brought very extensively into use for foot-pavements in less exposed situations, such as the platforms of railway-stations, for flooring, roofing, and protecting buildings in various ways from injury by damp. As it is capable of being usefully adopted in many cases where no other means would be effectual, it may be well to notice briefly the mode of applying it to such purposes as experience has shown it to be most suitable for, as pointed out in a pamphlet recently published, entitled 'Instructions for the use of the Seyssel Asphaltic Mastic,' which contains brief practical directions for the preparation and use of the composition, with representations of the necessary apparatus, and tables to enable persons unconnected with the company by whom this asphate has been brought into use to make all needful calculations, and to superintend its application.

The principal ingredient of the asphaltic mastic termed Seyssel Asphalte, is a dark brown bituminous limestone, found near the Jura Mountains. This stone is broken to powder and mixed with a portion of mineral tar, when intended for fine work, such as the covering of roofs and arches, the lining of tanks, and application as cement; or, when intended for the coarser purposes of pavement and flooring, with mineral tar and sea-grit; and the whole is exposed for several hours to a strong heat, in large caldrons, until the ingredients, which are continually stirred by machinery, are perfectly united. The mastic is then run into moulds about eighteen inches square and six inches deep, so as to form it into cakes or blocks weighing from 112 lbs. to 130 lbs. each. In this state the asphalte is delivered for use, and portable furnaces and caldrons are provided for re-melting it upon the spot by fires of wood or coke. In this operation 1 lb. of mineral tar is first put into the caldron or boiler, to which, as soon as melted, 56 lbs. of mastic, broken into pieces of not more than 1 lb. each, are added, the whole being stirred together with an iron instrument, formed something like a spoon with the centre of the bowl cut away, so as to reduce it to an oblong loop, and curved in such a way that the stirrer may pass the instrument close to the sides and bottom of the caldron, and lift the portions of mastic in contact with them to the surface, to prevent burning and ensure the perfect mixture of the ingredients. The caldron is then covered over, and a brisk fire kept up for a quarter of an hour, after which 56 lbs. more of mastic are added and stirred in. The caldron is again covered for a few minutes, and further quantities of tar and mastic are added, in the proportion of 1 lb. of the former to 112 lbs. of the latter, until the caldron is full, and the whole is completely melted and fit for use, which will be indicated by the emission of jets of light smoke from the mastic, which will drop freely from the stirring instrument. It should be observed that for this purpose, as well as for the original mixing of the asphalte, none but *mineral* tar, resembling that with which the limestone is impregnated, should be used; and also that where the mastic needs to be very stiff, as for kitchen-floors, or for use in tropical climates, a less proportion of tar than the above should be used. In such cases also a larger quantity of grit than usual may be mixed with the mastic; and whenever it is desired to convert fine asphalte into coarse, it may be done by mixing, at the time of melting, 30 lbs. of fine clean grit to every 112 lbs. of mastic, increasing, at the same time, the proportion of tar from 1 lb. to 2½ lbs. for every 112 lbs. When ready for use, the melted mastic should be carried very quickly to the spot where it is to be applied, either in iron ladles, or, if it be necessary to remove it to a greater distance, in heated iron buckets. In all cases however it is desirable to have the caldron as close to the work as possible; and in covering brick arches or arched roofs, it may be hoisted to the top of the building, care being taken, whenever it is necessary to set it upon an asphalted part, to lay a few inches thickness of sand and a double row of bricks to support it, and to shelter the finished work from injury.

The method of laying foot and carriage pavements in asphalte having been noticed in ROAD, P. C., it is sufficient here to advert to the necessity of securing a firm solid foundation, which, whenever the ground is soft, must be accomplished by ramming, or by removing the soft earth, and substituting a coarse concrete, consisting of seven parts of clear river-sand or gravel and one part of grey stone-lime, fresh ground to a fine powder. These materials should be mixed dry, and when mixed, only sufficient water should be added to moisten the mass, which must be immediately thrown into its place, levelled, and rammed solid. A much finer concrete should then be floated over the surface to fill in the hollows, and the whole should be allowed to dry before laying the asphalte, which, if this precaution be neglected, is liable to be full of air-holes, in consequence of its heat converting the moisture of the concrete into vapour. The risk of such failure may be diminished by sifting fine cinder-dust over the concrete when dampness is suspected; and in rainy weather, if the work cannot be protected with tarpauling, which is highly desirable, injury may be prevented by laying sheets of brown paper, tarred on the under side, between the concrete and the asphalte. The thickness of the coat of asphalte is regulated by gauges or slips of wood, which are laid down so as to divide the pavement into compartments, seldom exceeding, where but one person is employed to spread the mastic, thirty inches wide (though in very extensive works the layers or portions of asphalte may be double that width, and two spreaders may work together), and the composition is levelled by a curved wooden spatula, with the assistance of what is called a floating rule, which is a long straight piece of wood stretching across the layer of asphalte, over which it is moved with a sawing, or backward and forward motion, and resting upon the gauges. If the surface is intended to be smooth, a fine powder, consisting either of equal parts of silver-sand and slate-dust, or of two parts of silver-sand to one of dead plaster of Paris or powdered chalk, is sifted over it before the asphalte is perfectly set, and rubbed in with a heavy flat piece of wood; but where a rough surface is desired, clean sharp grit is very thinly sifted over in like manner, and beaten into the mastic with a flat wooden beater or block, worked with both hands. The grit will adhere better if heated before its application. When one layer or compartment of the pavement is complete, it is well to proceed to the next but one, leaving the intermediate space to be filled in afterwards, so as to avoid the necessity of treading or kneeling upon the finished part until it be perfectly cold and firm. In laying asphalte pavements, whether in streets or in buildings, it is well to increase the thickness a little in places most exposed to wear; thus, the wheel-tracks in coach-houses, and road-ways which are so narrow as to admit but one vehicle at a time; those parts of stable-floors exposed to the trampling of the horse's hind legs; the standing-places for the legs of iron bedsteads in barrack-floors, and other places similarly exposed, should be laid thickly, and with very stiff asphalte. In laying asphalte pavements upon suspension-bridges, or in other situations exposed to much vibration, a sheet of thin canvass laid evenly upon the surface of the concrete, and secured with nails, may be found useful. The concrete may in such cases be laid on a planked flooring, the joints of the floor being covered by battens, nailed at one edge only, to allow the necessary play. Though well adapted for the floors of kitchens, workshops, &c., asphalte does not form an eligible pavement for situations exposed to great heat, or for places in which much oil or greasy matter is used, as the contact of such matter would be liable to soften it.

The modes of applying asphalte to the pavement of cellars and basements for the purpose of excluding damp will be readily conceived from the above description of its use in ordinary pavements. Where water is liable to rise under the floor, a brick invert, laid in asphalte as a cement, should be adopted, as the simple pavement laid on concrete will not prove effectual. The invert should in such cases be built of masses of bricks previously united with hot mastic, and coated with it on the surfaces which are to form the extrados or outer side of the arch; and a portion of the internal brickwork of the wall, from the springing of the invert to a little above the level at which water is likely to percolate, should be removed, and replaced by bricks laid in asphalte, and having their internal faces coated with it; but as the mastic will not adhere to the damp brickwork of the old wall, any space remaining between the new and old work must be filled with Roman cement. Asphalted bricks for such purposes, and tiles coated with mastic in like way upon one surface, are prepared by heating the bricks (which must be perfectly dry), and laying them in rows upon a flat surface, between gauges of such thickness as to allow a coating of asphalte about a quarter of an inch thick to be spread over the whole in a manner resembling the laying of a pavement, and separating them, and bevelling the edges of the asphalte with a knife, before it is quite set. In some cases an invert may be dispensed with by laying first a bed of concrete covered with tarred paper, then a half-inch layer of fine asphalte, and over that two inches of sand, four inches of concrete (trodden solid, but not rammed, to avoid injuring the lower stratum of asphalte), and above all the ordinary pavement of asphalte, taking good care to line sufficient of the walls to prevent the damp rising through them. Damp may be effectually prevented from rising in walls by forming the whole of one horizontal joint a little above the ground level with mastic in lieu of mortar; and skirtings of asphalte, which are formed by pouring the mastic into iron moulds applied to the wall, and assisting its descent with the spatula, may in some cases be applied with advantage. The wall to which such skirtings are applied should be studded with plasterer's cast nails, driven so as to project about a quarter of an inch, to secure the asphalte. In covering upright surfaces however asphalte is not so applicable as in other cases, since it will not bear exposure to the heat of the sun, and will not adhere well to a damp, dirty, or soft surface. When so applied, the wall must be warmed with braziers, and the asphalte first spread with the spatula to the thickness of a quarter of an inch, and rubbed well to make it adhere. A second layer of equal thickness will complete the work, and fill up defective places caused by the blistering of the first. A more effectual way, which may even be resorted to in situations exposed to the heat of the sun, is to build a new half-brick wall of asphalted bricks, set in mastic, adjoining the wall to be protected, filling the intervening space with mortar or cement. If water percolates through the original wall towards the new wall of asphalted bricks, asphalted tiles, set in Roman cement, should be first applied as a covering to the wall, and to their asphalted surface the new brickwork may be laid solely with mastic. The lining of tanks and reservoirs is an operation so similar to the above as to need no detailed notice.

Roofs, especially if of flat pitch, may be advantageously covered with fine asphalte, laid upon a thin coat of fine concrete, supported by a rough boarding of dry wood. It is well in such cases to cover the concrete with canvass, and to remove the concrete for a width of about three inches wherever the joints of the layers of mastic will come, supplying its place with asphalte; so that if water should percolate at the joint in the upper coating, it will be unable to penetrate further. The lines of junction with walls must also be carefully secured by a kind of flashing, and scooping out the mortar to allow the asphalte to take hold of the brickwork; or, in the case of a stone wall, by cutting a groove to receive the upper edge of the flashing or fillet of mastic. It is recommended that, where roofs are not intended to be walked upon, and especially where they are exposed to the sun, the surface of the asphalte should be strewed with grit, as above described for rough pavements. Respecting the covering of arches, it is sufficient to observe that the asphalte may either be applied immediately to the surface of the brickwork forming the extrados of the arch, with an intervening thin coat of fine concrete; or the spandrils may be filled with concrete so as to form a level surface for the asphalte, even with the crowns of the arches; or, advancing a step further, the concrete may be laid up to the level of the roadway, and the covering of asphalte be used as a pavement, as well as for the exclusion of water. On the Greenwich Railway viaduct, upon which a surface of 430,000 square feet has been covered with mastic, an intermediate plan has been adopted; the asphalte being laid in an undulating surface, with a fall every way.

In whatever way asphalte may be applied, the greatest care is necessary to secure a solid foundation, to ensure the dryness of the concrete or brickwork to which it is applied, to use the mastic as hot as possible, and to make the joints perfect. Wherever any part needs repair it may be softened by laying some hot mastic upon it for a short time, and then cut away with a chisel without injuring the adjacent parts. The old mastic may be remelted, and, the edges of the old work being cut square, the hot material will readily adhere to them, if they are carefully freed from dust and moisture. It only remains to notice that the thickness of asphalte used for pavements varies from half an inch to about an inch and a quarter, the former being sufficient for common floors and court-yards not intended for carriages, and from three-quarters to an inch being the least allowed for carriage pavements; from half an inch to five-eighths is sufficient for roofs and the covering of arches to prevent the filtration of water, and for the lining of tanks and ponds; and about half that thickness is sufficient for covering the ground-line of brickwork, to prevent the rising of damp.

ASPIDIA'RIA (Presl). Several species of the Lepidodendra of Sternberg are thus named. From the coal formation.

ASPI'DIUM, a genus of Ferns, and one under which many species were arranged by older botanists, which are now placed under new genera. For an arrangement of the modern genera see Filices, P. C. S. One of the most remarkable species of this genus is the *Aspidium Baromez*, or Tartarian Lamb, recently referred by Mr. Smith to the genus Cibotium. This plant, from its peculiar colour and form, was at one time really supposed to be a kind of vegetable animal, as the following account from Struys, an old traveller, proves: 'On the western side of the Volga,' he says, 'there is an elevated salt plain of vast extent, but wholly uncultivated and uninhabited. On this plain, which furnishes all the neighbouring countries with salt, grows the Boranez or Bornitsch. This wonderful plant has the shape and appearance of a lamb, with feet, head, and tail distinctly formed. Boranez, in the language of Muscovy, signifies a little lamb, and a similar name is given to this plant. Its skin is covered with very white down as soft as silk. The Tartars and Muscovites esteem it highly, and preserve it with great care in their houses, where I have seen many such lambs. The sailor who gave me one of these precious plants, found it in a wood, and I had its skin made into an under-waistcoat. I learned at Astracan, from those who were best acquainted with the subject, that the lamb grows upon a stalk about three feet high; that the part by which it is sustained is a kind of navel, and that it turns itself round, and bends down to the herbage which serves for its food. They also said it dries up and pines away when the grass fails.' Struys adds many other wonderful things about this plant. His statement is however substantially correct. The rhizoma of the *A. Baromez* presents a rude resemblance to an animal. It is covered with a silky down, and when cut into has a soft inside with a reddish flesh-coloured appearance, sufficient to account for the origin of the fables with regard to its animal nature. It is not improbable that this fern dries up when the grass does, but of course the one has no dependence on the other. The Baromez possesses the astringent property which is common to all ferns; hence it has been used as a styptic. Dried specimens have sometimes been brought to this country, but the plant has not yet been brought alive.

Aspidium Filix Mas (now *Lastræa Filix Mas*), the male fern, is a native of Great Britain, and is admitted into the British Pharmacopœias on account of its anthelmintic properties. It has bipinnate fronds, obtuse and serrated pinnules, the sori near the central nerve, the lateral nerves forked. It is abundant throughout Europe, and grows in stony places on the skirts of woods, in open plantations and roadsides. The part used in medicine is the root, or rather the rootstock. This part of the plant is collected for medicinal purposes between the end of May and the middle of September. It will not keep well, and should be renewed at least every two years. It has often been chemically analyzed, and is found to contain,

Lignin	45
Starch	10
Uncrystallizable sugar .	10
Gum	10
Fixed oil	7
Resin	4
Salts, volatile oil . .	14
	100

The antients used this plant as a vermifuge, but it was nearly given up by modern practitioners of medicine when Peschier pointed out the conditions in which he had found it efficacious in expelling tape-worm. The best mode of administering it is an ætherial tincture: the æther seems to dissolve up the resinous oil on which the active properties of the plant depend. The dose of the root according to Peschier is about one drachm.

A. dilatatum (*Lastræa dilatata*), a British fern, is often confounded with the last for medicinal purposes. It has subtripinnate fronds; oblong, blunt, inciso-pinnatifid lobes; spinose, mucronate segments; a deciduous unfringed indusium. This is a common fern, but less generally diffused than the last.

A. filix-fœmina (Athyrium filix-fœmina), Lady-Fern, has a lanceolate pinnate frond; pinnæ linear, acute, regularly pinnate; pinnules linear-oblong, quite distinct, deeply serrate or pinnatifid; segments with 2 or 3 teeth. This is one of the most beautiful of the British ferns. The root is sometimes gathered for that of the male fern. It has 'a short perpendicular rootstock, black externally, with black root-fibres; and the tufts or bases of the leaf-stalks, which compose the greater part of it, form a very acute angle with its axis, while those of the male shield-fern extend outwards at a more open angle.' (Christison.)

(Burnett, *Outlines of Botany*; Babington, *Manual of British Botany*; Christison, *Dispensatory*.)

ASPIDORHY'NCHUS, a genus of fossil Ganoid fishes, from the lias and oolite of England. (Agassiz.)

ASPIDU'RA. A fossil species of ophiuroid Echinoderms is thus named by Agassiz. From the lias of Yorkshire.

ASPLENIO'PTERIS (Sternb.). [Pterophyllum, P. C. S.]

ASPLE'NIUM, a genus of plants belonging to the natural order of Ferns. [Filices, P. C. S.] It has elongated straight sori, with an indusium opening towards the central nerve or midrib. The species of this genus are known by the name of Spleenworts; several of them are common in Great Britain.

A. lanceolatum of Hudson has lanceolate doubly pinnate fronds; the pinnules ovate and deeply and sharply toothed, or lobed; the sori short, nearly marginal. It is a native of

England and Wales, on rocks and walls, but its distribution is very local. It is also a native of France, but its European habitats are few.

A. Adiantum-Nigrum, Black Spleenwort, has triangular attenuated fronds, twice or thrice pinnate, the pinnæ and pinnules triangular, sharply toothed; sori elongated, central. This plant is a native of Europe, and is abundantly distributed throughout the United Kingdom, where it occurs on rocks, walls, ruins, and hedge-rows. This is one of the ferns formerly much used in medicine, and is stated by Ray to be efficacious in cough, asthma, pleuritis, jaundice, stone, gravel, and other diseases. It has not however any reputation amongst modern practitioners of medicine.

A. Ruta-muraria, Wall Rue, has bipinnate fronds, the pinnules rhomboid wedge-shaped, notched or toothed at the end; the indusium jagged. This fern is very common on rocks and old walls, in Great Britain and throughout Europe, and is also a native of North America. It was at one time used as a remedy in coughs and asthmas, obstructions of the liver, and in cutaneous diseases; but has now fallen into disuse.

A. Trichomanes, Common Spleenwort, has pinnate linear fronds; roundish ovate, crenate, stalked pinnæ; the nerves forked below the sori. It is very common throughout Great Britain on rocks, walls, churches, ruins, bridges, and hedge-rows. It is a native also of Europe, Africa, and the United States. This fern has been also used in medicine, and for the same diseases as the previous species, but it has fallen now entirely into disuse. The other British species of Asplenium are *A. alternifolium*, *A. septentrionale*, *A. marinum*, *A. viride*.

These and other ferns may be easily cultivated, by placing them in situations resembling their natural habitats. They require a pure atmosphere, plenty of space, and natural shade, with a due supply of water. They may be planted on decayed wood, in holes of rocks and brick, with almost any soil. One of the most elegant modes of cultivating them is by means of inverted jars, under which they will thrive in any sandy or light soil. Cases well adapted for growing ferns are made on this principle, constructed according to directions laid down by Mr. Ward, who has the great merit of having first suggested this mode of growing plants.

(Babington, *Manual*; Newman, *History of British Ferns*; Ward, *Growth of Plants in Glazed Cases.*)

ASSAULT is in Scotland a punishable offence, usually prosecuted by the public prosecutors attached to the sheriffs' courts, to the police courts established by statute, and to the justice of peace courts. It is seldom brought before the supreme criminal court, unless it be of a highly criminal character; and it is then generally charged as assault with some specific aggravation, as 'assault aggravated by being to the effusion of blood,' or as 'being to the danger of life,' or 'by being committed against a magistrate,' or 'by being perpetrated with a lethal weapon,' an expression applicable to a sword, hatchet, hammer, or any instrument more formidable than an ordinary walking-stick. Criminal prosecutions for assault, at the instance of private parties, are almost unknown. The party injured may pursue for civil damages before a jury; but such prosecutions are not frequent. There is no division, as in England, into 'assault,' and 'assault and battery.' Many of the statutary regulations, as to assaults by manufacturers, &c., extend to Scotland. The later statute law on this subject, having been passed to alter laws peculiar to England, does not in general apply to Scotland. The 6 Geo. IV. c. 129, however, relative to assaults connected with combination, applies to that part of the kingdom. The respective punishments of the various kinds of assault have thus, in Scotland, been in a great measure fixed by the practice of the several criminal courts.

AST, GEORG ANTON FRIEDRICH, an eminent German scholar, was born in 1778 at Gotha, at the gymnasium of which place he was educated. In 1798 he entered the University of Jena, where he devoted himself at first almost entirely to theology; but he soon abandoned this pursuit, and gave himself up to philological and philosophical studies. In 1802 he began his career as an academical lecturer in the University of Jena; and in 1805 he was appointed professor of antient literature in the University of Landshut, where he remained until the transfer of that institution to Munich, in 1812. He spent the remainder of his life at Munich, where he died on the 30th of December, 1841.

Ast was one of the best and most industrious of modern scholars, and a very excellent teacher. His merits were recognised and rewarded by various distinctions which the Bavarian government conferred upon him. He occupied himself not only with philology, in the strict sense of the word, but also with several departments of philosophy and its history; and these pursuits led him, during the latter period of his life, to devote himself almost exclusively to the study of Plato, for the understanding of whose works he has done more than any other scholar. His numerous works may be divided into two classes, philosophical and philological. Among the former we must notice especially his 'Handbuch der Aesthetik,' Landshut, 1807, 8vo.; 'Grundlinien der Philologie,' Landshut, 1808, 8vo., an excellent introduction to the study of antiquity; 'Grundlinien der Grammatik, Hermeneutik und Kritik,' Landshut, 1808, 8vo.; 'Grundlinien der Philosophie,' 2nd edit., Landshut, 1825, 8vo., a very good introduction to the study of philosophy; 'Hauptmomente der Geschichte der Philosophie,' München, 1829, 8vo.; 'Platon's Leben und Schriften,' Leipzig, 1816, 8vo., one of the best works on Plato that have been written in modern times, and forming a very useful introduction to the study of that philosopher. Among his philological works we may mention 'Observationes in Propertii Carmina,' a youthful production which he published before entering the university in 1798. In 1809 he began editing a number of separate dialogues of Plato, such as the 'Phaedrus,' 'Symposium,' 'Alcibiades,' 'Leges,' and others, which were well received; and this led him to the publication of a complete edition of Plato's works (Leipzig, 1819-32), in 11 vols. 8vo., with a Latin translation, and a commentary which occupies the last two volumes. He next published, as a sort of supplement to this edition, a 'Lexicon Platonicum,' Leipzig, 1834-39, 3 vols. 8vo., which is one of the best special dictionaries that we have. In a critical point of view, his edition of Plato is greatly surpassed by some of the more recent editions of that philosopher.

(*Biographical Dictionary* of the Society for the Diffusion of Useful Knowledge; Brockhaus, *Conversat.-Lexicon*, 9th edition.)

ASTERACA'NTHUS, a genus of fossil Placoid fishes, including five British species, from the oolitic and lias formations. (Agassiz.)

ASTERA'CEÆ. [Corymbifera, P. C. S.]

ASTEROPHYLLI'TES (Brongniart), a fossil genus of plants, containing many species, from the coal formations of Europe and America.

ASTEROPTY'CHIUS, a genus of fossil Placoid fishes, from the mountain limestone of Ireland. (Agassiz.)

ASTLEY, JOHN, a portrait-painter, born at Wem, in Shropshire, in the early part of the eighteenth century, more distinguished for his good fortune than for his works, though these, according to Walpole and Edwards, were not without merit, especially those of his earlier years. He was the fellow-pupil of Reynolds with Hudson, and was at Rome also at the same time with Sir Joshua. He was very poor when studying in Rome; and Northcote, in his Life of Reynolds, tells a ludicrous anecdote about his poverty. On one occasion, upon a summer's evening ramble near Rome with other English artists, his companions took off their coats and advised Astley to do the same, to which he objected; and his persisting to keep his coat on appearing unaccountable to them, caused them to make some jokes at his expense, which at last forced him to follow their example, when the mystery was out,—the back of his waistcoat was made out of one of his own sketches, and the poor painter, with a waterfall on his back, made a ludicrous figure, which afforded his companions a hearty laugh.

After his return to England he spent a few months in London, and then tried his fortunes in Dublin, where he practised with such success that in three years he saved 3000*l*. He considered this capital sufficient to enable him to venture his fortunes in London; and 'as he was painting his way back to London,' says the writer in Adams' Biographical History, 'in his own post-chaise, with an outrider, he loitered with a little pardonable vanity in his native neighbourhood, and visited Knutsford Assembly with another gentleman. Lady Daniel, a widow then present, was at once so won by his appearance, that she contrived to sit to him for her portrait, and then made him the offer of her hand.' This lady was the widow of Sir William Daniel, and was possessed of a very large fortune, the whole of which she bequeathed to Astley, besides the reversion, at her daughter's death, of the estate of Duckenfield Lodge, Cheshire, worth 5000*l*. a year. Lady Daniel died not long after her marriage, and her daughter did not survive her many years. Astley obtained possession of the property, and gave himself up to a life of pleasure. He purchased the house in Pall Mall which had belonged to the Duke of Schomberg, of which Pennant, in his 'London,' says, 'It was in my time possessed by Astley the painter, who divided it into three, and most whimsically fitted up the centre for his own use.' He fitted up also a villa at Barnes, in Surrey, according to a peculiar fancy; and he made many improvements in Duckenfield Lodge. After a life of pleasure, as he was growing old, he married again, a young lady, by whom he left two daughters and a son. He died at Duckenfield Lodge in November, 1787. Before his death his character changed; he regretted the dissipated life he had led; but, as his biographer has said, if he owed his fortune to his form, he owed also his follies to his fortune.

(Walpole, *Letters*, vol. ii.; Edwards, *Anecdotes of Painting*, &c.)

ASTROCRINITES (Austin), a fossil genus of Crinoidea, from the mountain limestone of Yorkshire.

ASTY'LAR, one of the numerous compound architectural terms from the Greek *stylos* (στῦλος), column; which, having the Greek privative *a* prefixed to it, signifies without columns. It does not indeed occur in the usual architectural glossaries; but it ought to be adopted, being exceedingly convenient and expressive, inasmuch as it explains at once that the building described by it is without any order of columns or pilasters, however ornate it may be in all other respects. Thus, we speak of Astylar Italian in contradistinction from the columnar class of buildings in that style, or such as are decorated with the orders. Astylar composition is not only susceptible of a very high degree of embellishment, but of a species of grandeur not attainable (that is, on the same scale) in the Palladian style, or that where an order is raised upon a basement, or even more than a single order is employed for a façade, because in the former the cornice is proportioned to the entire elevation; sometimes of greatly increased proportions, and then distinguished by the name of *cornicione*. In this country we had no examples of such *astylar* class of design, until it was introduced by Mr. Barry, in the Travellers' and Reform Clubhouses; since which it has been employed by other architects.

ATHENS. In this supplement to the article Athens, P. C. vol. iii. p. 10, &c., it is intended to mention those corrections which have been made in the topography of Athens through the researches and excavations which have been carried on within the last ten years, and which are the more necessary as Colonel Leake, in the second edition of his Topography of Athens, has not incorporated all that could have been expected after such important discoveries by which many of the most conspicuous errors have been removed. In the second edition of Leake's work, the hill to the north-east of the city is still called Anchesmus, whereas it has been incontrovertibly shown that this hill is the Lycabettus (Forchhammer, 'Zur Topographie Athens, ein Brief aus Athen und ein Brief nach Athen,' Götting. 1833.) The site of the hill Anchesmus is still a disputed point. The hill in the west, which according to Leake is the Lycabettus, is proved by an inscription which was found there (Böckh, *Corpus Inscript. Graec.* i. No. 543), to have borne the name of the Hill of the Nymphs. In consequence of this error the antient walls of Athens are extended too far to the north-east, while in the west a large portion which was inclosed within the walls is described as having been without them. The antient walls (that is, those built by Themistocles) in the south and west ran, according to Leake, across the Pnyx and the hill of the Museum, and did not extend beyond the Ilissus in the south. He was led to this opinion by some remnants of a wall which are still visible on the Pnyx and the Museum, but Forchhammer supposes that they are not remains of an ancient Greek ructure, but that they belong to a wall erected in the reign of the Emperor Valerian. The antient walls, according to Forchhammer, comprised the Hill of the Nymphs, the whole of the Pnyx and Museum, and the well Callirrhoe, and to the south they embraced a considerable portion of the left bank of the Ilissus, so that the Enneacrunos, the temples of Demeter, Triptolemus, and Artemis Eucleia, which are mentioned by Pausanias, and farther on the Panathenaic Stadium, were inclosed within the walls, which again ran across the Ilissus in the neighbourhood of the Lyceum. The arguments by which Forchhammer has established this view are very cogent.

Respecting the gates of Athens a great diversity of opinions still prevails, and must prevail so long as critics are not agreed upon the gate with which Pausanias in his description begins his account. At present there are no less than four gates which claim this honour. The most probable opinion is, that he entered Athens by the Piraean gate, between the Museum and Pnyx, an opinion which was first expressed by Stuart, and has been adopted by Müller, Forchhammer, and others.

One of the fundamental errors in former topographies of Athens, was that ever since the time of Meursius it was believed that at two different times Athens had two market-places (ἀγοραί), an old and a new one; the former to the west and the other to the north of the Acropolis. Leake thinks that the Agora was transferred to the north in the time of Augustus, or in the last century before the Christian æra. But the passages quoted in support of this supposition are far from proving the case; and what was formerly called the gate of the New Agora, is proved both by its style and inscriptions not to have been a gate, but part of a building erected out of the donations of C. Julius Caesar and Augustus to the honour of Athena Archegetis. That whole district in which the new Agora is supposed to have been, was in the time of Thucydides not occupied by houses, but consisted of gardens. (Thucyd. ii. 17; Xenoph. *De Vectigal.* 2. 6.)

The form and basins of the port of Piraeeus have recently been the subjects of much discussion, and the late Professor Ulrichs endeavoured to establish an opinion which was totally opposed to that of Leake, as well as to the later one of Curtius, but it is as yet impossible to say which of the conflicting views is the correct one. (Curtius, *De Portubus Athenarum*, Halle, 1842, 8vo.; Ulrichs, Οἱ λιμένες καὶ τὰ μακρὰ τείχη τῶν Ἀθηνῶν, Athens, 1843.)

We cannot here enter upon an explanation of the minor points in which the topography of Athens has been improved and corrected by late investigations; the student must refer to the works quoted at the end of this article. We shall add only a brief account of the most important discoveries that have been made at Athens. The Acropolis is the only place in which excavations have been made on a large scale and with something like systematic order. Operations were commenced there in 1833 by a private society of antiquaries. The year after, when Athens was made the capital of the kingdom of Greece, the government took the work into its own hands. The excavations were conducted by the celebrated German architect L. von Klenze, and afterwards by Professor Ross, assisted by the architects Schaubert and Cleanthes, whose place was soon after supplied by Hansen. Ross was succeeded in 1836 by Pittakis. The results of these excavations down to 1843 are briefly but well described by Curtius, *Die Akropolis von Athen*, Berlin, 1844, 8vo.

The operations in the Propylaea began in 1834. The first thing that was done was to remove the modern constructions which blocked up the entrance to the Acropolis. The great or upper battery which extended from the pedestal of the statue of Agrippa in the north to the corner of the Cimonian wall in the south, was next taken down. The discoveries there made were most unexpected. The fragments of the ruined temple of Victory unwinged (Nike Apteros) were found almost complete, and very little injured; many fragments of the Propylaea, consisting of sculpture and pieces of architecture of every kind, and some highly important inscriptions, were brought to light. A considerable part of the marble flight of steps leading to the Propylaea was laid open at a somewhat later time.

In the winter of 1836-37 operations were commenced in the Propylaea itself; the central part and the northern wing were cleared from the modern constructions built in them, and from the battlements which had been erected upon the walls in the middle ages. In the central part, the six Ionic columns of the vestibule are still standing, though only about two-thirds of their original height, except one which is shorter than the rest. The parts of these columns, however, which had fallen down, were found among the ruins, but the capitals are much damaged. The northern wing is in perfect preservation up to the cornice; and the tower of the southern wing is still standing, but no trace has been found of the paintings which Pausanias saw in the Propylaea. The most remarkable discovery is that of the temple of Victory mentioned before. As all the fragments were in a state of almost perfect preservation, it cannot have been destroyed by force; and as Spon and Wheler saw it still standing, it was probably taken down by the Turks in 1684, for the purpose of using the masonry in constructing the great battery. Out of all that thus remained, the attempt was made to restore this beautiful edifice, and in 1836 the restoration was nearly completed. The work was conducted by Ross, Schaubert, and Hansen, but after the withdrawal of Ross in 1836 the progress was somewhat delayed. At present however, the restoration is complete, and the temple of Nike once more is seen in its full beauty; it serves as a temporary Museum in which some of the newly discovered relics of antiquity are deposited.

As the government had resolved upon clearing the whole plateau of the Acropolis from the rubbish and modern buildings, excavations were also made in and around the Parthenon. Here were found most valuable fragments of the metopes, the frieze, and of the statues in the pediments, which are deposited in the museums of Athens, but have not yet been examined. In 1842 the mosque which had been built within the cella of the Parthenon was cleared away, and the place where the temple-statue had stood was found. The area on the eastern side was then cleared, and the columns of the north side, which had fallen down, were erected again. In 1837 workmen were actively employed in removing the rubbish from within and without the Erechtheum, and all that could be restored out of the ruins has been restored, especially along the southern side, where the wall of the cella is now raised to half its original height. The flight of stairs in the eastern front has likewise been laid open. In the interior however the excavations do not seem to have been carried out to their full extent: nothing at least has been made known, except a few inscriptions.

With regard to the discovery of sculptured and architectural remnants on the Acropolis, we must notice that in 1839 the pedestal of the statue of Athena Hygiea (Paus. i. 23. 5) was found close by the Propylaea, and in the south of the same building remnants of the enclosure (peribolos) of the temple of the Brauronian Artemis were laid open. (Pausanias, i. 23. 7.) A little to the east the pedestal of the Trojan horse (Paus. i. 23. 10) and that of Epicharinus (Paus. i. 23. 11) were found. Besides these things, which are mentioned by Pausanias, a number of substructions and fragments of works of art have been discovered, which are yet unexplained. The Cimonian wall along the southern side of the Parthenon is also now laid open: its breadth varies between six and eight and a half metres.

For a detailed account of all the topographical discoveries, the reader is referred to the second edition of Leake's *Topography of Athens*, London, 1841; his paper *On some disputed Positions in the Topography of Athens*, in the Transact. of the Soc. of Lit. for 1839, p. 183, &c.; and his paper *On the Demi of Attica;* Forchhammer, *Topographie von Athen*, Kiel, 1841, which contains a detailed Plan of Antient Athens, together with one of the Modern city, showing the relation between the two; Ross, Schaubert, and Hansen, *Der Tempel der Nike Apteros*, Berlin, 1839; Welcker, in the *Rhein-Museum*, for 1843; Quast, *Das Erechtheion zu Athen*, &c., Berlin, 1840; Müller, *De Foro Athenarum*, Götting. 1839. A complete and critical survey of all that has been done in modern times for the topography and antiquities of Athens, is given by A. Westermann, in the *Neue Jahrbücher für Philologie und Pädagogik*, vol. xli. p. 230-248.

With regard to the modern city, dating from the commencement of King Otho's government, it can be considered at present as only in a state of formation. Hardly anything amounting to description is as yet to be collected respecting it. The precautionary measures which ought to have been adopted in the first instance, appear to have been neglected, it being spoken of by some as matter for very great regret that houses were allowed to be erected too precipitately, with regard only to immediate convenience, and just as suited individuals, without any or with scarcely any regard to the future growth, regularity, and beauty of the city. Sites that ought to have been reserved by the government, or else laid out according to some well-arranged general plan, were left to be built upon just as people pleased, whereby houses of a very inferior class have got possession of some of the best—or what ought to have been rendered the best—parts of the town. However, as they are not of very durable or costly construction, they will probably in a few years begin to give place to others. In the meanwhile some of the more recently erected habitations and other buildings are spoken of as being of a very superior kind—such as would be an ornament to any capital in Europe, but even if deservedly bestowed, such commendation is by far too general and vague to afford any idea of their style or particular merits.

It is the same with regard to what public edifices have hitherto been erected. We can therefore only enumerate them—or rather, only give the names of such as we have seen mentioned as the principal ones, *i. e.* the Mint, the Military Hospital, two Barracks, the Royal Stables, and the Royal Palace. It was at first proposed that the Palace should be erected on the Acropolis, at its east end, and along the south side there, nearly as far as the Parthenon, and designs for the purpose were made by Schinkel, who afterwards published them in his 'Höhere Baukunst;' but the idea was abandoned, probably on account of the difficulty of forming a sufficiently commodious ascent for carriages. Accordingly, other designs for a different situation were prepared by the great Munich architect, Von Klenze, but they also were laid aside; and a third set were made by Gärtner, another very eminent Munich architect. Gärtner's designs were finally adopted, and the first stone of the new structure was laid in March, 1836, on quite a different site from either of those at first proposed, namely, on the east of the city, and at that extremity of the new Hermes Street. This, which may be considered the main street, extends through the city from east to west, and two other principal new streets, Æolus and Athene streets, run into it on its north side. The new street called Stadion Street is to the north-east of the old town. By a letter from Athens, dated November 14, 1844 (published in the 'Athenæum'), it appears that the government intends to found a national Archaeological Museum, to be erected upon the Acropolis, and in which are to be placed the various antiques now deposited in the temple of Theseus and other places, and whatever others may either happen to be discovered or to be purchased by the state; also models of the antient buildings still remaining in Greece.

ATMOMETER, called also Atmidometer or Atmedometer (from ἀτμός, 'vapour,' and μέτρον, 'a measure'), an instrument employed to measure the quantity of exhalation from a humid surface in a given time. Allusion is made in the 'Edinburgh Encyclopædia' to an instrument of this kind described by Professor Richman (in the *Nov. Comment. Petropol.*, vol. ii. p. 121), with the nature of which we are unacquainted; but the instrument to which the name is usually applied is one invented by Professor Leslie, which consists of a very thin ball of porous earthenware, two or three inches in diameter, to which is cemented a long tube of glass, marked by a diamond with divisions, each of which is capable of containing as much liquid as would, if spread over the outer surface of the ball, cover it with a film equal in thickness to the $\frac{1}{1000}$th part of an inch. The open end of the tube is fitted with a brass cap and a leather collar; and when in use the instrument is filled with distilled or boiled water, and suspended vertically with the ball downwards, the end of the tube being perfectly closed with the cap and collar. The water then percolates through the porous ball precisely in proportion to the evaporation from its outer surface, of which its waste in the tube forms an accurate indication. The vacuous space above the water in the tube becomes, during the operation, gradually filled with air which enters through the porous ball. When the tube becomes empty, the cap is removed to refill it. This instrument is not only useful in meteorological observations, but is also capable of being applied with advantage in chemical operations, and in the application of science to agriculture.

ATMOSPHERIC RAILWAY. In a brief sketch of the history of this invention, in a lecture delivered by Mr. Vignoles (then professor of civil engineering at University College, London), to the Royal Cornwall Polytechnic Society, in October, 1842, that gentleman observed that the idea of producing motion by atmospheric pressure was conceived by Papin, the well-known French engineer, nearly two centuries since; and that, after slumbering for more than a century, the subject had been successively taken up by Messrs. Lewis, Medhurst, Vallance, and Pinkus, and lastly by Mr. Clegg, by whom, in connection with the late Mr. Jacob Samuda, the practicability of this mode of locomotion has been fully proved.* Of the connection of the name of Lewis with this invention the writer has no other intimation; but the publications of the late Mr. Medhurst, who was a practical mechanician or engineer, carrying on business in London, and known as the inventor of an ingenious printing-press, show that he not only cherished the idea of locomotion by atmospheric pressure for many years, but also devised, among other plans for its accomplishment, one which, excepting in practical detail, greatly resembles the present atmospheric railway. Medhurst published a short account of his scheme in 1810, under the title of 'A New Method of Conveying Letters and Goods by Air,' and in 1812 he issued another pamphlet of 'Calculations and Remarks,' to prove the practicability and advantages of such a mode of conveyance; but, as he observes in a more recent work, 'these publications met with that indifference and contempt which usually attends all attempts to deviate so widely from established customs.' In the pamphlet from which this remark is quoted, which was published in 1827, entitled 'A New System of Inland Conveyance for Goods and Passengers,' is a fuller account of the various modes in which it was proposed to accomplish the desired object, the principal of which were, first, the construction of an air-tight tunnel of sufficient magnitude to admit the passage of carriages within it, running upon iron rails, and propelled by forcing in air behind them by pumping machinery, the carriages being made so nearly to fit the tunnel that the air thus forced in could not pass them, but must act upon them as upon a piston; secondly, the propulsion of such carriages in certain cases, in the reverse direction, by exhausting the tunnel in front of them, instead of forcing in air behind them; thirdly, the use of a smaller tunnel, containing what may be termed a piston-carriage for the conveyance of goods within the tube or tunnel, and having a kind of valve which would open during the passage of the piston-carriage so as to allow a rod from it to pass out of the tunnel, and afford the means of propelling a second carriage, for passengers, running upon a railway either above or alongside of the tunnel, in the open air; and, fourthly, the construction of a railway or tram-road, in the centre of which should be laid a still smaller air-tight tube, containing a travelling piston which should be connected, as in the last-named contrivance, with an exterior carriage. One of the modes in which it was proposed to connect the carriage outside the tube or tunnel with the piston within it, was by an air-tight water-valve, which however would only have been applicable on a perfect level, and with a very low amount of atmospheric pressure; and another, applicable to all levels, was formed by thin elastic sheets of iron or copper, shutting down upon a soft substance, so as to form an air-tight joint, but capable of being readily lifted up to allow the passage of the connecting-bar, by the action of a wheel connected with the piston. In all cases Medhurst appears to have contemplated moving the piston by forcing air into the tube behind it, and thereby forming a plenum, in preference to forming a vacuum by exhausting the tube in advance of it; and he seems also to have formed a very inadequate idea of the degree of atmospheric pressure necessary to produce rapid motion, imagining that in a tunnel of thirty feet sectional area carriages might be propelled at the rate of sixty miles per hour without the condensation of the air becoming uncomfortable to the passengers, who, according to his original plan, would not have been shielded from its effects.

---

* A condensed report of this lecture, originally published in the 'Cornwall Gazette,' appeared in the 'Railway Times' of Oct. 29, 1842.

Before the publication of the last-mentioned pamphlet of Medhurst, but many years after the original promulgation of his scheme, Mr. Vallance, of Brighton, drew public attention to a similar project, which, being brought forward at a season of extraordinary speculation, excited much interest, as well as no little ridicule. Vallance's scheme, which was fully explained in a pamphlet published by him in 1825, entitled 'Considerations on the expedience of sinking capital in Railways,' was, like Medhurst's original design, for conveying passengers along a railway laid within an air-tight tunnel, which he proposed to construct either of cast-iron or of vitrified clay, resembling common brickwork, but less permeable to air; but, knowing that experiments had proved a very great loss of power to result from the attempt to impel air through a long pipe, he proposed to set the piston-carriage in motion solely by exhausting the tunnel in advance of it, and suffering the full pressure of the atmosphere to act upon its rear. This plan, which was patented in 1823, was brought into experimental operation at Brighton upon a sufficiently large scale to prove the possibility of so singular a mode of transport, but, had there been no other difficulties, the objections of the travelling public to transmission in a dark close tunnel would have proved sufficient to prevent its general adoption.

About the year 1835 the subject was revived in consequence of a patent being taken out by Mr. Henry Pinkus, an American gentleman residing in England, for an apparatus which he called the Pneumatic Railway, and which, as originally proposed, was to consist of a cast-iron tube from 36 to 40 inches diameter, internally, of an average thickness of three-quarters of an inch, and having a longitudinal slit or opening from one to two inches wide along what was, when laid in its proper position upon the railway, intended to be its upper side. Two ribs or cheeks, cast with the tube, along the sides of this opening, formed a channel or trough from four to five inches wide and deep, which in order completely to close in the tube or tunnel, and prevent the ingress of air, was filled with a valvular cord of some soft and yielding substance strengthened by being formed upon a peculiarly constructed iron chain, so arranged that when the valve was laid in its place in the trough the soft matter should completely exclude the passage of air, while the iron portion of the valve, lying upon and covering the edges of the vertical cheeks, should at once protect the valvular cord from injury and prevent its being forced into the tube by any external pressure. Within this tube was placed a piston-carriage, denominated the dynamic traveller, which was impelled forward by the pressure of the atmosphere in its rear whenever, by the action of pumping machinery connected with the tube, a partial vacuum was formed in front of it. In the rear of the piston the dynamic traveller carried an apparatus for lifting the valvular cord out of its seat, so as to allow of the free passage along the slit or opening of a connecting bar by which the dynamic traveller was placed in communication with an external carriage, called the governor, to which the vehicles to be drawn were attached; and immediately after the passage of this connecting-rod the valve was restored to its place, its sides being fresh lubricated by an apparatus attached to the governor, and the whole being pressed firmly down by a wheel or roller. In this form of the apparatus the governor and the carriage attached to it ran upon rails attached to or cast upon the external sides of the pneumatic tube; but in a subsequent modification of the invention the tube was greatly reduced in size, and laid down in the middle of the track of an ordinary railway, and a kind of pneumatic locomotive engine was substituted for the governor, the pistons of this engine working after the manner of a common locomotive engine, excepting that, in lieu of steam, a motive power was to be obtained from the atmosphere, by the aid of the rarefied tube, with which the engine was placed in communication. The former plan was publicly exhibited in a small model, and an experimental railway was partially laid down near the Kensington Canal for the trial of the latter upon a practical scale, under the auspices of an association formed for bringing the pneumatic railway into use; but, from what cause we are not aware, the matter fell through, and no more was heard of Pinkus's plan until the somewhat similar apparatus of Messrs. Clegg and Samuda was brought into operation, since which some feeble attempts have been made to stop their proceedings as being infringements of Pinkus's patent-right.

The failure which had attended so many attempts to bring pneumatic transport to a practical trial led to a very general feeling of distrust, when, in 1840, Messrs. Clegg and Samuda brought forward their 'Atmospheric Railway;' but after some satisfactory experiments upon a more limited scale, those gentlemen arranged with the proprietors of the then unfinished Thames Junction or West London Railway for the temporary use of a portion of their line near Wormwood Scrubbs, upon which they laid down about half a mile of railway, with a rising gradient partly of 1 in 120, and partly of 1 in 115, and with the disadvantage of a very badly laid track formed of old contractor's rails (which, it is curious to observe, had formed part of the original rails of the Liverpool and Manchester Railway); yet, notwithstanding these and other unfavourable circumstances arising from the imperfection of the machinery, and the shortness of the line, which would not admit of the attainment of a maximum speed, the results of the first trials, on the 11th of June, 1840, showed a maximum speed of 30 miles per hour with a load of 5 tons 9 cwt. in one carriage, and of 22½ miles per hour with a load of 11 tons 10 cwt. in two carriages. This experimental line, which had an atmospheric tube of only nine inches diameter, was publicly exhibited in action at intervals, for many months, during which it was visited by many eminent engineers of this and other countries, and its success was considered by the directors of the Dublin and Kingstown Railway to be so decisive, that they determined to adopt the atmospheric mode of working upon a projected extension of their line from Kingstown to Dalkey, the gradients and curves of which rendered it unsuitable for working by locomotive engines. This line, which was so far completed as to be ready for working in August, 1843, is at present (December, 1844) the only line of atmospheric railway in existence, the first-mentioned line having been removed to allow the completion of the West London Railway, which is worked by locomotives; but though no other lines are yet made, the London and Croydon Railway Company have recently obtained parliamentary sanction to a plan for laying down a line of atmospheric Railway alongside of their present road, from London to Croydon, and making an extension of the same from Croydon to Epsom, by which arrangement there will be a complete atmospheric line of about 18 miles, half of which will run parallel with and close to a railway worked by locomotive engines, thus affording the most satisfactory data for comparison between the two modes of transport. A further line from Epsom to Portsmouth,* and several other projected railways of considerable extent, are also proposed to be constructed in this manner.

The most important point in which the atmospheric railway of Messrs. Clegg and Samuda differs from previous contrivances of the like character is the construction of the valve, which, even when the speed of the piston and train is increased to 50 or 60 miles per hour (a speed frequently attained in experiments upon the Dalkey line), performs its office with surprising efficiency. The subjoined diagrams, without pretending to give minute details, will show the nature of this contrivance: *Fig.* 1 representing a cross-section of the atmospheric tube with the valve closed, and *Fig.* 2 with the valve open for the passage of the connecting-bar between the piston and the external carriage. The tube, which is formed of cast-iron, in convenient lengths, and flanged together, is laid in the middle of the railway track, and firmly secured to sleepers imbedded in the road. Its diameter may be different on different lines, or (with a change of piston) on different parts of the same line, so as to accommodate the power to the resistance to be overcome; but on the Dalkey line, which rises 71 feet in a distance of a mile and three-quarters, a tube of about 15 inches is used. Along the upper side of the tube is the continuous slit or opening, at *a*, *Fig.* 1, and a little on either side of it are the vertical ribs or cheeks *b* and *c*, cast with the tube, the space between which forms a trough wherein the valve may lie secure from injury. The valve itself consists of a piece of strong leather, firmly enclosed between two pieces of iron, the undermost of which exactly fits the slit in the pipe, and has its lower surface concave, so that when it is shut down, as in *Fig.* 1, the internal circumference of the tube is perfect and unbroken, while the uppermost is flat, and broader than the slit, so that it prevents the valve being forced into the tube by the superincumbent pressure of the atmosphere. The leather is, on the side marked *b*, considerably wider than the upper plate, and its projecting edge is attached to the flat floor of the valve-trough, at the base of the cheek *b*, so as to form a continuous hinge. The more perfectly to prevent the ingress of air, the opposite or opening edge of the valve is, when closed as in *Fig.* 1, hermetically sealed with a composition of wax and tallow, which fills the small groove or space left between it and the cheek *c*, and is indicated by a dark mark in the cut. To protect the valve more thoroughly the trough is closed in with a sheet-iron cover *d*, formed in lengths of about five feet, with lap-joints, hinged with leather to the top of the cheek *b*, and shutting down closely upon the top of the cheek *c*. The interior of the tube is completely lined with a soft composition, which fills up all little irregularities, and renders the passage perfectly smooth and even; and the piston is surrounded by leather collars in such a way as to be perfectly air-tight, and yet to move with very little friction. It is attached to the fore end of a rod which is seen in section at *f* (*Fig.* 2), and which carries rollers so fixed as to lift up and open the valve immediately after the piston has passed, thus bringing it into the position indicated in *Fig.* 2, which allows room for the passage of the connecting-bar *e*, by which the piston is united to the foremost carriage of the train; the iron cover *d* being previously raised and held open by a coulter and a series of wheels or friction-rollers attached to the carriage. After the connecting-bar has passed, a roller attached to the carriage presses the valve down into its seat, while a heater gliding along the mass of composition at its opening edge melts it, and thereby seals the joint afresh. The cover *d* is then allowed to fall into its place, and all is ready for the passage of another train so soon as the piston shall have quitted the pipe so as to allow of its being exhausted afresh. The end of the tube behind the train is left open, to admit the air by which the piston is to be impelled; but the end in advance of the train is closed, and the air is pumped out from the tube by a branch pipe near it, leading to the air-pumps, which may be worked either by a steam-engine or by any other prime mover of sufficient power. It is proposed, in an extended line of railway, to place engines at intervals of two or three miles, and to break or interrupt the continuity of the atmospheric tube at the principal stations, so as to allow of the use of switches, turn-tables, and the other ordinary arrangements of a railway station; but it is needless here to enter upon an explanation of the various means by which these objects are accomplished. It is sufficient to observe that the train is pushed forward by manual labour until the piston has entered the tube, which it may do, by the aid of an ingeniously contrived valve, without impairing the partial vacuum which may have been previously produced in it; it then advances with a speed proportionate to the rate at which air is abstracted from the tube by the air-pumps until it reaches the opposite end of the tube, where, without the aid of an attendant, the valve which has closed the tube flies open, and the piston and train proceed by momentum until they are stopped by breaks if requisite, or, if it be desired to pursue the journey without stopping, until the piston enters another length of pipe. As soon as it has passed out of the first length, the end-valves are again closed, and the engines immediately commence the rarefaction of the tube in readiness for another train. Both in the experimental line at Wormwood Scrubbs and the atmospheric railway at Dalkey the inclination of the road is sufficient to produce rapid motion in one direction by gravity alone, so that the atmospheric pressure is only required in ascending, while in descending the piston is moved aside in such a way as to pass clear of the tube: but this mode of propulsion is equally applicable to working in both directions, either by means of two separate tracks, each having its own atmospheric tube, or by a single track and tube, along which the piston is impelled alternately in either direction.

Fig. 1.

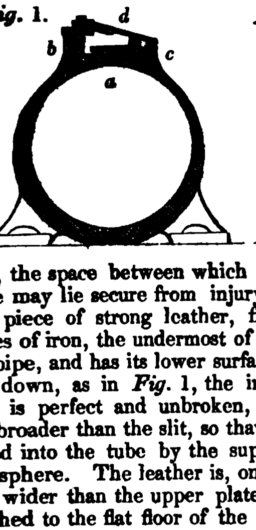
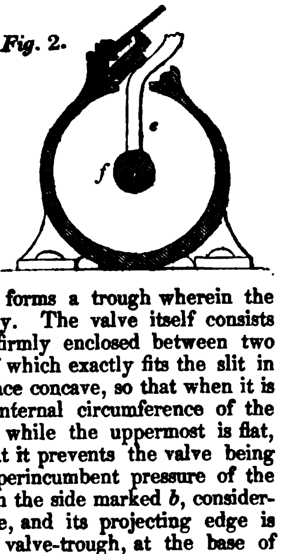


Fig. 2.



While the opinions of leading engineers continue at variance as to the merits of this mode of working a railway, it may be well to say very little of its proposed advantages. Some of these it claims in common with every other mode of working by stationary instead of locomotive engines [Railway, P. C., vol. xix., p. 260], of which the principal are the facilities which it affords for ascending steep gradients, and consequently for constructing railways at less cost than where heavy cuttings and embankments are necessary in order to procure easy slopes for the locomotive; the saving in the wear and tear, and consequently in the necessary strength and cost of the railway itself, in consequence of not having to convey the moving power with the train; and the security against collision, owing to the impossibility of moving two trains on the same stage or engine-length of railway at the same time. In like manner also some of the objections raised to this apply to every other mode of using stationary engines: such are the necessity of providing and constantly maintaining a power sufficient to conduct the largest amount of traffic which can ever be conveyed, which would render it as costly, as regards some large items of expense, to maintain a railway for the passage of four or five trains per diem as one upon which trains are constantly succeeding each other; and the liability of derangement to the whole system in consequence of the failure of a single point in it. These are the principal grounds for objection to what has been termed the *inflexibility* of the system, or, in other words, the comparative want of power to modify the mode of working according to the fluctuations of a variable traffic or the exigencies arising from accident. In drawing a comparison between atmospheric and rope traction there is less difficulty, for while in many points the merits and demerits of the two are identical, the vacuum in the one supplying the place of the rope in the other, it cannot be questioned that the train of an atmospheric railway is by far the most secure from accident, especially upon curves, it being as it were tied down to the track by the piston travelling within the tube; and also that, the difficulty of producing a valve which shall open with sufficient facility and close with sufficient exactness being once overcome, which it appears to be most perfectly, the friction and waste of power must be very much less in the atmospheric system than where a heavy rope and a long series of pulleys have to be put and kept in rapid motion; to say nothing of the chances of accident by the breaking of the rope, to which there is no equal risk as a parallel objection to the atmospheric system. Its safety is indeed one of the great advantages claimed for this mode of working a railway, as the worst which could happen in consequence of the failure of the apparatus would be the stopping of the train. In case it should be necessary to stop in the middle of the tube, so as to avoid collision with an obstacle on the road, the breaks will generally be found sufficient for the purpose, as there is not the immense momentum of the heavy locomotive to overcome; but it is proposed, if needful, to introduce a safety valve in the piston, or an arrangement for admitting air in front of it, in case of emergency. It is proposed generally to lay out atmospheric railways so nearly on the natural surface of the ground as to take advantage of many slopes of sufficient steepness for working by gravity alone; but while this has been much insisted upon by some advocates of the system as an advantage, it appears to be too little remembered that the advantage gained in one direction must inevitably produce a corresponding disadvantage in traversing the line in the opposite direction. Even some of those who still question the economical application of the atmospheric in lieu of the locomotive system, consider it well adapted for use upon such inclined planes as have hitherto been worked by ropes or by assistant engines.

---

* Since the above was written, the line alluded to has been rejected by the Board of Trade, so that it is now doubtful whether it will be brought before Parliament, or, if brought before Parliament, whether an act will be obtained for its construction; the Board of Trade giving the preference to a rival line, intended for locomotive engines, branching out of the South-Western Railway.

(Further information upon the early plans of atmospheric propulsion may be obtained from the pamphlets alluded to in this article, and, so far as those of Pinkus are concerned, from the *Railway Magazine*, First Series, 1835-6, and Second Series, vol. i. 1836, and Hebert's *Engineer's and Mechanic's Encyclopædia*, vol. i. pp. 35-40. Clegg's atmospheric railway has given rise to several pamphlets, chiefly of a controversial character, and, especially in connection with the Croydon and Epsom Railway Bill in the session of 1844, to much investigation by parliamentary committees; but the most complete body of information on the subject, with accurate records of the principal experiments at Wormwood Scrubbs and at Dalkey, will be found in the columns of the *Railway Times*, from 1840 to the present time.)

A'TRIPLEX, a genus of plants belonging to the natural order Chenopodiaceæ and the tribe Atripliceæ. It has monœcious, rarely perfect flowers, the perigone of two more or less connected parts, two stigmas, a free membranous pericarp, a crustaceous testa; the seed is vertical, attached by a lateral hilum, either near the base or by means of an elongated funiculus in the middle of the side; the radicle basal; the stamens five, continuous. Most of the species of this genus are insignificant weeds, and are sometimes troublesome pests in corn-fields. Babington, in his 'Manual of British Botany,' enumerates ten species as inhabitants of Great Britain. The most common forms of the genus on cultivated lands are *A. angustifolia*, *A. erecta*, *A. patula*. Mr. Babington has described recently a new species, which is also found in cultivated and waste places, not uncommonly in Great Britain. This is *A. deltoidea* (Bab.): it has an erect stem with ascending branches; opposite leaves, all hastate-triangular, with two descending lobes unequally dentate or sinuate-dentate; the perigone of the fruit ovate-triangular, dentate, tunicated on the back, rather longer than the fruit, collected into a many-flowered, branched, dense panicle; seeds smooth, shining. *A. rosea*, *A. laciniata*, *A. littoralis*, are frequent plants on the sea-shore. *A. prostrata* is a coast plant, but is rare in Great Britain, and Babington suspects that it may be a maritime form of A. patula.

(Babington, *Manual of British Botany*.)

A'TRYPA (Dalman), a subdivision of the great genus Terebratula, chiefly (if not entirely) confined to a fossil state, and to the Palæozoic strata. Many of the Spiriferæ of Sowerby (as Sp. glabra, fimbriata) and some of the Terebratulæ of the same author (as T. pugnus), have been referred to this very ill-characterized genus. T. psittacea is the recent analogue.

ATTENDANT TERM. [TERM OF YEARS, P. C.]

ATTIRET, JEAN DENYS, called Frère Attiret, a French painter attached to the Jesuit mission at Peking, in the middle of the eighteenth century. He was born at Dôle in the Franche-Comté, in 1702, and was first instructed by his father, an obscure painter of Dôle. He completed his studies at Rome, whither he was sent by the Marquis de Broissia. After practising a short time at Lyon, he settled in Avignon, and became a lay-brother of the Jesuits of that place; and when, in the year 1737, the French Jesuits of Peking requested their brothers at home to send them a painter, Attiret undertook to go, and set out in the same year.

In China Attiret soon obtained the favour of the emperor Këen Loong, by presenting him with a picture of the Adoration of the Kings, which he ordered to be placed in one of his own apartments; he however expressed a dislike to the gloss of oils, and employed Attiret only as a water-colour painter. Attiret became an object of envy to his Chinese rivals from an order he received from the emperor to restore a painting in one of the inner apartments of the palace, a commission as disagreeable as it was honourable to the French painter. He was locked up in the room from seven in the morning until five in the afternoon, with several eunuchs, ostensibly in attendance on him, but really as a guard over him. Palace etiquette would not allow him any convenience, and he was compelled to work in constant danger of breaking his neck, as a chair placed upon a table was the only scaffold he could procure. In addition to these evils, he was forced to leave his dinner and content himself with fruit and biscuits, as the emperor, in consideration of his great ability, sent him his dinner daily from his own table, but before it reached Attiret, through the ceremonious journey it had to perform, it was quite cold and spoiled. Attiret himself, in passing to and from the chamber in which he was at work, was obliged to deliver himself into the hands of various sets of eunuchs, and to await the repeated locking and unlocking of doors.

Attiret met also with many vexations from the Chinese court painters until he employed them to execute the secondary portions of his works, and conformed himself in some degree to the Chinese taste. He found that the Chinese painters executed the costume, landscape, and even animals, much quicker and quite as well as he could do them himself.

Between the years 1753 and 1760, when the emperor Këen Loong was at war with the Tartars on the north-western confines of his empire, he sent to Peking for Attiret, to join him and prepare some designs to illustrate his triumphs. Attiret arrived at the seat of war in 1754, and made many accurate drawings of triumphs, processions, festivals, &c., from which he afterwards painted pictures, some of which were preserved in the palace, and shown only by special permission of the emperor. Attiret painted the emperor's portrait, and introduced a great many portraits into these drawings, of Chinese officers, many of whom had to journey merely for the purpose of being painted as much as 800 leagues. Sixteen of these drawings were sent to France to be engraved, under the direction of C. N. Cochin the younger. They were engraved by various artists, on so large a scale that it was necessary to make paper expressly for them. As soon as they were printed, both prints and plates were sent back to China, a few impressions only being reserved for the royal family of France and for the Parisian Library. Helman the engraver made a small copy of them. The originals are not all by Attiret; some were by the Jesuits Castiglione and Sikelbar. They are defective in design, and it is evident that their authors have paid too much deference to the taste of the Chinese to satisfy that of the Europeans.

The emperor created Attiret a mandarin, but by his position as a Jesuit it was impossible for him to assume the worldly distinction: he died at Peking in 1768, aged 66. The emperor gave 200 ounces of silver towards the expense of his burial.

(*Extrait d'une Lettre du Père Amiot, du* 1 *Mars*, 1769, *de Peking*, *contenant l'éloge du Frère Attiret*, *&c.*, inserted in the *Journal des Sçavans* for June, 1771.)

ATTORNEY. By an act (6 & 7 Vict. c. 73) passed in 1843 the whole of the laws relating to attorneys and solicitors practising in England and Wales, which were previously scattered over no less than sixty statutes, were consolidated. In the new act special care is taken to prevent unqualified persons practising, and persons seeking to be admitted attorneys are subjected to a regular examination. The control of the profession, from the period of admission, and so long as they continue in practice, is confided to the Incorporated Law Society, which is appointed registrar of attorneys and solicitors. The Commissioners of Stamps are not to grant any certificate until the registrar has certified that the person applying is entitled thereto; and the commissioners are annually to deliver to the registrar all such certificates, with the date when they were granted. Persons who had discontinued their certificates to practise in the superior courts, but who were in the habit of practising in the inferior courts, and at the sessions and assizes, are now obliged to take out certificates, and are thus brought under the controlling power of the incorporated society. The act simplifies proceedings against members guilty of professional delinquency.

No person, unless he has taken a degree at the universities of Oxford, Cambridge, Dublin, Durham, or London, can be admitted an attorney or solicitor without serving a clerkship of five years to a practising attorney in England and Wales, and have undergone an examination; but a person who has taken the degree of Bachelor of Arts or Bachelor of Law at either of the above-mentioned universities can be admitted after having served three years; but the degree in arts must have been taken within six years after matriculation, and in law within eight years; and the articles of clerkship must commence within four years after the degree has been taken. There is an important provision which enables a clerk to serve one year of his articles with a barrister or special pleader, and one year with a London agent. An attorney cannot have more than two clerks at one time, and must make affidavit of being duly enrolled within six months after he takes a clerk. Before a clerk can be admitted an attorney he is required to make affidavit of having duly served, and he next undergoes an examination, with a view to ascertain his fitness and capacity, by the several masters of the Courts of Queen's Bench, Common Pleas, and Exchequer, with whom are associated other examiners, who are attorneys, and are appointed annually by the Incorporated Law Society. For the above purpose eighty or ninety questions are to be answered, which are arranged under the following heads:—1, Common and statute law, and practice of the courts; 2, conveyancing; 3, equity and practice of the courts; 4, bankruptcy and practice of the courts; 5, criminal law and proceedings before justices of the peace. There are some preliminary questions, two of which are for the purpose of ascertaining what law-books have been read and studied, and if the person under examination has attended lectures upon the law.

The Master of the Rolls has assimilated the practice of his court regarding notices of admission and renewal of certificates to that of the common law courts. Every person not previously admitted an attorney of these courts, or one of them, before he can act as a solicitor of the Court of Chancery, must undergo an examination touching his fitness and capacity. The examiners appointed by the Master of the Rolls are twelve in number, and any five of them are competent to act. They are appointed annually. On being admitted as attorney or solicitor, the oath of allegiance is required to be taken, and an oath to the following effect:—'I, A. B., do solemnly swear (or affirm) that I will truly and honestly demean myself in the practice of an attorney (or solicitor, as the case may be) to the best of my knowledge and ability. So help me God.'

The act makes some alteration in general practice, particularly in respect to costs, by enabling a solicitor to obtain the taxation of his own bill without the expense and delay of an action. The certificate of the taxing-master is rendered final. A bill cannot be taxed after a verdict or writ of inquiry, or after twelve months from the delivery of the bill, except under special circumstances, nor under any circumstances after twelve months' payment.

ATTORNEY, LETTER OR POWER OF. [Letter or Power of Attorney, P. C.]

ATTORNMENT is defined by Lord Coke to be 'an agreement of the tenant to a grant of a seigniory, rent, or manor, or of the donee or lessee to a grant of the reversion or remainder.' An attornment was necessary in all conveyances of a manor, services, remainder or reversion which operated by the common law: for in such case, if there was no attornment, the grant was void. But by the statute 27 Hen. VIII. c. 10, an attornment was not necessary where the estate passed by way of use: and now, by the statutes 4 & 5 Anne, c. 16, §§ 9, 10, and 11 Geo. II. c. 19, § 11, both the necessity and efficacy of attornments have been almost entirely taken away. An attornment may be either express or implied: an express attornment is when the tenant, after hearing the grant, expresses his agreement to it, as by using any words which show his assent to the grant; implied, when he pays rent to the grantee, or does any act acknowledging the grantee's title.

(Comyn, *Digest;* Co. Litt. 309, a.; Saunders' *Rep.*, i. 234 a. note 4, ed. 5, 1845.)

ATTRACTION. The possibility mentioned in the article Cohesion, P. C., of bringing under one law both the attraction of gravitation and that of cohesion, has been since reduced to more than a possibility, namely, to a considerable degree of presumption that the law can be actually stated. This remarkable addition to the nascent theory of molecular forces is the work of O. F. Mossotti, and was published in a pamphlet entitled 'Sur les Forces qui régissent la constitution intérieure des corps, aperçu pour servir à la détermination de la cause et des lois de l'action moléculaire,' Turin, 1836, 4to. This paper is translated in Taylor's 'Scientific Memoirs,' vol. i.; and Mr. Pratt, in the second edition of his 'Mechanical Philosophy,' observing that Mossotti's analysis, though conducted with an ultimate view to complex application, is really, for the present, only applied to simple cases, has given the mathematical view necessary to include those simple cases and no more, in a perfectly sufficient manner.

The observed facts are, that particles which are very nearly in contact with one another repel each other in a manner which certainly depends, among other things, on the temperature; but that at a certain distance they cease to repel, and begin to attract, each other, and that with considerable force; at a still greater distance that attraction becomes comparatively feeble, and coincides with what is called the attraction of gravitation, varying inversely as the square of the distance. That this attraction of gravitation, and no other (or comparatively a very small one) exists at ordinary sensible distances, is fully proved by the Cavendish experiment. [Weight of the Earth, P. C.]

Many hypothetical laws might be constructed which fulfil all these conditions; but the great interest of Mossotti's investigation, and perhaps much of its value, consists in his having taken a theory actually existing, imagined upon grounds with which his views had no necessary connexion, and upon his having given a basis of the utmost simplicity to the numerical law on which he proceeded. This basis is no other than that all molecular attractions and repulsions vary inversely as the squares of the distances.

When Æpinus explained Franklin's electrical theory, his hypothesis was that the particles of matter repel one another, and also the particles of the electrical ether, which he supposed to exist and to be attached to particles of ordinary matter. But he supposed the particles of ether to attract the particles of matter; so that of the two species of particles, called matter and ether, each repels the particles of its own kind and attracts those of the other. Æpinus even went so far as to suppose that the attraction of gravitation might be a necessary consequence of such a theory, on the supposition that the attraction of the matter and ether was a little greater than the repulsions. So far Mossotti has adopted his views; but, by applying mathematical analysis, he has shown what Æpinus could not have had the least reason to suppose, namely, that attraction of cohesion, the repulsion which takes place when the distance is smaller than that of cohesion, and the attraction of gravitation, which exists at distances too great for cohesion, are all to be found among the consequences of this theory.

If there exist in space molecules of matter which repel each other, in a fluid or ether of which the particles also repel each other, while the particles of the matter attract those of the ether, it is obvious that each of the particles of matter will, by its attraction, collect about it a condensed atmosphere of ether. If the attractions and repulsions be all inversely as the squares of the distances, Mossotti finds that, in consequence of the atmospheres of ether, two molecules at a distance r (the attraction of the particles of matter for those of ether being presumed a little, and but a little, greater than the repulsion of the particles of matter from each other) will repel each other with a force represented with great approximation by the formula

$$\frac{A(1+\alpha r)\varepsilon^{-\alpha r}-B}{r^2},$$

where A, α, B are certain positive constants. To make the results agree with observed facts, α must be considerable, and A much greater than B. When the formula is positive, repulsion is represented; when negative, attraction. When r is very small, the formula is positive, and represents repulsion; when r increases to a certain value, it vanishes, and afterwards becomes negative: at the value of r just mentioned there is stable equilibrium. As r still increases the attraction increases, becomes a maximum at another certain value of r, and afterwards, if α be considerable, diminishes as the inverse square of the distance, or in a ratio incomparably near to it. All this agrees with the facts of observation, and with the numerical law of the facts as far as we know it; to which it must be added that an increase of the density of the ether would increase the distance at which particles are in equilibrium, which is generally done by increase of temperature. It is very often objected to one step that it is not two or more. We have heard, for example, the above theory reproached with not giving electricity, magnetism, and chemical affinity among its consequences. It is, nevertheless, one step: the main *mechanical* facts of cohesion, gravitation, and caloric, are made consequences of one law, which was never done before. This law may or may not be the law of nature; in the latter case it may still be valuable as a suggestion towards finding the right law.

ATTRACTION, ELECTRICAL. Under this designation it is intended to notice the apparent attractions and repulsions which take place when bodies are in particular states with respect to electrical power.

From a very early time it was known that amber, when excited by being briskly rubbed, seemed to draw towards it such light bodies as straws and feathers; and the phenomenon, as well as that of an apparent repulsion, is now exhibited in a more striking manner by presenting a cylinder of excited glass or of excited wax to a pith ball suspended by a silk line. [Electricity, P. C., pp. 335-6.]

In attempting to explain by what means these actions might arise, it is imagined that there may exist in all material substances a fluid, or fluids, whose particles exercise upon one another attractive or repulsive powers, while a mutual attraction may take place between the fluid particles and those of the substance with which they are combined.

The hypothesis of Watson and Franklin was that there exists but one kind of such fluid: it was supposed that, in exciting glass and some other bodies by friction, the fluid was abstracted from the earth through the material by which the friction was produced, and accumulated upon the surface of the body, which thus obtained more than its natural quantity. It was supposed that this excess readily passed into any body near it, provided the latter had less than, or only its natural quantity, or at most had not so great a quantity in proportion to its magnitude. In the excitement of resinous bodies it was supposed that the fluid passes from those bodies, through the material employed in the friction, to the earth; and thus the resinous bodies were supposed to have less than the natural quantities. Hence arose the distinction between positive and negative, or redundant and deficient electricity; and the theory of Æpinus and Cavendish relating to the distribution of electricity on the surfaces of bodies is in conformity with this hypothesis. But the hypothesis is open to some objections: thus, when bodies are deprived of the fluid which, when they are in the ordinary state, is combined with them, they are observed to repel each other mutually; and it must therefore be inferred that the particles of bodies exercise upon each other a strong repulsive power, a circumstance which can scarcely be reconciled with the general attraction existing among the bodies in nature, or with the cohesive power by which the particles of all bodies are held together. It is moreover impossible to conceive, as Biot observes, why negative electricity, that is, a mere absence of fluid, should be developed on the surfaces of bodies according to the hydrostatical laws by which a real fluid would be developed.

To this hypothesis succeeded that which is now generally received. It was proposed about the same time by Symmer in England and Du Fay on the Continent, and consists in the assumption of two fluids, of directly opposite qualities, existing at the same time in combination with the particles of all bodies in nature: the particles of each fluid are conceived to exert on one another a strong repulsive force, while the particles of the unlike fluids mutually attract each other. The experiments of Coulomb with the electrical torsion balance have proved that the attractive and repulsive forces vary in intensity inversely as the squares of the distances between the particles, and that at equal distances the attractions and repulsions are exactly equal.

The manner in which the mutual actions of electrical particles produce the phenomena of attraction or repulsion in bodies with which they are combined, omitting the consideration of the effects arising from the decompositions of the natural electricities of the bodies, is conceived to depend in part on the pressure of the atmosphere, and in part on the conducting powers of the bodies. Thus, if by any excitement electrical particles be collected on the surfaces of two bodies (suppose two spheres) which are non-conductors, they will be retained there by the pressure of the surrounding air, and by the impermeability of the material: hence the bodies must take the motions which result from the repulsion or attraction of the fluids on them, according as those fluids are of the same or of unlike kinds. If one of the bodies be a conductor and the other a non-conductor, and they be both charged, for example, with electricity of the same kind, while that which is on the surface of the latter suffers little change of disposition, that which is on the other moves freely through its substance, and is, by the mutual repulsion of the particles, driven in abundance to the opposite side, so as to be more dense, or to form a thicker stratum there than on the side nearest to the non-conductor. But the reaction of the electrical fluid against the surrounding atmosphere being proportional to the square of the thickness of a stratum, it follows that there is an excess of force tending to make the conducting body recede from the other; and it is easy to perceive that a like explanation may be given of the contrary movement which takes place in the conducting body when the two are charged with unlike kinds of electricity.

The circumstances relating to the distribution of electricity on the surfaces of bodies agreeably to the hypothesis of two fluids, have been determined with the aid of a most refined analysis, by La Place, Ivory, and Poisson; and the 'Theory of Electricity,' in the 'Encyclopædia Metropolitana,' contains an investigation of the distribution on the surfaces of spheres. The results are there computed numerically, and compared with those which Coulomb has obtained by direct experiment, and the discrepancies are found to be only such as may fall within the limits of the unavoidable errors in the experiments themselves.

When a magnetized body is placed near one which is not so, a decomposition of the natural magnetism in the latter takes place, similar to that decomposition of the electrical fluids which occurs when a body in its natural state is brought near one which has been excited by friction [Electricity, P. C., p. 337]; and all the phenomena exhibited by magnetized bodies on one another are capable of being explained on the hypothesis of two fluids, the particles of which repel or attract one another according as they are of the same or of unlike kinds, the intensities of the forces being inversely proportional to the squares of the distances.

The hypothesis of two fluids, moving in opposite directions, is also adopted in order to explain the phenomena of galvanism and electro-magnetism; that which is considered as positive flowing from the zinc, through the acid, to the copper, and that which is called negative, from the copper, through the acid, to the zinc; but the discovery that a balanced magnetized needle was affected when placed in the vicinity of the wire connecting the opposite ends of a galvanic battery, has given rise to an hypothesis that the power supposed to exist in what was called by the general name of an electric fluid was produced by a spiral motion of the fluid current about the conducting wire, or about the particles of a magnetized needle.

Oersted, the discoverer of the electro-magnetic action, conceived that, when the circuit was completed by the wire passing from the zinc end to the copper end of a battery, the positive and negative fluids which, if unimpeded, would flow in straight lines, were compelled by acting against each other to move spirally about the wire; and this opinion is still generally held, it being supposed that the turns of the spiral are very near one another, so that they may be considered as circles whose planes are perpendicular to the axis of the wire. The course of either current, according to the explanation given by Mr. Barlow, may be easily understood from the following description, which relates in particular to that which is called positive. Let a conducting wire be imagined to be so bent that part of it shall be in a vertical position, and shall pass perpendicularly through the paper, the part above proceeding from the zinc or positive end of the battery, and the part below to the copper or negative end; the current of positive electricity being thus from above downwards: imagine, also, a small needle whose north and south poles are represented by *n* and *s* to be horizontally balanced on a pivot and placed successively at different points in the circumference of a circle described about the intersection of the wire with the paper. Then, the directive power of the earth on the needle being neutralized by the presence of a magnet, the line *ns* will assume in every part the position of a tangent to that circumference; the direction *ns* being always such as it would be if the point *s* revolved in advance of *n* round the axis of the wire in the same order as the hands of a watch move. [Electro-

Dynamics, P. C.] The negative current may be understood to be revolving at the same time in like manner, but in a contrary direction. The currents thus revolving are supposed to act on the particles of the magnetized needle, disposing them to arrange themselves parallel to its axis, and so as to bring the latter in the position of a tangent to the curve described by the fluid about the wire.

The hypothesis of Ampère differs from that which has been just stated: this philosopher having formed the conducting wire into two parts which could be so connected with the opposite poles of a galvanic battery that the current of positive electricity might be made to pass along the two parts in the same direction, or in contrary directions, found that, in the former case, the wires (which were delicately suspended in horizontal and parallel positions) seemed to attract, and in the other case to repel one another. He from thence inferred that the fluids passed in rectilinear directions, or parallel to the axes of the wires, and that the particles were so polarized as to present to each other, laterally, when they moved in the same direction, sides which had powers of attraction; and when they moved in contrary directions, sides which had powers of repulsion: he further supposed, in order to account for the effect of the wires on a magnetized needle, that magnetic currents revolve about every particle or rather every physical point of a magnetized body, as it were in the plane of an equator to an infinitely small sphere; and he assumed that the fluid in the conducting wire of a battery exerts actions upon these revolving currents, by which the planes of the revolutions are brought into such positions that, if produced, they would pass through the axis of the conducting wire. It is evident however that the effect thus produced on the needle is the same as that which was before described; for, as the planes of the revolving currents are supposed to be perpendicular to the axis of the magnetized body, that axis must tend to place itself in the direction of a tangent to a circle supposed to be perpendicular to the axis of the conducting wire of the battery.

It has been ascertained that the current of electricity produced by the electrical machine causes deviations in a magnetized needle; and it is now generally believed that the electric, galvanic, and magnetic fluids, if such there be, are identical. An experiment made by Mr. Faraday, in which a magnetized needle caused to float on water was found to enter a glass tube having its axis on a level with the surface and about which a galvanic conducting wire was spirally wound; while such magnetized needle would not enter the bore of a hollow magnet placed in the same situation as the glass tube—seemed however to show that the nature of the galvanic and magnetic fluids was not absolutely the same. But M. Ampère, in explanation, has observed that the result of the experiment is not inconsistent with the hypothesis of identity; since, when the wire is coiled about the glass tube, the needle is within the electric current, whereas it is outside of the currents about the particles of the magnetic tube.

ATTRACTION OF BALLS. [Weight of the Earth, P. C.]

ATTRACTION OF MOUNTAINS. [Attraction, P. C.]

ATTRACTIONS, ELECTIVE. This name is given to those tendencies by which the particles of bodies unite, or combine together, to form other bodies; and, as these tendencies exist in different degrees between the particles of different bodies, the name is intended to denote an apparent choice of the particles of one kind in preference to those of another kind. [Affinity, P. C.]

ATTWOOD, THOMAS, a composer of great eminence, equally distinguished by his productions for the church, the chamber, and the theatre, was born in 1765, and commenced his professional education, as one of the 'children of the Chapel-Royal,' under Dr. Nares, and his successor, Dr. Ayrton. On the change of his voice, and consequent retirement from the king's service, he was sent abroad, by and at the expense of his patron, the Prince of Wales, for the purpose of completing his studies in the schools of Italy. He first went to Naples, where he continued two years, receiving some instruction from Filippo Cinque, and more from Gaetano Latilla, one of the ephemeral favourites of the last age. But the discerning young student, seeing that the musical art was rapidly on the decline in the country where it had flourished so long, and that it was renovated and in full vigour in Germany, proceeded to Vienna, and immediately became the pupil of Mozart, with whom he formed an intimacy which led to a daily intercourse, and to the imparting not only the usual information, but also a knowledge of those deeper recesses of the art which seldom, if ever, is, or can be, communicated in the course of ordinary lessons. This happy result is manifest in all Attwood's secular compositions, and was recognised by the great master, who said—according the report of Michael Kelly, the singer—'Attwood partakes more of my style than any pupil I ever had.' (Kelly's *Reminiscences*.)

Soon after the young Englishman's return to his native country, his royal patron made him one of his chamber musicians, an appointment however which he soon relinquished, his friends not thinking it altogether compatible with the station he was entitled to hold. On the arrival of the Duchess of York in this country he became her 'musical preceptor;' and on the ill-fated marriage of the Prince of Wales (afterwards George IV.), he was constant in his attendance on the princess, to whom he gave almost daily lessons In the conscientious performance of this duty, which he continued to fulfil after it became evident that any slight shown to his illustrious pupil would not be displeasing in another quarter, he gave offence to his patron, who, for several years after, made his resentment felt.

In 1795 the dean and chapter of St. Paul's elected Mr. Attwood as organist of that cathedral; and in the following year, on the death of Dr. Dupuis, he was appointed composer to the Chapels-Royal. For the solemnity of the coronation of George IV., he was required officially to compose an anthem, when he produced 'The king shall rejoice,' a grand work which has since been heard and admired in all parts of the kingdom. This restored him to the favour of his early protector. It fell to his lot to be called on a second time to contribute to the ceremonial of a coronation, and for that of William IV. he composed the anthem, 'O Lord, grant the king a long life,' another great work, and in all respects equal to the former. In 1837 he was, without solicitation, appointed, by the bishop of London, to succeed Mr. Stafford Smith, in the office of organist of the Chapels-Royal. 'It was willed however that he should enjoy this spontaneous tribute to his merit only a few months.' He died in March, 1838, and his remains were deposited in St. Paul's Cathedral, under his own organ, with every honour that the church to which he belonged, the choirs of the Royal Chapel and Westminster Abbey, and the most distinguished members of his profession, could confer.

Mr. Attwood's compositions are so numerous, in each of the classes before named, that we can only say, generally, that a more than usual proportion of them are likely to reach distant posterity. His cathedral works, which unite the elegance of the modern school with the becoming sobriety of English church music, are, with one or two exceptions, unpublished; but it is to be hoped, both for the sake of the author and of the public, that his representative will not allow such undeniable proofs of his father's genius—compositions which will add so much to the resources of our choirs—to remain any longer in comparative obscurity.

AUCUPA'RIA. [Pyrus, P. C.]

AUDIANS, or AUDEANS, a sect of heretics, so called from their founder Audius, or Audeus, who is said to have been a native of Mesopotamia, and who lived in the fourth century. Having begun, as usual with religious reformers, by attacking the manners of the clergy, and perhaps also the government of the church, he proceeded in this line till he was expelled from the body of the faithful; upon which he assumed the episcopal office, and was hereupon immediately banished by the emperor Constantius to Scythia. This is stated to have been about the year 338. Among various erroneous opinions and practices attributed to Audius and his followers are the celebration of Easter after the usage of the Jews, the admission of all descriptions of persons indiscriminately to the Lord's Supper, the doctrine of the eternity of fire, water, and darkness, and especially that of anthropomorphism, or the resemblance of the Deity to the human form. This last heresy, in particular, which, as a Christian article of faith, appears to have originated with Audius, spread extensively. 'The pilgrim Cassian,' Gibbon writes, 'who visited Egypt in the beginning of the fifth century, observes and laments the reign of anthropomorphism among the monks, who were not conscious that they embraced the system of Epicurus.' (*Dec. and F. of Rom. Emp.*, chap. 47, note.) But we have no account of the tenets of Audius, either from himself or any of his followers: we are dependent for all we know of him upon the statements of the orthodox theological writers of that and the next age, Athanasius, Augustine, Epiphanius, and Theodoret. He is admitted to have been a person of learning, and Epiphanius acknowledges that in his exile he exerted himself with great success in converting the barbarians.

AUGMENTATION, COURT OF. This was a court established by 27 Hen. VIII. c. 27, for managing the revenues and possessions of all monasteries under 200*l.* a year, which by an act of the same session had been given to the king, and for determining suits relating thereto. The court was to be called 'the Court of the Augmentations of the Revenues of the King's Crown,' and was to be a court of record with one great seal and one privy seal. The officers of the court were, a chancellor, who had the great seal, a treasurer, a king's attorney and a king's solicitor, ten auditors, seventeen receivers, with clerk, usher, &c. The oaths of the different officers are given in § 4 of the act. All the dissolved monasteries under the above value, except those preserved incorporately, were in survey of the court, and the chancellor of the court was directed to make a yearly report of their revenues to the king. The annual revenue of 376 monasteries under 200*l.* a year, which were suppressed, was 32,000*l.* and the value of their goods, chattels, plate, &c. was estimated at 100,000*l.*

The records of the Court of Augmentation are now at the Augmentation-Office in Palace-Yard, Westminster, and may be searched on payment of a fee.

AUGUSTI, CHRISTIAN JOHANN WILHELM, a celebrated German theologian, was born on the 27th of October, 1771, at Eschenberge, a village near Gotha, where his father was pastor. After receiving his preparatory education in the gymnasium of Gotha, in 1790 he entered the university of Jena, where, under Griesbach, he devoted himself to theology and philology. After the completion of his studies several years passed before he obtained an appointment, but although he had to struggle with great difficulties in gaining a livelihood, he still continued his studies with great activity: he began his literary career by contributions to theological journals, and at length in 1798 he resolved upon entering on the career of an academical teacher at Jena. In 1800 he was made professor extraordinary, and in 1803 he succeeded Ilgen in the chair of Oriental literature, which he exchanged in 1807 for that of theology. The popularity of his lectures and the many valuable works which he published during his residence at Jena, not only induced the Duke of Saxe-Weimar to make him a member of his consistory, but other German universities made great efforts to draw him from Jena. In 1811 however he accepted the chair of theology in the university of Breslau, to which he was invited by the Prussian government, and in addition to which he was honoured with a seat in the consistory of the province of Silesia. Augusti, who had hitherto chiefly distinguished himself as a writer upon theology and ecclesiastical matters, had now ample opportunities for displaying the practical character of his mind. His influence upon the university of Breslau and upon all the educational establishments of Silesia was very great. At the time when the French marched into Russia, Augusti was rector of the university, and it was owing to his intrepidity and patriotic spirit that the property of the university was saved. His conduct was severely censured by the timid, and those who would have yielded to the enemy, but the calumnious reports which had been spread about him were soon shown in their true light, and the Prussian government acknowledged its gratitude to him by various honourable distinctions. In 1819 Augusti was honoured with the chief professorship of theology in the newly established university of Bonn, and with the title of Councillor of the Consistory at Cologne. The influence which he exercised over the Protestant Church in the Rhenish province of Prussia rapidly increased, and in 1833 he was placed at the head of the ecclesiastical affairs of that province, by being appointed director of the consistory of Coblenz. Notwithstanding the numerous duties which this office devolved upon him, he still continued his lectures in the university until his death on the 28th of April, 1841.

Augusti was one of the most voluminous theological writers of Germany. He was originally led by the influence of Griesbach to join the critical or philosophical school of theology, but this did not suit his natural bias, which was more inclined to maintain things as they are than to speculative investigations, and during the last forty years of his life he was a zealous advocate of the established form of religion, without being in the least degree bigoted. As far as his doctrines go, he may be considered an orthodox Lutheran. His writings, most of which are of an historical or archaeological nature, are very useful as works of reference; but they are deficient in elegance and simplicity of form, and contain more evidence of learning and industry than of the true spirit of an historian. The following list contains the most important of his works:—1, 'Exegetisches Handbuch des Alten Testaments;' 2, A continuation of Berger's 'Praktische Einleitung in das Alte Testament;' 3, 'Apologien und Parallelen Theologischen Inhalts;' 4, 'Memorabilien des Orients;' 'Lehrbuch der Christlichen Dogmengeschichte,' Leipzig, 1805, 8vo.; 5, Historisch-Kritische Einleitung ins Alte Testament,' Leipzig, 1806, 8vo.; 6, 'System der Christlichen Dogmatik nach dem Lehrbegriff der Lutherischen Kirche,' Leipzig, 1809; 7, Denkwürdigkeiten aus der Christlichen Archaeologie,' 12 vols. 8vo., Leipzig, 1817-35. This is the most important of all Augusti's works; he subsequently condensed it into a Manual of Christian Archaeology. 8, 'Handbuch der Christlichen Archaeologie,' 3 vols. 8vo., Leipzig, 1836-37; 9, 'Versuch einer Historisch-Dogmatischen Einleitung in die heilige Schrift,' Leipzig, 1832, 8vo.; 10, Historiae Ecclesiasticae Epitome,' Leipzig, 1834, 8vo.; 11, Beiträge zur Christlichen Kunstgeschichte und Liturgik.' Of this work only one volume was published when Augusti died.

(*Jenaische Allgemeine Literatur-Zeitung*, for June, 1841; *Intelligenzblatt*, p. 66, &c.; *Biog. Dict.* of the Society for the Diffusion of Useful Knowledge.)

AULA'CODON. [CHELODUS, P. C. S.]

AU'LOLEPIS, a fossil genus of Cycloïd fishes, from the chalk of Sussex and Kent. (Agassiz.)

AULO'PORA (Goldfuss), a fossil genus of Polypiaria, from the Silurian strata.

AURELIANUS, CÆLIUS. [CÆLIUS AURELIANUS, P. C.]

AUST CLIFF. In the bone-bed of this famous locality, usually classed with the lias formation, occur a few organic remains which appear to belong also to the keuper deposits. This has been thought a sufficient reason for removing these beds out of the lias. But if we regard their mineralogical and geological relation: this displacement will hardly be allowed.

AUSTEN, WILLIAM, an English metal-founder of the fifteenth century, and the contemporary of Donatello and Ghiberti, the most renowned of his foreign rivals. A very interesting document respecting Austen and other artists has been preserved by Sir William Dugdale in his 'Warwickshire.' Austen had a great share in the construction of the celebrated tomb at Warwick, in St. Mary's church, of Richard de Beauchamp, earl of Warwick, who died in 1439. In the document in question, which is the covenant between the earl's executors and the artists to be employed in the construction of the tomb, &c., William Austen is styled 'citizen and founder of London,' from which and the details of the agreement, which are highly interesting, it appears that he was not the designer or modeller of the figures which he cast in brass, for it is expressly stated that he is to work from models made of timber. 'Will. Austen, citizen and founder of London, xiv. Martii 30 H. 6, covenanteth, &c. to cast, work, and perfectly to make, of the finest latten (brass) to be gilded that may be found, xiv. images embossed, of lords and ladies in divers vestures, called weepers, to stand in housings made about the tombe, those images to be made in breadth, length, and thickness, &c., to xiv. patterns made of timber. Also he shall make xviii. lesse images of angells, to stand in other housings, as shall be appointed by patterns, whereof ix. after one side, and ix. after another. Also he must make an hearse to stand on the tombe above and about the principal image that shall lye in the tombe according to a pattern; the stuffe and workmanship to the repairing to be at the charge of the said Will. Austen. And the executors shall pay for every image that shall lye on the tombe, of the weepers so made in latten, xiii.*s.* iv.*d.* And for every image of angells so made [illegible]*s.* And for every pound of latten that shall be in the hearse x *d.* And shall pay and bear the costs of the said Austen for setting the said images and hearse.'

'The said William Austen, xi. Feb. 28 H. 6, doth covenant to cast and make an image of a man armed, of fine latten, garnished with certain ornaments, viz. with sword and dagger; with a garter; with a helme and crest under his head, and at his feet a bear musted (muzzled), and a griffon perfectly made of the finest latten, according to patterns; all of which to be brought to Warwick and layd on the tombe, at the perill (risk) of the said Austen; the executors paying for the image, perfectly made and layd, and all the ornaments in good order, besides the cost of the said workmen to Warwick, and working there to lay the image, and besides the cost of the carriages, all which are to be born by the said executors, in total xl.*li.*'

In the opinion of Flaxman, these works of Austen are equal to what was done in Italy at the same time, and though he is mentioned only as the founder, he may possibly be the designer of the figures, as the patterns spoken of in the covenant may have been made in relation to size and costume, and not as exact models to prepare the casts from. The pay of 13*s.* 4*d.* for making a brass figure appears small, but it was at that time the price of an ox. The tomb itself cost 125*l.*, the figure of the earl 40*l.*, and there was an additional expense of 13*l.* for gilding. The whole expense of the tomb and the chapel in which it is placed, called Beauchamp Chapel, was 2458*l.* 4*s.* 7*d.* The other artists employed in this monument were—John Essex, marbler; Thomas Stevyens, coppersmith; John Bourde, of Corffe Castle, marbler; Bartholomew Lambspring, Dutch goldsmith, of London; John Prudde, of Westminster, glazier and painter on glass; John Brentwood, citizen and steyner of London; and Kristian Coleburne, also a painter or steyner of London. The monument, one of the earliest and best in England, is still in a state of preservation, and is of brass; the meaning therefore of the word latten, which has been disputed, is evidently brass.

(Dugdale, *Antiquities of Warwickshire*, p. 446.)

AUSTEN, JANE, was born December 16, 1775, at Steventon in Hampshire, of which place her father was rector. Mr. Austen was himself a man of more than average literary acquirements, and he bestowed upon Jane an education superior to what was then general among females of her rank in society. But if education did much for her, nature did more, endowing her with considerable beauty of both features and person, with sweetness of disposition, good sense, and an indescribable engagingness of manner. During the latter years of Mr. Austen's life she resided chiefly at Bath, but after his decease his widow and her two daughters retired to Southampton, where they continued till May, 1817, and afterwards to the village of Chawton, where Jane wrote her novels. There they remained until her declining health rendered it desirable that they should remove to Winchester for the sake of better medical advice. She died July 24 of that year, and was buried in the cathedral.

Of her six novels, four were published in her lifetime, but anonymously—'Sense and Sensibility;' 'Pride and Prejudice;' 'Mansfield Park;' and 'Emma.' The two others, 'Northanger Abbey,' and 'Persuasion,' did not appear until the year after her death—an extraordinary circumstance as regards the former, that being her first production, and having besides been actually disposed of to a publisher, who nevertheless did not think fit to bring it out. Her novels are all of the domestic class—are all of them delineations of every-day life and actual society, entirely free from that 'professional' conventionality as to characters and incidents which gives a certain artificial quality to nearly all productions of the kind. If, according to the classification of critics, they do not belong to the foremost rank of that species of fiction, they exhibit extraordinary graphic power and truthfulness, and reality without exaggeration. Nor is it their least merit that they are all of decidedly moral and healthful tendency, without any parade of moralizing. They have all been translated into French by Madame de Montolieu and others.

AUSTRALIA, SOUTH. [SOUTH AUSTRALIA, P. C. S.]

AVANZI, JA'COPO DI PAOLO D', a celebrated old Italian painter of the fourteenth century; he lived at Bologna, but whether he was a Venetian or a Bolognese is doubtful. There was an antient noble family of Bologna of the name of Avanzi, of which Jacopo may have been a member, but there was an old painter at Venice, who, with more probability, may have been the father of Jacopo. This was Maestro Paolo, the oldest known painter of that city. In the sacristy of the Padri Conventuali there is a painting by him with the following inscription—'1333, Paulus de Venetiis pinxit hoc opus;' however, Maestro Paolo may have been only the master of Jacopo, as it was not an uncommon practice in the earlier centuries for painters to sign simply their Christian names followed by that of their master or father upon their works, as in this instance of Jacopo di Paolo, who in his earliest works signed himself 'Jacobus Pauli,' but in his later 'Jacobus de Avantiis.' Franco Bolognese and Vitale dalle Madonne are both said to have been his masters, but without the slightest certainty. Jacopo was himself sometimes called Dalle Madonne, because he, as well as Vitale, painted at one time almost exclusively Madonnas.

Jacopo is generally mentioned in company with Simone da Bologna, or Simone de' Crocifissi, or Il Crocifissaio, as he was called, for the same reason that Jacopo was called Dalle Madonne. They became partners, and each painted a part of their joint productions, a circumstance which has led to the error of treating of them as of one family: Simone's name was not Avanzi, but Benvenuti, according to the manuscript of Oretti.

Most of Jacopo's works have perished, but some remain. The frescoes of the chapel of San Felice, formerly San Jacopo, in the church of Sant' Antonio at Padua, which were long attributed to Giotto, were painted by Jacopo in 1376. He painted also, in partnership with Simone, many frescoes in the old church of the Madonna di Mezzaratta, without the Porta San Mamolo at Bologna, which were much praised by Michelangelo and the Carracci, considering their period. Besides which he painted two triumphs in a public hall at Verona, and some works in company with Aldighieri da Zevio in the chapel of San Giorgio in the church of Sant' Antonio at Padua. The former were considered works of extraordinary merit by Mantegna; the latter have been lately recovered from dirt and oblivion by Dr. E. Förster, one of the editors of the Kunstblatt. They were described by him in that journal, pp. 16 and 22, of the year 1838. Jacopo died probably in the early part of the fifteenth century. There are two pictures attributed to him in the gallery of Bologna.

(Vasari, *Vite de' Pittori*, &c., and the *Notes* to Schorn's German translation; Malvasia, *Felsina Pittrice;* Lanzi, *Storia Pittorica*, &c.; Giordani, *Pinacoteca di Bologna.*)

AVE'NA—*Medical Properties of.* Several varieties, chiefly of the species *A. sativa*, are cultivated in Britain, particularly the north of England and lowlands of Scotland, though on the east coast of Scotland the cultivation extends to the most northern limit of the kingdom. The climate of Scotland is peculiarly suitable to the profitable cultivation of this plant, which flourishes where wheat and even barley languish [OATS, P. C., vol. xvi. p. 383], while the constitution of its seeds renders it the most appropriate article of diet for the inhabitants of that country. The seeds, which are officinal, are at once dietetical and medicinal. The fruits or grains consist of the skin or husk, which is removed by machinery, and the seeds, which, when coarsely ground, form the well-known oatmeal. The relative proportion of these varies in the different varieties, and in different seasons and localities. Vogel, who is commonly followed on this point, gives the amount at 66 meal and 34 bran or husks; but under proper culture, it is often as high as 78 meal and only 22 of husk per cent. (Boussingault, *Rural Economy*, translated by G. Law, p. 228.) The meal or farina consists (per cent.) of starch 59 (sometimes as high as 72·8, Dr. Christison), 10·75 of saccharo-mucilaginous extract, 4·3 of albumen, 2 oleaginous matter, 24 ligneous fibre and moisture. The seeds, deprived of husks, or decorticated (*grutum*), are employed under the name of groats or grits to form with water the Decoctum Avenæ, or water-gruel. When bruised, ready for use, they are denominated Embden grits, or prepared or patent groats or grits. A greater or smaller quantity of these are to be used to a pint of water, according to the object in view. When employed for an article of nourishment, the gruel may be made thick; when required as a demulcent or diluent, to promote perspiration at the commencement of a cold, it should be thin; and the addition of butter, spices, and wine, or anything save a little salt and sugar, is to be avoided. This is regarded as a light and digestible article for invalids. With some, it readily produces heartburn, and the same objection is urged against oatmeal, whether eaten in the form of oat-cakes, or employed to form porridge, the usual breakfast of the labouring classes, and of the children of the middle classes in Scotland and even Ireland. This in a few instances is certainly true; but as a national fare, nothing could be found more fitting. It gives a warmth and support to the system, far superior to wheaten bread, and therefore most proper for a cold and damp climate. The Derbyshire miners, from choice, use in winter oaten cakes, 'finding that this kind of nourishment enables them to support their strength and perform their labour better.' (Sir Joseph Banks, in Davy's *Agricultural Chemistry*, 5th ed. p. 143.) The idea that oatmeal is the cause of cutaneous diseases seems devoid of foundation. (Cullen's *Materia Medica*, vol. i. p. 279.) The husks are frequently steeped in water for a few days, and then drained off. The liquid when boiled stiffens into a dish called sowens in Scotland. This is slightly acid, and forms with milk a favourite food of the peasantry for supper. Its cooling properties render it a most suitable article of diet in summer, in a climate where, for a short period the heat is intense.

When oats are used as food for horses, it is very advantageous to steep them in water for two or three days, till they sprout or spire; the saccharine matter is thereby developed, and they become more nutritive and digestible.

AVERAGE. [Ships, P. C., p. 403.]

AVERMENT. [Pleading, P. C.]

AVES (Fossil). Fossil birds have been recognised by bones and foot-prints in the red-sandstone of Connecticut (Hitchcock), in the Wealden of Sussex (Mantell), in the chalk of Maidstone (Owen), in the tertiary beds of England and France (Cuvier), in the bone-caves of Kirkdale (Buckland), and in many late deposits. From New Zealand comes the Dinornis of Owen.

AVICENNIA, a genus of plants belonging to the natural order Myoporaceæ. The calyx is 5-parted, persistent, the segments erect, subovate, obtuse, concave; the corolla monopetalous, 2-lipped, upper lip square, emarginate, flat, lower bifid, with ovate, equal, flat divisions, tube bell-shaped, short; the stamens 4, didynamous; ovary 2-celled; style, subulate, erect, length of stamens; the stigma bifid, acute, the lower division bent down; the seed single, large, albuminous. The species are natives of New Holland and America.

A. tomentosa, White Mangrove, has cordate, ovate leaves, tomentose beneath. It puts forth twigs from the stem, resembling those of the common mangrove. The bark is found to contain tannin, and is used in Rio Janeiro for tanning.

A. resinifera is a native of New Zealand, and is said by Forster to yield a green resinous substance that is eaten by the New Zealanders as food. It is remarkable also for its clusters of large flowers. *A. nitida* is a native of Martinique.

(Burnett, *Outlines;* Lindley, *Natural System.*)

AVI'DIUS, CA'SSIUS. [Cassius Avidius, P. C. S.]

AVOIDANCE OF A BENEFICE. [Benefice, P. C.; Cession, P. C.]

AVOWRY. [Replevin, P. C.]

AWARD. All that is necessary on this subject is contained under Arbitration, P. C.

AXI'NUS (Sowerby), a fossil genus of Conchifera, of which some species occur in the magnesian limestone, and one in the London clay. To those which are found in the magnesian and other palæozoic limestones, Mr. King applies the title of Schizodus, P. C. S.

AXIS, in Botany, a term that is applied to the root and stem of the whole plant. The result of placing the seed of a plant in a place fitted for its growth, is the development of the embryo. The plumule ascends into the air, whilst the radicle descends towards the earth. The former is said to be the *ascending axis* of the plant, the latter the *descending axis*. It is around these axes of growth that all other parts of the plant are arranged. Those which are found upon the ascending axis, or stem, are collectively termed the *appendages of the axis*, and individually constitute the scales, leaves, bracts, flowers, sexes, fruit, and modifications of those parts of the plant; all these parts are in connexion with the vascular system of the axis, and must not be confounded with mere expansions of the epidermis and the like, such as ramenta, thorns, &c., which have no real connexion with the axis.

The cause of the direction taken by the ascending and descending axis of plants has been variously explained. This is evidently a complicated question, and one which involves the great mass of facts in the organization of plants, and probably animals, which determine their peculiar forms, habits, and movements. Dutrochet, who has lately written on this subject, and who is quoted by Lindley in his 'Introduction to Botany,' says:—'The downward direction of the roots may appear easy of explanation: it may be said that, like all other bodies, they have a tendency towards the centre of the earth, in consequence of the known laws of gravity (as is the opinion of Knight in 'Phil. Trans.' for 1806); but on what principle then is to be explained the upward tendency of the stem, which is in direct opposition to those laws? And here lies the difficulty. Dodart is the first who appears to have paid attention to this circumstance; he pretends to explain the turning backwards of seeds sown in an inverted position, by the following hypothesis:—He assumed that the root is composed of parts that contract by humidity; and that the stem, on the contrary, contracts by dryness. For this reason, according to him, it ought to happen, that when a seed is sown in an inverted position, the radicle will turn back towards the earth, which is the seat of humidity; and that the plumule, on the contrary, turns to the sky, or rather atmosphere, a drier medium than the earth. The experiments of Du Hamel are well known, in which he attempted to force a radicle upwards and a plumule downwards by enclosing them in tubes which prevented the turning back of these parts. It was found that as the radicle and plumule could not take their natural direction, they became twisted spirally. These experiments, while they prove that the opposite tendencies of the radicle and the plumule cannot be altered, still leave us in ignorance of the cause of such tendencies.' The well-known fact of the stems of plants seeking the light when confined in dark places, has led De Candolle and other observers to attribute the tendency of the stem to an upward growth to the influence of light. Another well-known fact, that of the tendency of the roots of plants to grow towards water, or moisture, might have suggested water as a cause of the tendency of the root to grow downwards. Observing that the ascending axis of plants is always coloured, and that the descending axis is white, Dutrochet suspected that the action of light on the coloured parts of the plant was the cause of its growing upwards. He found by experiments on the Mirabilis jalapa and other plants, that although roots have in general no tendency towards the light, yet such a disposition does become manifest provided the terminal shoot of a root becomes slightly green, as occasionally happens. He found that the ends of the roots of Mirabilis jalapa became occasionally coloured, and, on placing the plants in damp moss, he found these roots had a tendency to come to the surface towards the light. Not only is this the case, but the colourless stems of such plants as Sagittaria sagittifolia are known to assume the directions of roots. In this plant 'shoots are produced from the axillæ of all the radical leaves which grow at the bottom of the water. These shoots have their points directed towards the sky, like those of all vegetables. The young stems which are produced by these shoots are entirely colourless, like roots; and instead of taking a direction towards the sky, as coloured stems would do, they lead downwards, pointing towards the centre of the earth. This subterranean stem next takes a horizontal course, and does not assume any tendency towards the sky until the points become green.'

Herr von Kielmeyer gave a report on the direction of the organs of plants, to the assembly of naturalists at Stuttgart, in 1835, in which he explained the upward and downward growth of the axis of plants by the theory of polarity. He supposes that there is acting upon plants a principle the analogue of magnetism and electricity, which, polarizing the cells of which a plant is composed, give to one set an upward and to another a downward growth. Although every writer on this subject has endeavoured to give to one agent the position of a cause in this phenomenon, it will be found on inquiry that the particular directions of the stems of plants can no more be referred to one cause, than the growth in particular directions of the organs of animals. Growth, in whatever directions, is the result of all the forces that are acting on an individual organism; and therefore there can be little doubt that gravitation, light, the chemical constitution of the tissues, and electrical agency are all involved in producing the determination of the particular direction of the roots and stems of plants.

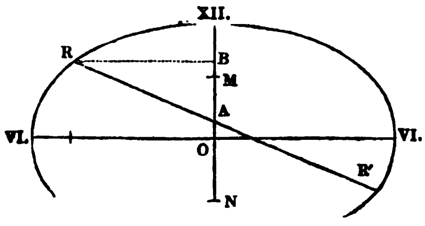
(Meyen, *Pflanzen-Physiologie;* Lindley, *Introduction to Botany;* Dutrochet, *Ann. des Sciences Naturelles*, xxix. 1833.)

AYLIFFE, JOHN, LL.D., an English jurist, of the circumstances of whose life hardly anything is known. He left behind him in his works substantial monuments of his industry and learning. He styles himself Fellow of New College, Oxford. In 1714 he published in 2 vols. 8vo. 'The Antient and Present State of the University of Oxford,' &c.; a work of which a great portion is avowedly an abridgment of Wood's 'Athenæ.' In 1726 he published in folio 'Parergon Juris Canonici Anglicani, or a Supplement to the Canons and Constitutions of the Church of England,' in which he brings much learning and research to bear against the exercise of a separate and independent legislative power by ecclesiastical bodies. In 1732 he published 'The Law of Pledges and Pawns as it was in Use among the Romans;' and in 1734, in a large folio volume, a 'Pandect of the Roman Civil Law, as anciently established in that Empire,' &c. This volume covers the greater part of the author's subject, but the complete work was never published. Ayliffe's books give an explanation of those scientific terms of reference to the Corpus Juris which often puzzle casual readers of the foreign civilians.

AYMESTRY LIMESTONE, one of the calcareous bands in the upper Silurian series, which has been produced by coral and shell accumulations amidst the masses of argillaceous sediments. It is not traceable beyond the districts of Ludlow, Abberley, Malvern, Woolhope, May hill, and Usk. Partially characterised by Pentamerus Knightii.

AYTOUN, SIR ROBERT, was born in Fifeshire, of an old family, in the year 1570, and followed King James I. to London upon the union of the crowns. He seems to have spent the remainder of his life principally in attendance on the king's person, holding several places at court. He died in the palace of Whitehall, in 1638, and was buried in Westminster Abbey, where there is still a monument to his memory. The 'Delitiæ Poetarum Scotorum' contains a considerable number of occasional poems of his, in Latin hexameter and elegiac verse. His English poems were neglected and scattered abroad, many of them probably never finding their way into print. Two or three of these however have long been known and admired, though not always attributed to their true author. One collection of them was printed a few years ago, in the 'Miscellany of the Bannatyne Club;' and a volume entitled 'The Poems of Sir Robert Aytoun,' edited by Charles Roger, Edinburgh, 1844, contains all the poems attributed to him in both languages. It includes a good many English verses hitherto unpublished, that had been found (though in a modernized orthography) in a manuscript accidentally discovered. Aytoun's Latin poems, although creditable to his Latinity, now call for little notice. His English poems are greatly more interesting and original; and there are very many of them which we are quite willing to attribute to a man whose friendship was boasted of by Ben Jonson, and whose verses were praised by Dryden and imitated by Burns. Those poems are remarkable as being probably the earliest attempts made by any Scottish writer to compose verses in the language which had become peculiar to the southern part of the island. But they are yet more valuable for the grace and animation which pervades the best of them, especially those of a sportive cast; and for that clear pointedness of expression which is general throughout the series, and which often reminds one of the lyrical manner of Jonson.

AZIMUTH or ANALEMMATIC DIAL is one whose plane is parallel to the horizon, and whose gnomon, or stile, is moveable in a vertical position. The hour-points are in the periphery of an ellipse, as VI, XII, VI, of which let O be the centre; and the foot of the style moves in a north and south line, as MN, which is graduated from O to M and from O to N in tangents of the sun's declination, from zero to 23½ degrees, the radius of the circle being equal to the eccentricity of the ellipse. To these graduations are annexed as many corresponding days of the months as can be introduced.



In order to investigate the place of any hour-point, as R, let A be the foot of the style for any given day. Then AR will be the direction of the shadow for the given hour; and there must be found the azimuthal angle MAR, or its supplement MAR'. Now the sun being in the plane of the hour-circle which cuts the horizon in RAR', and it being understood that, in the celestial sphere, there may exist a spherical triangle formed by arcs joining P the pole of the equator, S the place of the sun, and Z the zenith of the place, or the point vertically above O [see fig. to AZIMUTH, P. C., and imagine S to be put in place of *], we shall have PZ the co-latitude of the place, PS the sun's north-polar distance, and the given hour-angle at P; to find the angle at Z (=MAR' or MAR).

In that triangle we obtain [SPHERICAL TRIGONOMETRY, P. C., page 343, formula 6],

$$\text{cotan } Z = \frac{\cos ZP \cos P - \text{cotan } PS \sin ZP}{\sin P}$$

But RB (fig. above) being let fall perpendicularly on OM produced if necessary, let OB$=x$, BR$=y$, OA$=x'$; then

$$\text{cotan MAR } (=\text{cotan } Z) = \frac{AB}{BR} = \frac{x-x'}{y}.$$

Equating these values of cotan Z, there is obtained $x'=$

$$\frac{x \sin P - y \cos ZP \cos P + y \sin ZP \text{ cotan } PS}{\sin P}.$$

This equation containing three unknown quantities, the problem is indeterminate; but, since the following conditions must be satisfied, the values of x and y may be found:—First, the position of R, the hour-point, must be independent of the sun's polar distance; therefore x and y must be independent of PS, which gives

$$x \sin P - y \cos ZP \cos P = 0;$$

also x' must be independent of the given hour; whence $\frac{y \sin ZP}{\sin P}$ must be considered as constant; let the constant be represented by m; then

$$y = \frac{m \sin P}{\sin ZP} \text{ and } x' = m \text{ cotan } PS.$$

From the equation for 0 we have

$$x = y \cos ZP \text{ cotan } P,$$

and substituting the value of y,

$$x = m \text{ cotan } ZP \cos P.$$

Squaring the values of x and y, and adding the results together, there is obtained, after reduction,

$$\frac{x^2}{m^2 \text{ cotan}^2 ZP} + \frac{y^2}{m^2 \text{ cosec}^2 ZP} = 1,$$

which is the equation to an ellipse, having for its semitransverse axis m cosec ZP, and for its semi-conjugate axis m cotan ZP.

The constant m may be taken of any magnitude at pleasure according to the intended scale of the dial; thus the ellipse may be traced. The hour-points may be found by giving to the angle P successive values, as 15°, 30°, &c., and corresponding values for the half-hours, quarter-hours, &c. in the above values of x and y.

INDEX TO THE LETTER A.

VOLUME I.

Abatement of Legacies [Legacy, P. C., p. 391]
Abáti, or Abbáti, Niccolò, page 1
Abercrombie, John, M.D., 1
Aberdeenshire, 2
Abinger, Lord [Scarlett, James]
Ablaikit, 10
Abortion [Infanticide, P. C., p. 469]
Absentee, 10
Absorption of Light, 11
Abstract of Title [Vendor and Purchaser, P. C., p. 204]
Abstraction and Absorption of Heat, 12
Abutment, 12
Abydénus, 13
Abyssinia, 13
Acanthodérma, 25
Acanthódes, 25
A'canus, 25
Acceleration and Retardation of Tides, 25
Accidental Colour, 26
Accomplice [Approver, P. C.]
Accordion, 27
Account stated, 27
Accountant, 27
Accountant-General, 28
Accumulation [Thellusson, P. C., p. 305]
Accumulation of Power, 28
Acerathérium, 28
Acervulária, 28
Achilléum, 28
Acidáspis, 28
Aconítum, 28
Acorínæ, Acorídeæ, or Acoraceæ, 29
Acqui, 30
Acre, Saint Jean d', 30
Acrocúlia, 30
A'crodus, 30
Acrógaster, 30
Acrógnathus, 30
Acrólepis, 30
Acrosalénia, 31
Acrotémnus, 31
Acta Sanctorum [Bollandus, P. C.]
Actínocamax, 31
Actinóceras, 31
Actinocrinítes, 31
Actinómeter, 31
Action, (at Law), 31
Action upon the Case [Case, Action upon the, P. C.]
Action and Reaction [Motion, Laws of, P. C.]
Action, Least, Principle of, 32
Active or Living Forces [Vis Viva, P. C.]
Acton Burnel, Statute of, 32
Adal, 33
Addington [Sidmouth, Lord, P. C. S.]
Adelaide [South Australia, P. C. S.]

VOL. I.
Adelócrinus, 36
Adelsberg, 36
Aden, 36
Adersbach Rocks, 36
Adjudication, 37
Adjutage, or Ajutage, 37
Admiralty, Court of, 38
Admissions in a Suit, 38
Admittance [Copyhold, P. C.]
Adulteration, 39
Advocates, or Faculty of Advocates [Barrister, P. C., p. 504]
Aélodon, 40
Æolharmonica [Harmonium, P. C. S.]
Æolína, 40
Æolódikon [Harmonium, P. C. S.]
Æólophon [Harmonium, P.C.S.]
Æpinus, 40
Aerial Images, 41
Aeshna, 42
Æthers, 41
Aethophýllum, 42
Aëtion, 42
Aëtius, 42
Aetóbates, 43
Affeerers [Leet, P. C.]
Afghanistan, 43
Africánus, Sextus Caecílius, 57
Agatharchus, 57
Agáthias, 58
A'gathon, 58
Agathótes Chirayta, 58
Agen [Lot et Garonne, P. C.]
A'glaophon, 59
Agnóstus, 59
Agnothérium, 59
Agricultural Institutions, 59
Agriculture, 62
Agriculture, Statistics of, 66
Air-Beds and Cushions, 67
Air-Vessels, 68
Aix-en-Provence, 68
Aizáni, or Azani, 68
Aláni, 69
Alaric II., 70
Alba, 70
Albategnius, 70
Albenga, 71
Albertinelli, Mariotto, 71
Alcámenes, 72
Alcohol, 72
Aldegréver, Heinrich, 73
Alethópteris, 73
Alfénus Varus, 73
Algæ, Fossil, 74
Algardi, Alessandro, 74
Algebra, 74
Algebraic Geometry, 78
Algérie, L', 79
Algorithm, 84
Alien, 84
Alimentus, Cíncius [Cincius Alimentus, P. C. S.]
Alison, Rev. Archibald, 85
Alkalies, 85
Alkaloïds, 86
Allan, David, 86
Allegation, Ecclesiastical, 87
Allen, John, M.D., 87
Allen, William, 88
Allóri, 88
Allotment System, 88
Allston, Washington, 92
Aloes, 92
Alpaca, or Paco, 93
Altdorfer, Albrecht, 94
Altered Strata, 94
Alúnno, Niccolò, 94
Alvarez, Don José, 95

VOL. I.
Alveolítes, 95
Amaltéo, Pompónio, 95
Aman, Johann, 96
Amáto, Giovanni Antonio d', 96
Amberger, Christoph, 96
Amblýpterus, 97
Amblysémius, 97
Amblyúrus, 97
American Antiquities, 97
Amigóni, Jácopo, 100
Amman, Jost, 101
Ammanáti, Bartoloméo, 101
Ammodytes, 101
Ammonia, 102
Ammóniacum, 102
Ammonites, 103
Amómum, 103
Amontons, Guillaume, 104
Ampère, André Marie, 104
Amperístus, 105
Amphídetus, 105
Amphíon, 105
Amphioxus [Branchiostomata, P. C. S.]
Amphithérium, 105
Amplexus, 105
Ampyx, 105
Amýgdalus, 105
A'nabas, 106
Anabathra, 106
A'nableps, 106
Anamorphósis, 106
Anamorphósis (Botany) [Metamorphosis, P. C.]
Ananchýtes, 107
Anárrhicas, 107
Anatólia, 107
Anatomy Act, 115
Anchor, 116
Anchovy Pear [Grias, P. C. S.]
Anchúsa, 117
Ancient Demesne [Manor, P. C.; Soccage, P. C.]
Ancient Lights [Lights, P. C. S.]
Ancylóceras, 117
Anderson, John, 117
Andrómeda, 118
Andros, 118
Anenchelum, 119
Anéthum Graveolens, 119
Angélico [Fiesole, Fra Giovanni da, P. C. S.]
Angelo Buonarruoti [Buonarruoti, P. C. S.]
Angle, 119
Angole [Ongole, P. C. S.]
Angoulême, Duc d' [Charles X., P. C. S.]
Anguísciola, Sofonisba, 120
Animal Charcoal [Charcoal, Animal, P. C.; Carbon, P. C.]
Animal Flowers [Actinia, P. C.]
Animal Magnetism, 120
Animal Physiology [Physiology, P. C.]
Animal Strength, 121
Animal Tissues [Tissues, P. C. S.]
Ankóbar [Abyssinia, P. C. S.]
Annotto [Arnotto, P. C.]
Annuities and Assurances, 122
Annulária, 124
Anomalína, 124
Anomöpteris, 124
Answer [Pleading, P. C.]
A'nthemis Nóbilis, 124
A'nthemis (or Anacyclus) Pyrethrum, 124
Anthémius, 124
Anthiánus, Furius, 124
Antholithes, 124

VOL. I.
Anthophyllum, 124
Anthospérmeæ, 124
Anthracothérium, 124
Anticlínal, 124
Antidicomarianites, 124
A'nti-Mílo, 125
Antipater, Lucius Caelius [Coelius, P. C.]
Antíphilus, 125
Antirrhínum, 125
Antonello da Messína, 125
Apelleans, or Apellites, 126
Aperea [Leporidæ, P. C.]
Aphyllum [Aspidiaria, P. C. S.]
Apiocrinítes, 126
Aplanatic Lens, 126
Apostasias [Metamorphosis, Vegetable, P. C. S.]
Apothecaries, Company of, 127
Apothécia, 127
Appáritor, 127
Appearance [Pleading, P. C.]
Appeal to the Sessions [Sessions, P. C.]
Appendíni, Francesco Maria, 127
Appiáni, Andréa, 127
Appiáno, 127
Appointment [Trust & Trustee, P. C.]
Apportionment, 128
Appropriation [Advowson, P.C.; Benefice, P. C.]
Appropriation [Payment, P. C. S.]
Apsendésia, 129
A'ptychus, 129
Aquifoliáceæ, 129
A'quila, Julius, 129
Aquilariáceæ, 129
Arábia, 130
Arábia Petræa, 134
Aráchnida (Fossil), 135
Aræometer, 135
Araucarites, 135
Araxes [Aras, P. C.]
Arcade, 135
Arcadius Charisius, Aurelius [Charisius, P. C. S.]
Arches, Court of, 136
Archimedean Screw [Screw Propeller, P. C. S.]
Arcograph [Cyclograph, P.C.S.]
Ard, Loch, 137
Ardwick Limestone, 137
Aretíno, Spinello, 137
Arfe, 137
Arges, 137
Aristeas [Septuagint, P. C.]
Arjóna, Manuel de, 137
Arkansas, 138
Arlaud, Jacques Antoine, 138
Armagh Observatory, 138
Armin, Robert, 139
Arníca, 139
Arnold, Thomas, D.D., 139
Arrest, 141
Arrest of Judgment, 141
Arrestment, 141
Arriáza, Juan Bautista, 142
Art-Unions, 142
Artemisia Absinthium, 142
Arthrópterus, 143
Articles [Allegation, Ecclesiastical, P. C. S.]
Articles of the Peace, 143
Articles of War [Mutiny Act, P. C.]
Artificial Horizon, 143
Artillery, Application of [Tactics, P. C.]
Artísia, 144

VOL. I.
Artotyrites [Communion, P.C.]
Arzobispo, Yslas del, 144
A'saphus, 144
Ascárides [Entozoa, P. C.]
Asclépias, 144
Ash [Fraxinus, P. C.].
Aspen [Salicaceæ, P. C.]
Aspergillus [Byssoideæ, P.C.S.]
Asphalte, 144
Aspidiária, 146
Aspídium, 146
Aspidorhýnchus, 146
Aspidúra, 146
Aspleniópteris [Pterophyllum, P. C. S.]
Asplénium, 146
Assault (in Scotland), 147
Ast, Georg Anton Friedrich, 147
Asteracánthus, 147
Asteraceæ [Corymbiferæ, P. C. S.]
Asterophyllítes, 147
Asteroptýchius, 147
Astley, John, 147
Astrocrinítes, 148
Astýlar, 148
Athens, 148
Atmometer, 149
Atmospheric Railway, 149
A'triplex, 152
A'trypa, 152
Attendant Term [Term of Years, P. C. S.]
Attiret, Jean Denys, 152
Attorney, 152
Attorney, Letter or Power of [Letter or Power of Attorney P. C.]
Attornment, 153
Attraction, 153
Attraction, Electrical, 154
Attraction of Balls [Weight of the Earth, P. C.]
Attraction of Mountains [Attraction, P. C]
Attractions, Elective, 155
Attwood, Thomas, 155
Aucupária [Pyrus, P. C.]
Audians, or Audeans, 155
Augmentation, Court of, 156
Augusti, Christian Johann Wilhelm, 156
Aulácodon [Chelodus, P. C. S.]
Aúlolepis, 156
Aulópora, 156
Aurelianus, Cælius [Cælius Aurelianus, P. C.]
Aust Cliff, 156
Austen, William, 156
Austen, Jane, 157
Australia, South [South Australia, P. C. S.]
Avanzi, Jácopo di Paolo d', 157
Avéna, 157
Average [Ships, P. C., p. 403]
Averment [Pleading, P. C.]
Aves (Fossil), 158
Avicénnia, 158
Avidius, Cassius [Cassius Avidius, P. C. S.]
Avoidance of a Benefice [Benefice, P. C.; Cession, P. C.]
Avowry [Replevin, P. C.]
Award, 158
Axínus, 158
Axis, 158
Ayliffe, John, LL.D., 158
Aymestry Limestone, 158
Aytoun, Sir Robert, 159
Azimuth or Analemmatic Dial, 159

B

BABER, or rather **BABBER**, is an island of the Indian Archipelago, and sometimes included in the Moluccas; but it must properly be included in the large group which is called the Tenimber Islands. Babber lies between 7° 45′ and 8° S. lat., and is traversed by 130° E. long. According to Kolff's chart it may be about 20 miles long and 10 miles wide. It is surrounded by several smaller islands, of which the largest is Wetang, which lies west of it; and between them is good anchorage in from 14 to 160 fathoms. The island is mountainous, but does not rise to a great elevation, except towards the extremity, where a summit rises to a considerable height. The interior of the island is uninhabited, except on the western and eastern shores, where there are small settlements. They constitute two independent communities, which are continually at war with one another; and the principal object of their military incursions is to kidnap young persons, who are sold as slaves to the vessels that visit the island, or obliged to cultivate the fields for their captors. The greater part of the island is still covered with trees and bushes; but the remainder is cultivated, and produces several kinds of roots, Indian corn, and plantains. There are also considerable plantations of cocoa-nuts and sago-trees. The principal animals are cattle, hogs, and goats. Fowls and birds are numerous, especially several kinds of pigeons. Fish is also plentiful; but the natives do not turn it to account. The inhabitants belong to the Malay race, and resemble in their manners, dress, and food the inhabitants of the neighbouring islands. They have a few prahus, from 10 to 20 tons burden, with which they occasionally visit the neighbouring islands; but it does not appear that they have any regular exchange of commodities with them. There come every year to Babber one or two country vessels from Banda, which import small pieces of cotton-cloth, and export a few slaves and some provisions. When the Dutch spread over the Indian Archipelago, they had a small establishment on this island; but they abandoned it after some time, and it does not appear that the inhabitants have reaped any advantage from the stay of the Dutch. Lately however the Dutch government has again opened some communication with them.

(Kolff, *Reize door den weinig bekenden zuidelijken Moluk-schen Archipel.*)

BABIROUSSA, or **BABYROUSSA**. [Suidæ, P. C.]

BA'BRIUS (Βάβριος). Since the publication of the article Babrius in the P. C. a considerable number of his fables have been discovered and published. Among the numerous MSS. which M. Minoides Minas found in the convents of Greece, there was one containing the choliambic fables of Babrius, which was found in the convent of St. Laura on Mount Athos. He took a copy of it (the price which the monks asked for the original being too exorbitant), and brought it with the rest of his treasures to Paris in 1842. M. Villemain entrusted the office of editing the fables to M. J. F. Boissonade, and the work appeared towards the end of 1844 in one octavo volume. The Greek fables which were thus rescued are now before the world, but are not however the complete collection which Babrius made. Their number is 123; they are arranged in alphabetical order, that is, according to the initial letters of the fables, and the present collection does not go further down than the letter O. A considerable number of fables is therefore still wanting. The whole collection is divided into two sections, the one extending from the letter A to L, and the other from M to O inclusive, and each of them is preceded by a procemium. The age at which the poet Babrius lived, and which was formerly believed to have been the last century before the Christian æra, is at present more doubtful than ever, on account of certain allusions which occur in the fables. M. Boissonade, who believes that Babrius was a Roman, has not entered upon the question, but some German scholars are busily engaged in investigating the subject. Boissonade has added a critical commentary and a Latin translation: the title is Βαβρίου Μυθίαμβοι. 'Babrii Fabulæ Iambicae CXXIII., nunc primum editæ. J. F. Boissonade recensuit, Latine convertit, annotavit,' Paris, 1844, 8vo.

(*Classical Museum*, part vi. p. 412, &c.)

BABYLONIA (Βαβυλωνία), the territory so named from the city of Babylon on the Euphrates. [Babylon, P. C.] It was considered by the antient geographers as a part of Assyria: but its boundaries cannot be fixed. The physical character of the Babylonian Plain is described in the articles Bagdad (Pashalic) and Tigris, P. C.

BACHELOR, an unmarried man. The legislation of the Romans placed unmarried persons (caelibes) under certain disabilities, the chief of which were contained in the Lex Julia et Papia Poppæa. The original Lex was simply called Julia, and was passed B.C. 18. (Dion Cassius, liv. 16.) The Lex Papia et Poppæa, which was intended as an amendment and supplement to the Lex Julia, was passed A.D. 9; and both these leges seem to have been considered as one, and they are often referred to under the title of the Lex Julia et Papia Poppæa. One object of the Lex was to encourage marriage. An unmarried person (caelebs), who was in other respects qualified to take a legacy, was incapacitated by this Lex, unless he or she married within one hundred days. (Ulpian, *Frag.* xvii. 1.) The law was the same if the whole property (hereditas) was left to a caelebs. (Gaius, ii. 111, 144, 286.) It was the opinion of the lawyers, that though a caelebs could not take directly under a testament, a caelebs could take by way of fidei commissum, or trust; but the Senatus-consultum Pegasianum, which was passed in the time of Vespasian, rendered a caelebs equally incapable of taking anything by way of fidei commissum. (Gaius, ii. 286.) A testamentary gift, which failed to take effect because the heres or legatee was a caelebs, was called Caducum (and the word was applied to other cases also), 'something which failed or dropped.' In the first instance, such a gift came to those among the heredes who had children; and if the heredes had no children, it came to those of the legatees who had children. If there were no such claimants, the Caducum came to the public treasury (aerarium). But by a constitution of the emperor Antoninus Caracalla, the Caducum came to the Fiscus, or Imperial treasury, instead of the public treasury; the rights of children and parents, however, were reserved. (Ulpian, *Frag.* xvii.) An unmarried man who had attained the age of sixty, and an unmarried woman who had attained the age of fifty, were not subjected to the penalties of the Lex Julia et Papia Poppæa as to celibacy, but a Senatus-consultum Pernicianum (Persicianum), passed in the time of Tiberius, extended the penalties to unmarried persons of both sexes who were above sixty and fifty years old respectively, and it made them for ever subject to the incapacities. However, a Senatus-consultum Claudianum, passed in the time of Claudius, mitigated the severity of the Pernicianum, in case a man married above the age of sixty, provided he married a woman under fifty, for the Roman law considered a woman under fifty as still capable of procreation. (Ulpian, *Frag.* xvi.; Suetonius, *Claudius*, c. 23.)

The Lex Julia et Papia Poppæa also imposed incapacities on *orbi*, that is, married persons who had no children from the age of twenty-five to sixty for a man, and twenty to fifty for a woman. Childless persons who came within the terms of the Lex lost one-half of any hereditas or legacy; and what they could not take became Caducum. The Lex also gave direct advantages to persons who had children. The original object of this Roman law was perhaps only to encourage marriage, but it was afterwards used as a means of raising revenue.

In the preceding exposition of the Lex Julia et Papia Poppæa, it has been assumed that the provisions above enumerated applied both to males and females. The word *caelebs*, indeed, seems to be applied only to males, and the Latin term for an unmarried woman is *Vidua*, which means any woman who has not a husband. But the expression of Ulpian (*Frag.* xvi. 3), 'Qui intra sexagesimum vel quae intra quinquagesimum annum neutri legi (the Julia, or Papia Poppæa) paruerit,' &c., shows that the provisions applied both to males and females. The word caelebs would not be used in the enactments of the Lex, but the phrase would be 'Qui Quaeve,' &c. That the Lex applied to women also, appears from other evidence. (*Cod.* viii. tit. 57.) Under the republic there were also penalties on celibacy, and legal inducements to marriage, which are mentioned in the speech which Dion Cassius (lvi. 57) puts into the mouth of Augustus. Julius Caesar, in the division of the Campanian lands, gave allotments only to those who had three children or more. (Dion Cass. xxxviii. 7; Appian, *Bell. Civil.* ii. 10.) The censors also are said to have had the power of imposing a penalty called Aes Uxorium, 'wife-money,' on men who were unmarried. (Festus v. 'Uxorium.') It was always a part of the Roman policy to encourage the procreation of children; the object of the English law imposing extraordinary payments on bachelors, and relieving to a certain extent married persons with children, was apparently to raise money, though a certain vague notion that marriage should be encouraged seems also to have occurred to the law-maker. A constitution of Constantine (*Cod.* viii. tit. 58) relieved both unmarried men and women from the penalties imposed on caelibes and orbi, and placed them on the same footing as married persons. This change was made to favour the Christians, many of whom abstained from marriage from religious motives.

Not only bachelors, but widowers have been unequally taxed in this country, and there is more than one instance, within the last sixty years, in which persons have been favoured by special exemptions, or have been charged less on account of the number of their children. In 1695 an act was passed (6 & 7 Will. III. c. 6) entitled 'An Act for granting to his Majesty certain rates and duties upon marriages, births, and burials, and upon bachelors and widowers, for the term of five years, for carrying on the war against France with vigour.' Bachelors above the age of twenty-five, and widowers without children, paid 1*s*. yearly, and further according to their rank. Thus, for a bachelor duke the tax was 12*l*., and other ranks in proportion. An esquire was charged 35*s*. a year, and a person of the rank of gentleman 5*s*. Persons possessed of real estate of 50*l*. a year, or personal property of 500*l*. value paid 5*s*. A supplementary act was passed two or three years afterwards (9 Will. III. c. 32), to prevent frauds in the collection of the taxes imposed by the former act, but the tax was allowed to expire in 1706. In 1785, when Mr. Pitt proposed a tax on female servants, he exempted persons who kept only one servant, and who had two or more lawful children or grandchildren under the age of 14 living in the house with them. But to make up for the deficiency, he proposed that the tax on servants should be higher for bachelors than for others; and he stated that the idea of this tax was borrowed from Mr. Fox. This differential rate has been continued to the present time, and the number of servants charged at the higher rate in 1842 was 11,831, or rather more than one-tenth of the whole number charged. Roman Catholic clergymen are exempt from additional duty. When the income-tax was imposed by Mr. Pitt, in 1798, deductions were allowed on account of children, and an abatement was made of 5 per cent. to a person with children, when the income was above 60*l*. and under 400*l*.; and other rates of abatement were allowed according to the amount of income and the number of children: this indulgence extended to incomes of 5000*l*. a year and upwards.

There does not appear to be a tax on bachelors in any country in Europe. In the city of Frankfort an income-tax is paid by journeymen who work in the city, 'if they are foreigners, and not married.'

BACILLA'RIA, a large family of Infusorial animalcula, constituted by Ehrenberg, who includes in it upwards of thirty genera. The siliceous shields of these animalcula are amongst the most numerous of the forms of Microzoaria in the cretaceous, tertiary, and superficial deposits. Xanthidia occur in the chalk and its included nodules of flint: Gaillonellæ, Naviculæ, Actinocycli, Coscinodisci, Gomphonemæ, and other genera, abound in the white tertiary marls of Greece, Italy, Bohemia, England, and North America. The siliceous beds of Bohemia (Polierschiefer), which are fourteen feet in thickness, contain innumerable shields of Naviculæ, and probably few of the superficial lacustrine deposits of Europe are wholly devoid of these exuviæ. [INFUSORIA, FOSSIL, P.C.S.]

BACIOCCHI, MARIE ANNE ELISA BONAPARTE, the eldest of the sisters of Napoleon, born at Ajaccio in Corsica, in 1777, received her early education in the Royal School of St. Cyr, near Paris. When that institution was suppressed by the National Convention, in 1792, Marie Anne Bonaparte returned to Corsica, from whence she emigrated with her mother and sisters to Marseille, the English having occupied her native island. At Marseille she married, in 1797, her countryman Captain Baciocchi, a retired officer of the former Royal Corsican regiment. In the following year she removed to Paris, where her brother Lucien was a member of the Council of the Five Hundred, and she undertook to do the honours of his saloon, where she became acquainted with several literary and scientific men, with whom she loved to wrangle upon all sorts of topics. She rose in rank and station with the rest of her family, in consequence of her brother Napoleon's elevation to supreme power. After his assumption of the imperial crown, Napoleon made Baciocchi and his wife Princes of Piombino, and soon after of Lucca. On that occasion Marie Anne assumed the more euphonous name of 'Elisa,' 'Princess of Lucca and Piombino.' In 1806 the principality of Massa and Carrara was added to her dominions, we say *her* dominions, because it is notorious that she was the ruler, her husband having no share in the administration. Elisa's administration was upon the whole beneficial to Lucca, where she fixed her residence. In March, 1809, Napoleon by a decree appointed the Princess Elisa to be Grand Duchess of Tuscany, and to administer in his name the three departments into which that country was divided as a part of the French empire. Her husband was not even named in the imperial decree. In consequence of this new appointment, the Princess Elisa removed to Florence, where she kept her court until the downfall of Napoleon. She was by no means as popular at Florence as she was at Lucca, which difference may be partly accounted for by the fact that in the latter country she was her own mistress, whilst in Tuscany she was a mere lieutenant of her imperious brother, and as such was obliged to enforce all his obnoxious measures, the conscription, the burthensome taxation, the rigorous police, &c. But it seems also as if her removal to a larger sphere of administration had rendered Elisa's character more haughty and harsh. She became very fond of military pomp and parade. In 1814, when the allied armies advanced into Tuscany, Elisa left Florence without any marks of sympathy on the part of the population, and after some wanderings, she repaired in the following year to Heimburg, near Vienna, where her sister Caroline Murat had taken up her residence. Some time afterwards she removed to Bologna in the Papal States, where she went by the name of Countess of Campugnano. She died at Bologna, of a nervous fever, in August, 1820. She left one son and a daughter. The son, Frederic Baciocchi, died at Rome in 1833, of a fall from his horse. The daughter married Count Camerata of the Papal States. The father, Felice Baciocchi, purchased the splendid palace Ranuzzi at Bologna and the title of a Roman prince, and died there in 1841.

(Lesur, *Annuaire Historique*; Duchesse d'Abrantes, *Salons de Paris*; *Supplement* to the *Biographie Universelle*.)

BACTRIAN COINS. After the death of Alexander, Bactria remained for fifty years a province of Persia, with which it was united by Seleucus Nicator, between B.C. 312 and 301. When Seleucus became king of Syria, Bactria became a dependency of the great Syrian empire of the Seleucidae. During the reign of Antiochus Theus (B.C. 262-247) Bactria was constituted an independent kingdom by the governor Theodotus or Diodotus, who was a Greek by birth, and it continued so under his successors for several centuries. The history of the Bactrian kings of Greek descent is not given by any of the extant Greek or Roman historians. It may have been noticed in Arrian's lost history of the successors of Alexander. A few names mentioned by the antient historians, or discovered on some rare coins, and the fact related by the Chinese annalists that this Greek kingdom was overthrown by the Scythians, was all we knew of it. In spite of the barrenness of materials, the learned Bayer undertook to write his 'Historia Regni Graecorum Bactriani,' Petersburg, 1738, a book more valuable for what the author says on things connected with Bactria, than for information on Bactria itself. Bactrian coins were then so rare, that the discovery of two gold coins towards the end of the past century created a great sensation in Europe, and the acquisition of the names of two kings was considered a valuable addition to our knowledge of Bactrian history. Nobody expected that Bactrian coins would be found in such quantities as to be sold by the measure and for little more than their intrinsic value. This is actually the case now in some places in India and Afghanistan, though only with the copper coins. In the beginning of this century the late Colonel Tod made a collection of coins during his long residence in India, of which several are of high interest for the history of Bactria. A description of them was given with engravings in the first volume of the Transactions of the Royal Asiatic Society, 1824. Two of these coins bore the names of Apollodotus and of Menander, both Bactrian kings. Their historical value, says Wilson, is undiminished, but nothing is calculated to exhibit the rapid progress of numismatic discovery in respect to Bactrian coins more strikingly than the diminution of their value as objects of rarity within the last twelve years. Instead of only two medals, the cabinets of Paris and London now possess nearly two thousand of the coins of Menander and Apollodotus, of silver and copper, of a great variety of types, and mostly in excellent preservation. The country on both sides of the Indus and north of the Hindu Koosh having been explored with a view of searching for coins, great discoveries were made. Generals Ventura, Alard, and Court, Dr. Swiney, James Prinsep, Sir Alexander Burnes, Masson, and many others, mostly British residents in India, have made collections of Bactrian coins, which enabled us to make out a complete series of Bactrian kings, of Greek and barbaric descent.

Under the term Bactrian coins are understood in this article only such medals as were struck by kings of either Greek or barbaric descent who ruled over the antient kingdom of Bactria or parts of it; but not coins of Hindu, Afghan, or foreign Mohammedan princes who reigned at Kabool and other places in Afghanistan. The Greek coins may be divided, with respect to their inscriptions, into pure Greek and bilingual coins. The first class comprehends the names of five kings, Theodotus I., Theodotus II., Euthydemus, Demetrius, and Eucratides, who ascended the throne in B.C. 181, and perhaps reigned as long as B.C. 155. Of Theodotus I. two coins are known. One, a gold medal, was bought at the fair of Nishni-Novgorod in Russia, and is now in the Royal Cabinet of Paris. It corresponds in weight and style with the gold coins of Antiochus II., and the portrait bears so close a resemblance to that of Antiochus, that it is supposed the artist copied the head of that prince. The obverse has the head of Theodotus. The reverse has a naked figure of Jupiter erect, with his back to the spectator, and turned to the left; he is in the act of hurling his thunderbolt from his right arm raised, whilst his left arm extended bears the aegis: on one side, in the field of the coin, is a crown, and at the foot of the figure an eagle. The legend on each margin of the reverse is ΒΑΣΙΛΕΩΣ ΔΙ°Δ°Τ°Υ, perfectly distinct. The second coin is a silver tetradrachm, presented by Sir Alexander Burnes to the British Museum, where there are also many coins belonging to the other Greek kings of Bactria. The bilingual class begins with Heliocles, who reigned about B.C. 147, but bilingual inscriptions are also found on the square copper coins of his predecessor Eucratides. The two languages are Greek and Prakrit, a Hindu dialect written with particular characters forming the Arian or Arianian alphabet. The oldest bilingual coins are all square, the barbaric inscriptions having been adopted together with the barbaric shape, but the later coins are both square and round. Fourteen kings with Greek names are ascribed to this class, the last of whom is Pantaleon, who reigned about B.C. 120. The Greek letters on these coins are nail-headed; the design is generally good, on some very fine, and probably done by Greek artists; but there are also many of apparently barbaric execution, and in the whole the appearance of Eastern emblems of royalty, and different Indian animals and other figures, betrays the decline of Greek civilization. Among the animals, the elephant and the elephant's head, which we find on the coins of Demetrius, Menander, Apollodotus, Lycias, and Heliocles, and the humped bull on the coins of Philoxenus, Diomedes, and several other kings, are supposed to indicate dominion in India. The wild horse however and the double-humped camel are believed to have exclusive reference to Bactria. Barbaric dynasties reigned over Bactria from the end of the second century before Christ. The coins struck by them are bilingual, and betray the decline of art and prevalence of Eastern influence. To this class belong the coins of several kings of the Arsacidan dynasty, such as Vonones, Undopherres, Abagasus, and others, who seem to have been independent of the Arsacidae in Parthia. These coins are rare, and they are bilingual.

Only two Bactrian gold coins are known, one of Diodotus and one of Euthydemus: all the others we know of are of silver, of billon, or of copper.

As early as the beginning of our æra parts of Bactria were conquered by princes of Scythian (probably Turkish) descent, whose seats were at Kabool and Jellalabád, and who were finally subdued by the Arabs. The coins of these Scythic princes are exclusively of gold and silver, and bilingual—a proof that Greek civilization, although on its decline, had still some influence upon the people, as was the case in Parthia under the Arsacidae. There are also many Sassanian coins found in Afghanistan; a fact by no means extraordinary, as the power of the Sassanians in Persia extended occasionally as far as the Indus, so that those Scythian kings were not always independent, but paid tribute to the Persians. The prince of Iskardo, in the upper valley of the Indus, pretends to be descended from Alexander. As the Greek power in Bactria was maintained in some parts of the Hindu Koosh after the Scythian conquest, the principality of Iskardo may be a remnant of the Bactro-Greek empire, and a closer investigation into the history of Iskardo and the whole upper valley of the Indus would perhaps lead to interesting results.

The obscurity prevailing in the history and chronology of Bactria has of course an influence upon Bactrian numismatics, and one cannot be surprised at seeing the principal writers on these subjects at variance on most essential points. [AFGHANISTAN, P. C. S.]

(Wilson, *Ariana Antiqua*; Lassen, *Zur Geschichte der Griechischen und Indo-Skythischen Könige in Bactrien*, &c.; Grotefend, *Die Münzen der Griechischen, Parthischen, und Indo-Skythischen Könige von Bactrien*, &c.; H. T. Prinsep, *Note on the Historical Results deducible from recent Discoveries in Afghanistan*.)

BADALO'CCHIO, SISTO, an Italian painter and engraver, born at Parma towards the close of the sixteenth century. He was the pupil and for some time the assistant of Annibal Carracci at Rome. He was highly valued by Annibal as a draughtsman, who confessed that he surpassed himself; but in painting he was much inferior to Guido or Domenichino. His engravings are not numerous: the most celebrated are the so-called Bible of Raphael, which he executed in company with Lanfranc, and dedicated to Annibal Carracci; and the six prints from Correggio's cupola at Parma. Of his paintings the best was Galatea, in the Verospi palace at Rome; a San Francesco at the Capucins of Parma, was also one of his best works; but like his friend Lanfranc, says Lanzi, he always did less than he was capable of doing. The date of his death is not known.

(Lanzi, *Storia Pittorica*, &c.; Malvasia, *Felsina Pittrice*; Bartsch, *Le Peintre-Graveur*.)

BAGGESEN, JENS, a writer of considerable distinction both in Danish and German literature, was born at Corsoer in the island of Zealand, February 15, 1764, and was educated at the University of Copenhagen. From his earliest youth he displayed unusual liveliness of imagination, of which, together with satiric humour, his first production, at the age of twenty, his 'Comic Tales,' gave evidence, and obtained a most favourable reception from the public. Yet he himself says that he had no taste for the comic; that in writing his tales he consulted that of the public far more than his own, and that he published them for the purpose of paying off his father's debts and assisting the family: from which it would appear that they were left in embarrassed circumstance. Still he seems to have been for some time afterwards without fixed pursuit of any kind, except that of writing some of his smaller poetical compositions and the opera of 'Holger Danske.' He had however acquired the favour of the Prince of Holstein-Augustenborg, who bestowed on him a small pension. In 1789 he visited Pyrmont in hope of benefiting from the waters, and meeting there with his countryman the young Count Moltke, who was also an invalid, he accompanied him to Switzerland, and returned home through France and Germany. Of this journey he has given a full narrative, or rather picture, in his 'Labyrinthen,' one of the most interesting of his works, it being, as he himself calls it, his 'Digtervandringer,' or 'Wanderings of a Poet,' in which he records his varied feelings, opinions, and contemplations, and portrays his own character. For that period of his life to which it refers, it may in fact be considered a piece of autobiography, and it certainly enters at some length into one rather important circumstance of his personal history—his acquaintance with Sophia Haller, the granddaughter of the poet, whom he married at Berne, in March, 1790, after which event he immediately returned to Denmark. Notwithstanding his poetical attachment to his native land, he did not remain there long: he fancied it a sphere too contracted for him, felt unsettled and unable to apply to anything seriously, so set out again for Germany, taking with him his wife, for the purpose of leaving her with her family at Berne. He then visited Paris, being at that time an ardent enthusiast for the French Revolution, and there he became acquainted with many of the public characters of the day. On his second return to Copenhagen, in 1796, he obtained a professorship at the university, but found it too irksome for his disposition, and as change of climate was thought necessary for his wife's health, he set out the following year for Germany, but lost his wife at Kiel. Instead of returning, he proceeded to Switzerland, taking with him his two young children; and in 1798 again visited Paris, where he married Fanny Reibaz. This planless mode of life and constant change of place did not contribute to better his circumstances: he first got into debt, and then into prison. It was during his stay in France, which was prolonged till 1810, that he composed his chief German poems; among others the 'Parthenais, oder Alpenreise,' an epic idyll, in twelve cantos, after the manner of Voss's 'Luise,' and, like that, written in hexameters. On its first appearance (1806) that production was received most favourably, as one that entitled its author to very high rank among the poets of Germany; but criticism has since spoken of it in a more sober tone. His long residence at Paris terminated by his being glad to accept the appointment of professor of Danish literature at the University of Kiel. Even that he did not retain very long, but returned in 1814 once more to Copenhagen, where he was most warmly received, yet soon embroiled himself in a violent feud with Oehlenschlager, whom he opposed as the leader of the romantic party in poetry. This led him to make Paris once more his place of residence, with occasional visits however to Copenhagen. On his health beginning to decline, he went, in 1825, to Carlsbad for the benefit of the waters, and was returning thence to Copenhagen, when he died at Hamburg, October 3, 1826. After his death, but in the same year, appeared his 'Adam and Eve,' a most extraordinary subject for a 'humourous epic;' not less so for being chosen by one who had told the public that he had naturally no relish for the comic strain, in which he nevertheless indulged when on the verge of the grave. The warm-heartedness and enthusiasm of his youth must have been exchanged for a very different temper of mind before he could have brought himself even to the contemplation of such treatment of such a subject, and his rapturous admiration of Klopstock must have evaporated altogether. He is said to have left in manuscript a poem of similar and even stronger character, of which Faust was the hero. His correspondence with Reinhold and Jacobi, in two volumes 8vo., was published by his sons in 1831; and a complete edition, in twelve volumes, of his 'Danske Værker,' comprising all his Danish poems and other writings in that language, his translation of Holberg's 'Niels Klim' inclusive, was published by his sons and C. J. Boye, 1827-32. A well-executed portrait of him is prefixed to it.

BAGLIO'NE, GIOVANNI, a Roman fresco and oil painter of the seventeenth century, at present better known for his 'Lives' of his contemporaries than for his paintings, though in his time he enjoyed the highest patronage. He was born at Rome about 1573, and was for a short time the pupil of a Florentine painter, Francesco Morelli. He attracted the notice of the popes Sixtus V. and Paul V., the latter of whom created Baglione a Cavaliere del Abito di Cristo. In 1618 he was elected Principe of the Academy of St. Luke. The date of his death is not known; he was still living in 1642. He executed a great many works in Rome, some at Naples, and some at Mantua; but he painted very few easel pictures, whence his works are rarely seen in collections; he excelled in colour, and in light and shade. One of his best works is the Resurrection of Tabitha, in St. Peter's at Rome.

His book of memoirs, of which he has written 81, is written in an extremely simple style, without the slightest attempt at criticism, and if he ever ventures upon a qualifying remark, it is sure to be one of commendation. G. B. Passari published an edition of it at Naples in 1733, with the addition of the Life of Salvator Rosa: there is also a memoir of Baglione, which contains a long list of his works. The following is the title of the book—'Le Vite de' Pittori, Scultori, Architetti, ed Intagliatori, dal Pontificato di Gregorio XIII. nel 1572 fino a' tempi di Papa Urbano VIII. nel 1642.' The editio princeps was published at Rome in 1642, and a second appeared in 1649, according to Orlandi.

BAGLIO'NI, an historical family of Perugia in Italy, which in the middle ages produced many distinguished warriors, several of whom exercised supreme power over their native town. Perugia was in those times one of the most populous and important cities of central Italy, and governed itself as a municipal community, under the nominal protection first of the Emperors and afterwards of the Popes. Like most other Italian cities, it was distracted by two parties, that of the nobles, and that of the people. The Baglioni belonged to the nobles. We find in the twelfth century Ludovico Baglioni appointed Imperial Vicar of Perugia, by the emperor Frederic I. (Barbarossa), who in his diploma styles him his relative, as being issued, like himself, from the Ducal House of Suabia. After the fall of the Suabian dynasty, the nobles and the popular party had frequent conflicts with alternate success. In the year 1393 a general outbreak took place, when Pandolfo and Pellino Baglioni, with seventy other gentlemen, were killed in fight in the streets, and their adherents being driven away, the popular party remained in possession of the town, until 1416, when Braccio Fortebracci, as the head of the nobles, re-entered the town by force, and was proclaimed Lord of Perugia. Malatesta Baglioni, son of Pandolfo, was one of the foremost followers of Braccio, whose niece he married One of his sons, named Braccio Baglioni, was appointed General of the Holy See by Pope Callixtus III.: he defeated Francesco Sforza near Lodi in 1453, was made Lord of Spello by Sixtus IV., and died in 1474. His brother Ridolfo left a son called Gian Paolo Baglioni, who became conspicuous in the Italian wars of the beginning of the sixteenth century: Gian Paolo began his career as a condottiere, or captain of one of these mercenary bands which sold their services for a time to any one of the Italian States that was willing to pay for them, and he acquired a great reputation for military skill as well as for personal bravery. After a time he availed himself of the civil dissensions of his native town to obtain supreme power over it, and he made alliance with Pandolfo Petrucci, who had likewise made himself Ruler of Siena, and with Vitelli, Lord of Città di Castello. He allied himself also with Cesare Borgia in his wars of the Romagna, but when Borgia in 1502 waylaid and put to death Vitelli, Orsini, and others of his former allies, Baglioni was glad to make his escape, and leave Perugia to Borgia. He returned in 1503, after the death of Pope Alexander VI., but in 1506 he agreed to give up Perugia to Pope Julius II., who followed up Borgia's plan of putting down all the petty tyrants who had parcelled among themselves the greater part of the Papal state. Gian Paolo then resumed his old profession of condottiere, and served the Venetians for several years in the war of the league of Cambrai. He was taken prisoner by the Spaniards in 1513, but being released, he returned to Perugia, where he resumed his former ascendancy. Some years after, Leo X., who had at first winked at his usurpation, hearing repeated complaints of Baglioni's conduct, requested him to come to Rome, under pretence of consulting with him about weighty state matters, and sent him a safe-conduit. On his arrival at Rome, Baglioni was arrested, taken to the Castle St. Angelo, and there put to the torture, being charged, among other things, with being implicated in the conspiracy of Cardinal Petrucci discovered some years before. He was speedily condemned and beheaded. This happened in 1520. Perugia was then taken possession of by the pope. After Leo's death, Malatesta and Orazio Baglioni, the sons of Gian Paolo, recovered possession of Perugia with the assistance of the Duke of Urbino. Malatesta was saluted by the citizens as 'Pater Patriæ,' and a medal was struck in honour of him. Orazio afterwards obtained the command of the mercenary corps called the 'black bands' in the service of France, and followed Marshal Lautrec in his expedition against Naples in 1528, in which he was killed. His brother Malatesta remained at the head of the government of Perugia till September, 1529, when he was obliged to surrender it to the papal and imperial allied arms, and at the same time he was chosen by the Florentines to be their Captain-General against the same enemies. The choice was unlucky. Baglioni, either through incapacity or treachery, or both, did not defend Florence as he might; he entered into correspondence with the besiegers; and lastly, in August, 1530, was dismissed from his command. He refused however to give it up, and even turned the guns of one of the ramparts against the city. Florence, worn out by famine and disease, was obliged to capitulate and submit to the rule of the Medici. Baglioni returned to Perugia, where he died in December, 1531. He left a son, Ridolfo, who became general of the troops of Cosmo I., Grand Duke of Tuscany.

Gentile Baglioni, grandson of Braccio above mentioned, was made Bishop of Orvieto in 1505, but afterwards, in consequence of his three brothers dying without legitimate issue, he renounced his dignity, married Giulia Vitelli, and was for a time governor of Perugia for the pope. He was driven away by his relative Orazio Baglioni, who caused him to be put to death in 1527, with two of his nephews. The various branches of the Baglioni family were in constant enmity against one another. Gentile left two infant sons: one, Adrian, served in the papal troops, and died in 1574; and the other, Astorre Baglioni, is better known in history for his military reputation and his tragical end. Astorre was brought up under the care of his uncle Alessandro Vitelli, a distinguished general of his age, whom he followed to the

Hungarian wars against the Turks. He afterwards served Charles V. in Italy and on the coast of Tunis; and he rose high in the favour of Pope Paul III., who restored to him his paternal estates. Lastly he entered into the service of the republic of Venice, which intrusted him with several important situations. He was governor of Famagosta in the island of Cyprus when the Turks besieged the place in 1570. After a long and brave defence he was obliged to capitulate, in August, 1571, on condition of being sent to Venice with his garrison. But Mustapha Pasha, disregarding the capitulation, caused Baglioni and the other Venetian officers to be beheaded, except Bragadino, who was flayed alive by order of the Pasha.

Several other individuals of the family of Baglioni distinguished themselves in the Italian wars of the fifteenth and sixteenth centuries.

(Crispolti, *Perugia Augusta;* Sansovino, *Della Origine e dei Fatti delle Famiglie Illustri d' Italia;* Vermiglioli, *Vita e Imprese Militari di Malatesta Baglioni*, Perugia, 1839; Fabretti, *Biografie dei Capitani Venturieri dell' Umbria*, Montepulciano, 1840.)

BAGSHOT SAND. One of the higher members of the tertiary group of England is thus designated. It has been investigated by Mr. Warburton. (*Geol. Trans.*)

BAIL. [P. C., vol. iii. p. 287.] The general principles of the Law of Bail remain unchanged. But as, since the statute 1 & 2 Vict. c. 110, § 2, all personal actions are to be commenced by writ of summons, the cases in which a defendant may be held to bail in civil causes are now confined to those which are specified in the third section of that statute. It is thereby enacted that if a plaintiff in any action in any of the superior courts of law at Westminster, in which the defendant is now liable to arrest, shall show by affidavit to the satisfaction of a judge of one of the said courts that such plaintiff has a cause of action against such defendant or defendants to the amount of 20*l.* or upwards, or has sustained damage to that amount, and there is probable cause for believing that the defendant or any one or more of the defendants is or are about to quit England, unless he or they be forthwith apprehended, such judge may order the defendant or defendants to be held to bail in any sum he may think fit, not exceeding the amount of the debt or damages. The plaintiff may thereupon sue out a writ of capias, and arrest the defendant, who, when so arrested, is to remain in custody till he shall have given a bail bond to the sheriff, or shall have made deposit of the sum endorsed on such writ of capias, together with 10*l.* for the costs, according to the present practice. All subsequent steps of the proceeding are to be conducted according to the present forms. The power given by the statute to a judge to grant an order to hold to bail, is not affected by the act of 7 & 8 Vict. c. 96 (Lord Brougham's Act).

With regard to criminal law, the statute 7 Geo. IV. c. 64, has been somewhat altered by the 5 & 6 Will. IV. c. 33, § 3, which provides that any two justices of the peace, if they shall think fit (of whom one or other shall have signed the warrant of commitment), may admit any person or persons charged with felony, or against whom any warrant of commitment for felony is signed, to bail, in such sums and with such sureties as they shall think fit; notwithstanding such person or persons shall have confessed the matter laid to his or their charge, or notwithstanding such justices shall not think that such charge is groundless, or shall think that the circumstances are such as to raise a presumption of guilt.

BAILLIE, ROBERT, was born in Glasgow, April 30, 1602. His father, Thomas Baillie, is described as a citizen of Glasgow, and was a younger son of the family of Baillie of Jerviston, a small property near the town of Hamilton in Lanarkshire (not to be confounded, as it has often been, with the family of Baillie of Jerviswood, in the same county, the head of which, in the latter part of the seventeenth century, was the eminent Presbyterian patriot Robert Baillie, who, after a long imprisonment and many other sufferings, was executed at Edinburgh in 1684). The subject of the present notice was educated first at the grammar-school and afterwards at the university of Glasgow, at which he was entered a student in March, 1617. He took his degree of M.A. in 1620; probably in 1623 or 1624 he entered into holy orders; in August, 1625, he was admitted to the office of one of the masters or regents (as the professors were then styled) of the college; and this situation he held till the year 1631, when he was presented by the Earl of Eglinton to the parish church of Kilwinning in Ayrshire. At this time Baillie's sentiments on the subject of church government were extremely moderate; his ordination had been episcopal, and he was attached on principle, as well as by education and habit, to that form of polity, which was indeed at this time the established ecclesiastical system in Scotland. But when Charles I. made his attempt in 1636 and 1637 to impose the new service-book and canons upon the Scottish church [Spotswood, John, P. C., p. 379], Baillie was induced to attend a meeting of the Supplicants, as the opponents of the obnoxious measures called themselves, which was held at Edinburgh on the 18th of October, 1637; and this proved the turning point of his life. He was probably far less zealous upon the subject of mere forms and ceremonies than any other person present; but he had studied the doctrinal controversies touching antinomianism and other points which then divided the English theologians; and, having been prevailed upon to explain the reasons upon which he confessed, although in mild terms, that he disapproved of the new service-book, he spoke at some length, and so delighted his audience by his citation and exposure of the opinions avowed by Laud and his party, the authors of the book, that he was urged to send the substance of his speech forthwith to the press, and from this time he took his place as one of the chief managers and leaders of the Presbyterian and anti-court party. When he first rose to speak at the Edinburgh meeting, it was, he tells us, 'with some piece of blushing, in such an auditory,' the like whereof he had never before addressed; but he adds that he was heard with very great applause, and ere evening was a famous man over all the town.

He still however retained something of his original moderation when he made his appearance, as one of the members for the presbytery of Irvine, at the celebrated General Assembly which met at Glasgow on the 21st of November, 1638; so much so, that he stood alone in refusing to concur in the vote declaring episcopacy to have been always abjured by the Scottish church: he proposed that it should be declared to be 'removed now, but never before abjured.' The prevailing party however were aware of his value, and he was soon entirely gained over. When arms were taken up, he appeared in the camp at Dunse Law, in the beginning of June, 1639, in quality of preacher to a division of the troops, and carrying, he tells us, as the fashion was, a sword, and a couple of Dutch pistols at his saddle—though he intended, he says, to fight no man unless he should encounter a robber by the way. A pacification was in fact arranged at Berwick (on the 18th of June) before any blood was shed.

In April, 1640, Baillie published what may be considered to have been an extension of his speech at the meeting of Supplicants, in a large quarto pamphlet at Edinburgh, under the title of '*Αὐτοκατάκρισις*; The Canterburians' Self-conviction; or, An Evident Demonstration of the avowed Arminianism, Popery, and Tyranny of that faction, by their own confessions,' &c. In the following October, when the Scotch had again taken arms, he proceeded, on the invitation of the earls of Rothes, Montrose, and Argyle, to the council of war at Newcastle, taking with him a number of copies of his book; and here he was nominated one of the four clerical commissioners who were deputed, with nine laymen, to proceed to London, under the protection of the great seal, to negotiate a treaty with the king. He reached London on the 16th of November, and remained there till the beginning of June, 1641, having, during his residence, witnessed the trial of Strafford and other remarkable occurrences, of which his letters contain very detailed and graphic accounts. In one of his letters written during Strafford's trial, he writes, in a somewhat sanguine as well as sanguinary strain, 'When we get his head, then all things will run on smooth.' In June, 1642, Baillie was appointed joint Professor of Divinity in the University of Glasgow; but immediately after this he was again dispatched to England as one of the five clerical commissioners from the General Assembly to the Westminster Assembly of Divines. He reached London on the 18th of November; and his stay this time lasted for more than two years: he did not leave till the 6th of January, 1645. He was sent back again before the end of March, when, as he was proceeding by sea, the ship was driven towards the coast of Holland, and forced to run up the Maas, which gave Baillie an opportunity of spending a few days at Middelburg and Rotterdam. He remained in London on this his last visit till December, 1646, employing every moment that was not taken up in attending the Assembly of Divines in preaching and in writing sermons, pamphlets, and letters to his friends in Scotland and elsewhere. He now resumed his duties as Professor of Divinity—continuing also, however, to take an active part in public proceedings. After the execution of the king, he was one of two clergymen sent over to the Hague, in March, 1649, with the commissioners of the Scottish estates (or parliament) to enter into negotiations with Charles II. Upon this mission he was absent till July, and during that interval he composed and published at Delft an answer to a pamphlet against Presbyterianism by Bishop Bramhall, under the title of 'A Review of Doctor Bramble, late Bishop of Londonderry, his Fair Warning against the Scotch Discipline.' When Cromwell advanced upon Glasgow, in October, 1650, after the battle of Dunbar, Baillie fled to the isle of Cumray with Lady Montgomery, but left, he tells us, all his family and goods to Cromwell's courtesy, 'which,' he adds, 'indeed was great; for he took such a course with his soldiers that they did less displeasure at Glasgow, nor [than] if they had been at London, though Mr. Zachary Boyd railed on them all to their very face in the High Church.' Under the new government, he was, in January, 1651, appointed First Professor of Divinity on the removal of his colleague to a chair at Edinburgh; but he was after this greatly disquieted by the promotion to offices in the university of various persons who went much farther than he was disposed to go in compliance with the times. In church politics Baillie now allied himself with the more moderate party, or those who were called the Resolutioners (that is, the supporters of certain resolutions passed at an Assembly held at Perth, in December, 1650), in opposition to the minority, known as the Remonstrants or Protestors. One of his great vexations was the appointment of Patrick Gillespie, one of the leaders of the latter party, as Principal of the university in 1653; but immediately after the Restoration Gillespie was turned out, and Baillie himself was promoted to his office in January, 1661. He did not however long enjoy this preferment, having died about the end of August in the following year. He had been twice married, and had eight children, of whom only one was by his second wife.

Of Baillie's works the most important, besides those already mentioned, are his 'Dissuasive from the Errors of the Time,' 4to. Lond. 1645; his 'Anabaptism, the True Fountain of Independency, Brownism, Antinomy, Familism, &c.' (a Second Part of the Dissuasive), 4to. Lond. 1647; his 'Appendix Practica ad Joannis Buxtorfii Epitomen Grammaticae Hebraeae,' 8vo. Edin. 1653; and his 'Operis Historici et Chronologici Libri Duo,' folio, Amst. 1663, and Basil, 1669. He also published several sermons and other short tracts. But of all the produce of his pen by far the most interesting part consists of his Letters, written to various friends, and especially to his relation, the Rev. Mr. William Spang, minister of the Scottish church at Campvere, and afterwards of the English congregation at Middelburg in Zeeland, which extend, with inconsiderable interruptions, from 1637 to within a few months of the writer's death, and are to be ranked among the most valuable memorials of that important period of our national history. These letters were originally copied by an amanuensis under Baillie's own eye, and the transcript thus formed is now among the records of the Scottish church. Other transcripts, more or less perfect, also exist—the most valuable of which is one, in four vols. folio, made for the use of Baillie's family, and now in the possession of the Rev. Thomas M'Crie, of Edinburgh. An edition of them appeared at Edinburgh, in 1775, in 2 vols. 8vo., under the title of 'Letters and Journals written by the deceased Mr. Robert Baillie, Principal of the University of Glasgow; carefully transcribed by Robert Aiken' (supposed to have been schoolmaster at Anderston). This publication is said to have been undertaken on the recommendation of Dr. Robertson and Mr. Hume; but it is in fact only a selection from the letters, and is far from presenting a faithful text even of so much of them as it professes to give. The book besides had become excessively scarce and high-priced. Historical readers and inquirers therefore have gladly welcomed a complete edition of the Letters, which has been lately produced under the care of David Laing, Esq., in 3 vols. cr. 8vo., Edin. 1841-2, with annotations, a Life of Baillie (to which we have been indebted for the materials of this notice), and other illustrative matter. The book was originally printed in 4to. for the Bannatyne Club, and the 8vo. impression, for public sale, was afterwards taken off by over-running the lines. It is in all respects a very carefully edited book.

BAILY, FRANCIS, the best friend of astronomy among the Englishmen of his day, and one of the most distinguished of its promoters, will be biographically known to posterity by a valuable memoir, read by Sir John Herschel to the Astronomical Society, in November, 1844. From this memoir, and the writer's personal knowledge of Mr. Baily, the following account is drawn up.

He was born April 28, 1774, at Newbury in Berkshire; his father was a banker at that place. He had, of course, a liberal education, and is said to have shown an interest in pursuits of physical science at an early age; his attachment to these branches of knowledge was afterwards increased by an intimate acquaintance with Priestley. But a life of business was his own choice, and he accordingly served his time in the city of London. He then changed his views, and after travelling for about two years (1795-96) in the United States of America, and then residing some time at Newbury with his father, he went into business as a stockbroker, being taken into partnership by his father's friend, Mr. Whitmore: this was before 1802, and probably not long after his return from America. He soon began to be known to the public, and became as eminent in his business as afterwards in his scientific pursuits. In 1806 he wrote a pamphlet in defence of the stockbrokers against the city of London, and in 1814, he was appointed by the Committee of the Stock Exchange to get up the evidence against the perpetrators of the celebrated fraud of De Berenger (better known in connexion with the name of Lord Cochrane), which he is said to have done in so masterly a manner that no more complete chain of evidence was ever offered to a court of justice. He published two reports on the subject, and another on the distribution of the money stopped.

It is the peculiar part of Mr. Baily's history, that while actively engaged in business, in which he accumulated a large fortune, he gained a first-rate reputation in one species of mathematical application, and laid the foundation of another, to be completed after his retirement from the Stock Exchange, at the age of fifty-one. He had a good working knowledge of mathematics, in all the elementary branches, and an extensive acquaintance with English writers on the subject. He first published his 'Tables for the purchasing and renewing of Leases' (1802, 1807, 1812, 8vo.); next 'The doctrine of Interest and Annuities,' (1808, 4to.); then 'The doctrine of Life Annuities and Assurances (1810, 8vo.); lastly, 'Appendix to the doctrine of Life Annuities and Assurances' (1813, 8vo.). Also, 'An Account of the several Life Assurance Companies' (1810, 1811, 8vo.), which is an extract from the work on life assurance. The book on leases was very useful; that on interest was accompanied by a reprint of the best tables (those of Smart), and was the most complete exposition of the subject which had been given. The work on life annuities (translated into French by M. de Courcy in 1836) is still much sought after, and was exceedingly useful; it was the first in which algebra was systematically applied in a modern and symmetrical form to the whole of the subject; the first in which tables of greater vitality were allowed to compete with the Northampton Table; and the first in which an attempt (not so complete as the subsequent one of Mr. Milne) was made to represent cases of annuities, &c. by a distinct notation. The appendix arose out of the refusal of the Royal Society to print in the Philosophical Transactions the method of calculating annuities proposed by Mr. Barrett. [REVERSIONS, P. C.] This method, which is now very extensively adopted, and will, beyond a doubt, supersede all others, would probably have been lost if Mr. Baily had not thus preserved and given it to the world; in doing which he made some justly severe remarks on the Society which had thus endangered a capital improvement in commercial mathematics. The whole work used to sell for four and five times its original price when it became a second-hand book; and if the writer had published nothing but the writings already enumerated, he might still have been cited as a remarkable instance of active and useful exertion during the hours of relaxation from a laborious occupation.

It was Mr. Baily's habit so methodically to commit to writing all he learnt, that his notes enabled him to publish the 'Epitome of Universal History,' 2 vols. 8vo. 1813, a short account of the political changes of the world with dates attached, and valuable chronological tables at the end. He had previously (1812) published his 'Chart of History' with an explanation; an extension of Priestley's Chart which we cannot here minutely describe. In these researches he remarked the unsettled date of the eclipse of Thales, and made the calculations and wrote the paper in the Philosophical Transactions described in ALYATTES, P. C. This was his first astronomical paper, and previously to his retirement from business he had published in the Philosophical Magazine and elsewhere a number of small tracts calling attention to different points of astronomical interest as they arose.

He retired from business in 1825, and shortly afterwards left his chambers in Gray's Inn for a detached house which he had bought, No. 37, Tavistock Place, which will always be remarkable as the building in which the repetition of the Cavendish experiment was performed. From this time till his death, he was engaged with all the energy of his character in the promotion of astronomy. Between the ages of fifty-one and seventy, when most men in his circumstances would have been enjoying the leisure to which commercial men above all others are apt to look forward, he did the work of a lifetime. We can here only note a few heads, referring the reader for a full list of his writings, and for further details, to the memoir already cited.

He was (in 1820) one of the founders of the Astronomical Society, a body which has done as much for the promotion of its science as any one ever did in its first quarter of a century; and that so much can be said is mainly due to Mr. Baily, whose attention to its affairs was as constant and minute as if it had been a firm of which he was the chief clerk, with expectation of being taken into partnership. 'Of his management of our society,' says Mr. Sheepshanks, 'it is difficult to speak so as to convey a correct idea. No assumption, no interference with other people, no martinet spirit (which seems almost natural to all good business men), but everything carried on smoothly and correctly, and without bustle. He hit, better than any chairman I have ever seen, the mean between strictness and laxity, and while he kept everything going in its proper channel, he also kept everybody in good humour. This natural tact was a great gift; but there was another quality which I never saw in any one but him, and that was his readiness to give precedence and room to every one who wished to do anything useful, and his equal readiness to supply every deficiency and to do the work of everybody else. He was also the person who never was asleep and never forgot anything, and who contrived, by his good humour, hospitality, and good sense, to keep everything in train.'

He was one of those who exerted themselves to produce a reformation and enlargement of the Nautical Almanac, and whose efforts did at last prevail upon the government to place it upon its present distinguished footing.

In pendulum experiments [Pendulum, P. C.] he was among the foremost of those who investigated the newly observed effects of the air upon the instrument. When the expedition which set out under Captain Foster returned with the loss of its able commander, Mr. Baily reduced and digested his observations, which take up the whole of the seventh volume of the Astronomical Society's Memoirs.

He superintended the formation of the same society's standard scale, and wrote a full and valuable account (*Mem. Astron. Soc.* vol. ix.) of the history and present state of the subject, with details of the experiments. These were carried on in a committee-room of the House of Commons, the government scale, of which that of the society is a copy, being under the charge of the Speaker. As it happened, Mr. Baily's unremitting habits of business were the cause of the preservation of this copy; had the work lasted a few months more, as it would have done in most hands, the copy would have been destroyed with the original in the fire at the Houses of Parliament in 1834.

Of the repetition of the Cavendish experiment we have spoken elsewhere. [Weight of the Earth, P. C.] Had that article not been written during his lifetime, we should have said much more on the determined honesty with which the experiments were carried on until the cause of the observed discordances was detected. A very large number of hours, which there is every reason to suppose underrated when it is called *twelve hundred*, was spent in the mere act of watching the movements of the torsion pendulum. The account of this experiment forms volume xiv. of the Memoirs of the Astronomical Society.

The Astronomical Society's catalogue of stars was the suggestion of Mr. Baily and Mr. Gompertz, and was superintended by Mr. Baily. Up to that time there had been no general consent as to the method of reducing the stars. Sir John Herschel says that this catalogue 'put the astronomical world in possession of a power which may be said without exaggeration to have changed the face of sidereal astronomy.'

Of the remarkable circumstances attending the publication of Mr. Baily's Life of Flamsteed (4to., 1835, with supplement in 1837) we have spoken elsewhere. [Flamsteed, P. C.] To this work was annexed a new edition of Flamsteed's catalogue, with such a complete examination of the original observations as make it quite a new work. None but those who knew Mr. Baily well can have any idea of the confidence with which such an examination made by him is to be treated. He had already revised Mayer's and Lacaille's catalogues in the Astronomical Society's memoirs, volumes iv. and v.

He put the finishing hand to his revision of antient catalogues in the 13th volume of the Memoirs of the Astronomical Society, which is entirely his own work, and printed at his own expense. It is the third complete *volume* (independently of the catalogue) which he contributed to these Transactions, with about fifteen memoirs inserted in other volumes, almost all the annual reports, and various addresses, notices, &c. It contains a new edition of Ptolemy's catalogue in Greek, with those of Ulugh Beigh, Tycho Brahé, Halley, and Hevelius. Mr. Baily was not a professed scholar, but he had quite knowledge enough to do for Ptolemy more than any scholar could have done. An astronomer might have restored Ptolemy's catalogue to what it ought to have been; a scholar might have made a judicious collation of existing editions: but the former alone would in many cases have undesignedly sacrificed the probable text to astronomical correctness; and the latter would have let pass many instances in which a corrupt text can be divested of astronomical impossibility and restored with the highest probability. Mr. Baily had every requisite, and experience, combined with methodical habit, had given him extraordinary resources. It will be long, we suspect, before the old catalogues can be properly cited from any other writer.

He suggested to the British Association the republication of the immense catalogue of Lalande, called the *Histoire Céleste*, combined with that of Lacaille; the two together containing fifty-seven thousand stars. He suggested to the same body the extension of the Astronomical Society's catalogue to ten thousand stars, accompanied by the coefficients of reduction. He superintended the construction of these tables and a portion of the printing, and he left the preface to the latter completely written. He had also undertaken the construction of the new standard scale, wanted by the government in consequence of the destruction of the old one.

This is a brief account of Mr. Baily's principal works; we cannot enter upon every one of the ninety heads under which all his writings, great and small, are given in the Memoir cited.

In June, 1841, while crossing Wellington Street, a man riding furiously to carry the news of some public event to an evening paper, threw him down, and he received a severe wound in the head. After lying for more than a fortnight in the greatest danger, he slowly recovered, and began to apply himself to the Cavendish experiment as usual. In the spring of 1844 an affection of the kidneys came on (not, it is supposed, to be traced to the accident), of which he died, August 30, 1844. His last public appearance was at Oxford, on the 2nd of July, to which place he went with some difficulty to receive the honorary degree of Doctor of Civil Law. He was never married.

'To term Mr. Baily,' says Sir John Herschel, 'a man of brilliant genius or great invention, would in effect be doing him wrong. His talents *were* great, but rather solid and sober than brilliant, and such as seized their subject rather with a tenacious grasp than with a sudden pounce.' This sentence, read as it was to an assembly which had had long experience of the qualities of its subject, was better understood than it can be by those who were not acquainted with him. He was in fact one of the most remarkable men we ever knew; and yet it is not easy to give a precise description of that which distinguished him from other men. Again, his biographer describes him as possessing 'a calm the reverse of apathy, a moderation having nothing in common with indifference, a method diametrically opposed to routine.' This sentence will look as if it had been written for the sake of the points; and yet there is an absolute truth about it which would have been sacrificed if it had simply been said that Mr. Baily was calm, moderate, and methodical. When the memoir which we have cited had been read, its hearers, well as they thought they had known their deceased president, were astonished to find how much they had underrated the enormous amount and collective value of his labours, until the mass was placed before them: they could vouch for the items, but had never rightly formed the sum total.

Mr. Baily's knowledge of his subject was great, and he never began to carry a plan into execution until he had sedulously examined his own views and those of others. His judgment was sound, and he really exercised it; he was one of the few men who ask advice to get the means of coming to a decision. But there was in his habits of execution something unique: to us it seems right to say that in this respect he was a genius of an uncommon order. Many persons thought he learnt this power in business: we are perfectly satisfied that he carried it to the Stock Exchange, and would have had it whatever walk of life he might have been thrown into. There was nothing like a retired accountant in his proceedings: instinct seemed to point out to him the proper mode of undertaking things to which he had never been accustomed. In a few days he could digest his plan, and begin to work upon its separate parts. Even when engaged in research such as that required by his Life of Flamsteed, he was never to be found at a table loaded with materials for reference. To have painted his picture as literary men are sometimes represented, near a mass of folios and manuscripts, would have spoiled the likeness: there should have been a pen, a paper, a book. When engaged in discussion with his astronomical friends in his own house, which generally required the production of some fresh volume every ten minutes, the books fell into their places again almost of their own accord, and without any apparent interruption of the conversation. These little things were perfect emblems of the manner in which he arranged his studies: his mind was as ready for use as his bookcase. He was not distinguished, as far as we ever knew, for powerful memory, he never refused a visit on the plea of occupation, he seldom worked in an evening, and he was very much in society. Nevertheless his share of any work was always done before that of any one else. But with all this rapidity, the moment that any difficulty arose which required counsel, there was a suspension of operations without effort; and he could repeat the subject again and again, in private thought and discussion with his friends, from week to week and from month to month, as if he had been one of those slow and deliberative persons who never do anything because they can never make up their minds precisely how it is to be done. In our opinion this was the greatest secret of his reputation: namely, that he could at pleasure, as occasion required, execute with impetuous zeal, or deliberate with more than coldness. It is no exaggeration to say that he did, in the last twenty years of his life, much more and better work than younger men of much greater original power have done in twice the time. And besides this, the admirable personal qualities to which we have already alluded, and which made it so easy to co-operate with him, led to his being able to make others do more than they could have done without him. His high moral worth added to his power; and all these together made him the most influential member of the astronomical world. He had, we suspect, a strong love of fame, though perfectly free from vanity; but the same judgment which marked his selection of other things appeared in his choice of means to secure a lasting reputation. That he has won it is certain: the history of the astronomy of the nineteenth century will be incomplete without an account of his labours. Those who are well acquainted with Delambre's history of the science will easily imagine how much that severe judge would have abated of his rigour, had there came before him such models of patient thought, all but impeccable accuracy, careful research, and well-chosen objects, as the writings of Francis Baily.

BALA LIMESTONE, one of the most interesting of the calcareous deposits which have been examined by Professor Sedgwick in the midst of the schistose rocks of North Wales. There are two bands of this rock, exhibited on the west of the Berwyn mountains and on the east of Bala Lake. Two miles north-east of Bala, the limestone, and the schistose rocks in which it lies, may be well seen, and numerous fossils may be gathered at this and at many other points in the vicinity of Bala, on both sides of the lake. Professor Sedgwick has satisfied geologists of the true position of these rocks with reference to the slates of the Berwyn range, and the flags and slates of Llangollen. The series is in two parts, thus:—

Upper Part. Flags and schistose beds of Llangollen, with upper Silurian fossils.

Lower Part. Schistose beds with *limestone bands*, the lowest of which occur at Bala, and yield lower Silurian fossils.

This is the view of Professor Sedgwick, and we have had, through his guidance, personal opportunity of proving its truth. The Bala and Llandeilo limestones are thus nearly coeval.

BALDI'NI, BA'CCIO, a Florentine goldsmith, and one of the first Italian engravers, whose works on that account have an historical interest, but are otherwise of a very low scale of merit. As is the case with the majority of the artists of that period, little or nothing is known about him. He appears to have been active from about 1460, and after 1481; he was bred a goldsmith, and was taught engraving by Finiguerra himself, who was the inventor of the art according to the Italians. Baldini however, though acquainted with the art, could derive no benefit from it, as he was incapable of making a design; he communicated it therefore to Alessandro Botticelli, and the two entered into partnership; the one designed and the other engraved. Such is the story of Vasari. The first prints published in Italy are those of the books entitled 'Il Monte Santo di Dio,' and of an edition of Dante, with the commentary of Landini, both printed by Niccolo di Lorenzo. The former by Fra. Antonio di Siena was printed in 1477, the latter in 1481, both in Florence. In the 'Monte Santo' there are three engravings by Baldini, and for the Dante he engraved 19; but two only were ready when the book was published; the remaining 17, in the Vatican copy, have been pasted on the blank places left for them. Niccolo di Lorenzo left a blank place for a print at the head of every canto. All these prints were made from the designs of Botticelli. Baldini executed many other prints, which are noticed at length by Bartsch and other writers on prints. Heineken, Strutt, and others have published copies of some of Baldini's engravings as specimens of the early Italian style.

(Vasari, *Vite de' Pittori*, &c., in the Life of Marcantonio; Strutt, *Dictionary of Engravers;* Heineken, *Nachrichten von Künstlern;* Bartsch, *Le Peintre-Graveur.*)

BALDUNG, HANS, called also Hans Grün, a celebrated old German painter and wood-engraver, the contemporary and the friend of Albert Dürer. He was born at Gmünd, in Swabia, about 1470, or a few years later, but lived chiefly in Switzerland, at Strassburg, and its neighbourhood. From the inscription upon a picture of the Crucifixion, in the church of Freiburg in Breisgau, which is considered his masterpiece, his full name appears to have been Hans Baldung Grün or Grien, for it is there written 'Johann. Baldung, cog. Grien, Gamundianus, Deo et Virtute auspicibus faciebat, 1516.' It is painted upon canvas glued upon wood. His woodcuts are also variously signed, H. B., H. B. G., and H. G. His prints are rather numerous. Bartsch mentions two engravings on copper, and 59 woodcuts; and Brulliot states that there are still many which have been overlooked by Bartsch. Baldung's latest cuts bear the date 1534. There are two small folio cuts of horses with this date. The earliest date of his cuts appears to be 1507. His latest works are the best.

As a painter he was little inferior to Albert Dürer in expression, in colouring, or in finish. He painted portraits and history, sacred and profane: the heads are the best parts of his works. The year 1545 is given in several works as the year of his death. There is in the gallery of Carlsruhe a book of studies and portraits by him; and to one of the portraits there is the date 1543: on the last leaf is the following motto:—'Hodie Aliquid Cras Nihil.' The very old print with the reputed date of 1455, and attributed to Baldung by Sandrart, 'Teutsche Academie,' is evidently a double error; there is no print with so early a date, and if there were, it could not be by Baldung.

(Füssli, *Allgemeines Künstler-Lexicon;* Heineken, *Dictionnaire des Artistes*, &c.; Bartsch, *Le Peintre-Graveur;* Brulliot, *Dictionnaire des Monogrammes*, &c.; Nagler, *Neues Allgemeines Künstler-Lexicon.*)

BALECHOU, JEAN JACQUES, a very celebrated French engraver, born at Arles in 1715. His works are still much valued and eagerly sought for by collectors. His merit however consisted solely in a perfect mastery of the graver. In the representation of the natural appearances of objects, or in the imitation of textures, he has been surpassed by many artists. He gave every object the same appearance. The strongest condemnation of Balechou's style, says Huber, is to be found in the prints of Woollet. It is certainly a great defect in a work of art, if the means and method of its production first and principally occupy the attention of the observer.

He engraved portraits and landscapes. Among the latter are three from Joseph Vernet, of which the Storm and Calm are very celebrated prints. These two prints, in the opinion of Strutt, were unrivalled until the appearance of Woollet's plates after Wilson.

Of his portraits, Balechou's masterpiece is the large upright print of Augustus III., King of Poland, after the picture by

Rigaud. It forms the frontispiece to the 'Recueil d'Estampes après les plus célèbres Tableaux de la Galère de Dresde.' It was however the cause of Balechou's disgrace at Paris, for he retained some of the impressions, and even damaged the plate before he sent it to the king, at whose expense it was engraved. His right of election to be a member of the French Academy of Painting, of which he was Agréé, equivalent to our degree of Associate, was forfeited in consequence, and he retired to Avignon, where he died in 1764.

(Heineken, *Dictionnaire des Artistes*, &c.; Watelet et Levesque, *Dictionnaire des Arts*, &c.; Huber, *Manuel des Amateurs*, &c.; Strutt, *Dictionary of Engravers*.)

BA′LEN, HENDRIK VAN, a distinguished Flemish historical painter, and the first master of Vandyck and Snyders, was born at Antwerp in 1560. He went early to Rome to study his profession, having acquired the rudiments from Adam van Oort.

He was an excellent colourist, a good draughtsman, and painted with great facility. Of his works, which are numerous, one of the best is St. John in the Wilderness, an altarpiece in one of the chapels of the Cathedral of Antwerp: the background is by Velvet Breughel, who painted the landscape backgrounds of many of Van Balen's pictures. He died in 1632, and was buried in the church of St. Jacques at Antwerp. Vandyck painted his portrait; and it has been engraved by Paul Pontius. The painter Jan Van Balen was the son of Hendrik.

(Van Mander, *Leven der Skilders;* Descamps, *La Vie des Peintres Flamands*, &c.; Heineken, *Dictionnaire des Artistes*, &c.)

BALESTRA, ANTO′NIO, a distinguished painter of Verona, where he was born in 1666. He was brought up as a merchant, but before his 21st year he was studying as a painter under Bellucci at Venice. He afterwards studied under Maratta at Rome, and he eventually painted much more in the style of the Roman than of the Venetian: he however combined the chief beauties of Venetian colour with the characteristic correctness and solidity of design of the Roman school.

Balestra was one of the most able painters of his time, and instructed at Venice a numerous school, in which were educated several very distinguished painters, as Giambattista Mariotti, Giuseppe Nogari, and Pietro Longhi. Lanzi mentions particularly, by Balestra, a Nativity, and a Deposition from the Cross, at Venice; a Santa Chiara at Padua; and a San Vincenzio, at the Dominicans', in Verona. He died in 1734, according to Guarienti, but in 1740, according to Zanetti and Oretti. Heineken mentions many prints after the works of Balestra. He engraved also a few plates himself.

(Zanetti, *Della Pittura Veneziana;* Lanzi, *Storia Pittorica*, &c.; Heineken, *Dictionnaire des Artistes*, &c.)

BALIO′STICHUS. A fossil plant in the laminated lithographic limestone of Pappenheim, is named Baliostichus ornatus by Sternberg.

BANA′NA. [Musa, P. C.]

BANDANAS, or BANDANNAS, a term originally applied to a peculiar kind of silk handkerchief made by the Hindus, is the name now commonly given to silk and cotton handkerchiefs manufactured in this country, and decorated with patterns of similar character, though by a very different process. The distinguishing peculiarity of a bandana handkerchief is that it has a uniformly dyed ground, usually of bright red or blue, ornamented with circular, lozenge-shaped, or other simple figures, either perfectly white, or in some cases of a yellow colour. These spots are said to be produced, in real Indian bandanas, by tying up the parts intended to be white or yellow with bits of thread before exposing the handkerchief to the action of the dye, and thus protecting them from it. Rude as this process appears, British manufacturers were, owing to the difficulty of imparting a sufficiently durable ground-colour by the ordinary process of calico-printing, unable to imitate Indian bandanas successfully, until a plan was contrived for dyeing the whole surface, and afterwards discharging the colour from the spots forming the pattern by the agency of chlorine; a plan which, according to the article in the 'Penny Magazine' referred to below, was invented by M. Kœchlin, of Mühlhausen, in 1810, and which has been carried into effect on a large scale at the Barrowfield Dye-works near Glasgow, by Messrs. Monteith and Co., with a degree of perfection far exceeding the original Oriental bandanas.

The object of this notice being simply to describe the peculiar method of discharging the colour from the spots, it is unnecessary to detail the processes by which a uniform colour is imparted to the whole surface of the cloth, on both sides. A number of pieces being thus dyed, they are taken to an apartment containing a range of powerful hydraulic discharging-presses, each of which has a roller at the back, to receive the cloth to be operated upon, and another in front, to receive it after the pattern has been discharged; the intervening portion of the cloth resting upon the bed-plate of the press, which is about a yard square, or equal in size to a single handkerchief. This bed-plate is formed of lead, perfectly smooth and even, and is perforated with holes corresponding with the white spots of the desired pattern; and a similar plate, perforated in like manner, is fixed parallel with, but at a short distance above it. Fourteen pieces of dyed cloth being laid carefully upon one another, are rolled together upon the back roller of the press, and acted upon simultaneously; and, when their ends are drawn over the bed-plate, and secured to the foremost roller, the hydraulic apparatus is brought into action, so that the bed-plate, with the fourteen thicknesses of cloth lying upon it, is raised and pressed with immense force against the upper plate, which is firmly fixed in the press. The bleaching-fluid, which is a solution of chloride of lime, is then poured into a trough connected with the upper plate; and finding its way through the perforations of the pattern, percolates through the fourteen thicknesses of cloth, and escapes through the perforations of the lower plate, its passage through the cloth being sometimes facilitated by a powerful current of air. The extreme tightness with which the dyed cloth is compressed prevents the action of the bleaching-liquid from extending beyond the perforations; and as mechanical contrivances are adopted to ensure the perfect tallying of the perforations in the two leaden plates, the pattern produced by them is very accurately transferred to the cloth. After allowing a few minutes for the action of the bleaching-liquor, it is drawn off, the pressure is removed, and the portion of cloth which has been operated upon is wound on to the front roller, a second portion being, by this operation, drawn forward upon the bed-plate, for a repetition of the process. By means which will be readily understood by those conversant with dyeing and calico-printing, the discharged spots may be made yellow instead of white; and by such an arrangement of the pattern and of the channels for conducting the discharging fluid as will allow two fluids to be used independently of each other, some parts of the pattern may be made white, and others yellow, by one operation. In the establishment above mentioned there are sixteen presses for the production of bandanas; and when these are in full work the period required for the complete discharge of the colour in the first press is equal to that required for bringing the remaining fifteen into action, so that one discharger, with his assistants, can keep the whole in constant operation. The whole routine of operations occupies about ten minutes, so that the sixteen presses (each producing fourteen handkerchiefs at each operation) will produce 224 handkerchiefs at each time of working, the whole being completed within the short space of time mentioned above, and, by the aid of powerful and ingenious machinery, requiring only the labour of four men to effect the various necessary changes and adjustments. A much fuller account of this process, with the details of the discharging press, is given in Dr. Ure's *Dictionary of Arts*, art. 'Bandanna,' and a minute though popular description of the whole manufacture in Dodd's *Textile Manufactures of Great Britain*, pp. 78-85, and the *Penny Magazine*, vol. xiii. pp. 291-293.

BANDON, River. [Cork, P. C.]

BANDON, or BANDON-BRIDGE, an Irish corporate, market, and post town, partly in the parish of Kilbrogan in the barony of Kinalmeaky, but chiefly in the parish of Ballymodan, which extends into the two baronies of Kinalmeaky and East Carberry (East Division); all in the county of Cork: 20 miles south-west of Cork, and 146 south-west of Dublin. The two parishes have an aggregate area of 15,658 statute acres, with a population in 1841 of 14,702.

The town was founded by the English settlers on the forfeited estates of the Earl of Desmond, in the reign of Elizabeth, and takes its name from a bridge over the river Bandon, which flows through it. The Earl of Cork, who had come into possession of the town, added to the previous settlers, in the reign of James I. or Charles I., a colony of Protestants from Bristol; and as the town was walled, it became, in the great civil war of 1641, the chief place of refuge for the Protestants of the neighbourhood, and several conflicts took place between the townsmen and refugees and the revolted

Irish. On Cromwell's approach, the inhabitants declared for the Parliament. In 1688 they expelled the garrison placed here by James II., but were obliged soon after to submit to a detachment of his army. At this time the walls were razed, and have never been rebuilt.

The town is almost entirely comprehended in the boundaries of the parliamentary borough, as determined by the Irish Boundary Act (2 & 3 Will. IV. c. 89), and consists of several streets on both sides the river Bandon, which has a course nearly due east, and over which there is a bridge. The streets are indifferently paved, and only partially flagged. The area of the parliamentary borough is 447 statute acres; it contained, in 1841, 1256 houses, namely, 1180 inhabited, 74 uninhabited, and 2 building; with a population of 1760 families, or 8275 persons. The population of the borough in 1831 was 2007 families, or 9917 persons; the number of houses was 1580, namely, 1436 inhabited, 137 uninhabited, and 7 building. As the present parliamentary limits embrace a larger portion of the town than those of 1831, the number both of houses and inhabitants must have materially decreased in the ten years 1831-41. Of the inhabited houses in 1841, 168 were of superior character; 665 smaller, of from five to nine rooms, but substantial; 274 were mud cottages of more than one room; and 73 mud cabins of only one room. The parish churches of Ballymodan and Kilbrogan are both in the town; the latter on the north, the former on the south side of the river. There are a spacious Roman Catholic chapel, and a nunnery of the Order of the Presentation, with a conventual chapel and a school-room; a Presbyterian meeting-house in connexion with the synod of Munster, and places of worship for the Primitive and Wesleyan Methodists. There are a court-house, where the quarter-sessions for the west riding or division of the county are held in turn, and a county bridewell. The trade of the place has declined: the linen manufacture, which was formerly considerable, is almost if not quite given up; there were in 1837 two banks, two large mills, three breweries, two distilleries, and several tanyards. Coal, corn, and timber are brought up the river to Collier's Quay, three miles from the town. There are two weekly markets, on Wednesday and Saturday, of which the latter is the chief; and there are four yearly fairs for cattle and general merchandise. The meat and fish market is on the north side of the river; the corn, potato, and egg market on the south side. A great number of eggs are sold every spring, and sent to Cork to be shipped for England.

Bandon was incorporated by charter of 11 James I. (A.D. 1614). The corporation, before its abolition by the Irish Municipal Reform Act (3 & 4 Vict. c. 108), consisted of a provost, 12 burgesses, and an unlimited number of freemen. The borough returned two members to the Irish Parliament; but was, on the Union, reduced to one. Before the Irish Reform Act the right of election was limited to the mayor and burgesses. The boundary of the borough was enlarged by the Irish Boundary Act. The constituency in 1835-6 was 367; in 1840 it was 460, showing an increase in the interval of 93; but in 1841 it was only 355.

The living of Ballymodan is a vicarage, of the yearly value of 414*l.* gross, or 367*l.* clear; that of Kilbrogan is a rectory and vicarage, of the yearly value of 719*l.* gross, or 550*l.* clear: both are in the diocese of Cork. There were in the two parishes, in 1834, 17 day-schools with 1355 children on the books, namely, 564 boys and 791 girls. Of these schools one was a classical school founded by the Earl of Burlington, and partly supported by a grant from the Duke of Devonshire; and all the others, except three, were partly or wholly supported by endowment or subscription. One, of 350 to 400 girls, was taught by the nuns of the order of the Presentation. Three schools, for boys, girls, and infants respectively, were taught in a building erected by the Duke of Devonshire; and schools for boys, girls, and infants were supported by the Wesleyans. Beside the day-schools there were, in the two parishes, three Sunday-schools with 667 children.

(*Parliamentary Papers; Lewis's Topographical Dictionary of Ireland.*)

BANKRUPTCY. Within the last twenty years (since 1826) there have been three important acts passed relating to the law and administration of bankruptcy—first the general Bankrupt Act (6 Geo. IV. c. 16), which consolidated, altered, and simplified the law; secondly, the act 1 & 2 Will. VI. c. 56, which constituted the Court of Review and a local Court of Bankruptcy for London; and thirdly, the act 5 & 6 Vict. c. 122, which made some alterations in the law and also established country courts of bankruptcy. The last act has been passed since the article BANKRUPTCY, P. C., was written, and came into operation on the 11th of November, 1842.

By 5 & 6 Wm. IV. c. 29, the judges of the Court of Review were reduced from four to three; and by 5 & 6 Vict. c. 122, the court is formed of one judge (§ 64). One of the new vice-chancellors is now chief judge of the Court of Review.

Before the passing of 5 & 6 Vict. c. 122, the mode of working bankruptcies in the country was as follows:—One hundred and forty separate lists of commissioners (each list containing the names of two barristers and three attorneys) were appointed by the Lord Chancellor, on the nomination of the judges, to act in one hundred and thirty-two different cities and towns throughout England and Wales (exclusive of London); and fiats in bankruptcy were directed to the commissioners in whose district the trader resided.

Under 5 & 6 Vict. c. 122, the Privy Council is empowered to select towns for the establishment of district courts of bankruptcy, and to fix or alter the extent of their jurisdiction. The act limits the number of commissioners of district courts to twelve, who must be sergeants, or barristers of seven years' standing, and each of them is competent to exercise the jurisdiction of the court. Their salary is 2000*l.* a year. The number of commissioners appointed for each court is two (with the exception of Exeter, where there is only one), with two registrars, and from two to four official assignees. The district courts are auxiliary to each other for proof of debts and examination of witnesses. Fees are accounted for to the chief registrar of the Court of Bankruptcy in London.

The district courts of bankruptcy already established are at Birmingham, Bristol, Exeter, Leeds, Liverpool, Manchester, and Newcastle. The district assigned to each court varies from forty to upwards of eighty miles in length. The London Court of Bankruptcy has an extensive local jurisdiction, and includes a city of so much importance and so far distant as Norwich. The affairs of a bankrupt who has carried on business in the southern part of the county of Nottingham are administered at the district court at Birmingham; but if the trader has resided in the northern part of the county, the fiat is worked at the Leeds court. It is alleged that the present mode of administration occasions loss of time and great expense to the estate, from the distance of the district court; and some other objections are made, which may be removed without much difficulty. Thus the practice of the Leeds court might be made general. The Leeds commissioners, 'with a view to avoid the heavy charges of the petitioning creditor, solicitor, and others travelling a distance of from forty to seventy miles, and for their loss of time, have determined to receive the proofs of the petitioning creditor's debt, &c. upon depositions made out of court, and have called upon the solicitors to work the fiat through their agent at Leeds, and have directed the messengers, instead of themselves travelling to secure the effects of the bankrupts, to employ deputies in the nearest towns.' If the district courts are proved to be a better tribunal in bankruptcy than the old 'lists' of country commissioners, several new courts might be established so as to divide the country into smaller jurisdictions. A court at Sheffield, for example, would be a great advantage to that town, and would bring Nottingham one-half nearer to a court than it is at present; and although the present number of seven or even a dozen courts might not be locally so convenient as the former large number of one hundred and thirty jurisdictions, it must be recollected that railways have diminished two-thirds or more the distance in point of time, of most places from each other, and that fifty miles has become equal only to sixteen. Sufficient experience has scarcely yet been obtained of the advantages or disadvantages of the plan of district courts. The only official return of expenses which has yet been made public was prepared when the new courts had been only established about a year. It purports to show the amount of solicitors' and messengers' bills, up to the choice of assignees, in the first twenty fiats removed into the district courts, and of the first twenty registered in the said courts.

This return, an abstract of which is subjoined, is not so complete as could be wished:—

	Fiats transferred.	New Fiats.
Leeds Court	£72	£70
Bristol	79	41
Newcastle	85	54
Exeter	98	65

In the return from the other three courts the solicitors' and in one or two instances the messengers' costs are stated:—

	Solicitors' Bills.	Messengers' Bills.	Total.
Birmingham Court:			
Fiats transferred . . .	£56	£10	£66
New fiats	36	18	54
Manchester:			
Fiats transferred . . .	81	..	..
New fiats	38	15	53
Liverpool:			
Fiats transferred . . .	54	..	..
New fiats	28	12	40

The principal alterations which have been made relating to e law of bankruptcy remain to be noticed. The 5 & 6 Vict. 122, § 10, has added to the list of persons who may be made nkrupts, 'Livery-stable-keepers, coach-proprietors, carriers, ip-owners, auctioneers, apothecaries, market-gardeners, w-keepers, brick-makers, alum-makers, lime-burners, and llers.' Other persons besides the above and those enumeted in 6 Geo. IV. c. 16 [Bankrupt, P. C., p. 391] must satisfied with the relief that they can obtain as insolvent btors. By 7 & 8 Vict. c. 70, a person not being a trader thin the meaning of the Bankrupt Acts may present a tition to the Court of Bankruptcy, and on compliance with e terms of the act may effect a composition of his debts and tain protection from arrest; and by 7 & 8 Vict. c. 96, a ader who owes less than 300*l.* may obtain a similar advange by much the same process. [Insolvent, P. C. S.] The 7 & 8 Vict. c. 111, is an act 'for facilitating the winding up of the affairs of joint-stock companies unable to meet their pecuniary engagements;' but the bankruptcy of such companies is not to be construed to be the bankruptcy of any member individually. With some special exceptions the proceedings are the same as under an ordinary fiat. The act only applies to companies defined in the act. [Joint-Stock Companies, P. C. S.]

The debt of the petitioning creditor is not required to exceed 50*l.* by 5 & 6 Vict. c. 122, instead of 100*l.*; and if two creditors petition, their joint debts need not exceed 70*l.*, instead of being 100*l.* Three creditors whose joint debts amount to 100*l.* may petition; and by the same act, § 3, the Lord Chancellor may dispense, if he thinks fit, with the petitioning creditor's bond of 200*l.*

The 5 & 6 Vict. c. 122, § 11, also enacts that when the creditor of any trader has made an affidavit of his debt in the proper court, and of his having delivered a written account of such debt, and demanded payment thereof from his debtor, the court may summon the debtor, and require him to say whether he admits the demand against him or not. He is also allowed to make a deposition upon oath in writing, that he believes he has a good defence to such demand or to some part thereof, which he must specify. If the trader does not appear on the summons of the court, or shall appear and refuse to admit the demand, and not make such deposition as above mentioned, in such case, if he does not pay or compound the debt within fourteen days, or give security for its payment, he shall be considered to have committed an act of bankruptcy; and if he admits the debt, but does not pay or compound, or give security for it within the time fixed by the act, he will also be adjudged to have committed an act of bankruptcy. The trader adjudged a bankrupt is to have notice thereof before the adjudication is advertised, and is to be allowed five days to show cause against the adjudication; and if the petitioning creditor's debt, the trading, or the act of bankruptcy, appear insufficient, the adjudication will be annulled (5 & 6 Vict. c. 122, § 23). A trader against whom a fiat has issued, may be arrested on proof to the court that there is probable ground for believing that he is about to quit the country, or fraudulently to conceal his goods; but any person so arrested may apply for his discharge forthwith (§§ 5, 6). A bankrupt who conceals goods, &c. to the value of 10*l.* is guilty of felony, and liable to transportation for life, or imprisonment, with or without hard labour, for any term not exceeding seven years. The period allowed for disputing the fiat has been abridged by 5 & 6 Vict. from two months to twenty-one days, from the appearance of the notice of bankruptcy in the Gazette. The time for which clerks and servants of a bankrupt can claim salary and wages in full is reduced from six months to three.

The alteration effected by 5 & 6 Vict. c. 122, respecting certificates, is of considerable importance. The 6 Geo. IV. c. 16, required that the certificate should be signed by four-fifths in number and value of the creditors who had proved debts above 20*l.*; or after six calendar months from the last examination of the bankrupt, either by three-fifths in number and value of such creditors, or by nine-tenths in number of such creditors. But the recent statute of 5 & 6 Vict. c. 122, dispenses with the signatures of the creditors, and the court, which is authorized to act in the prosecution of any *fiat* in bankruptcy, holds a public sitting, of which due notice is given to the solicitor of the bankrupt's assignees, and in the London Gazette, and at such sitting any of the creditors may be heard against the certificate being allowed, but the court will judge for itself of the validity of such objections as are made, and either find the bankrupt entitled thereto and allow the same, or refuse or suspend it, or annex such conditions to its allowance as the justice of the case may require. The certificate will not be a discharge unless the court certifies to the Court of Review in manner provided by the act, that the conduct of the bankrupt as a trader, both before as well after his bankruptcy, has been in conformity to the bankrupt laws. The bankrupt is required to make oath in writing that such certificate was obtained fairly and without fraud. The allowance of the certificate must be afterwards confirmed by the Court of Review, against which confirmation any of the creditors may be heard before the court. Gambling or misconduct, as concealment of property, fraudulent entries in his books, being privy to the proof of false debts, &c., disentitle a bankrupt to his certificate under the act 5 & 6 Vict. c. 122, much in the same way that it did under previous acts.

The salaries of the judge, commissioners, and other officers of the Court of Bankruptcy, amounted, in the year ending 1st of January, 1844, to 49,382*l.*; and 12,326*l.* were paid besides as compensation to the old commissioners and other officers, of which amount 7352*l.* was paid to Thurlow, Patentee of Bankrupts, and 468*l.* to Thurlow, Rev. J., Clerk of the Hanaper. The whole of this sum of 12,326*l.*, with the exception of 2433*l.* paid to thirteen late commissioners of bankrupts, goes to persons who are entitled on the Parliamentary Return 'Hanaper Officers,' of whom the Patentee of Bankrupts receives the sum above stated. This office was and is a sinecure. The judge receives 2500*l.* per annum; London commissioners, 2000*l.* (1500*l.* before passing of 5 & 6 Vict.); commissioners of the country district courts, 1800*l.*; the accountant in bankruptcy (first appointed under 5 & 6 Will. IV. c. 29), 1500*l.*; the Lord Chancellor's secretary of bankrupts, 1200*l*; two chief registrars, 1000*l.* each; the deputy-registrars in London 800*l.*, and the deputy-registrars of the district courts 600*l.* per annum each. The Lord Chancellor is empowered to order retiring annuities of 1500*l.* a-year to the judge, and of 1200*l.* to the commissioners; and also retiring annuities of different amounts to the accountant in bankruptcy, registrars, &c. These salaries are paid out of the fund entitled the 'secretary of bankrupts' account.'

The amount of certain fees taken in the Court of Bankruptcy, London, for the year ending 11th January, 1844, was 2892*l.*; and from 11th Nov., 1842, to 11th Jan., 1844, the fees taken in the seven district courts amounted to 1881*l.* After payments to ushers of the courts, clerks, and other charges, the sum of about 2000*l.* was divided amongst the registrars and deputy registrars under § 89 of 5 & 6 Vict. c. 122.

The sum paid out as dividends to creditors by the accountant in bankruptcy for each of the following years ending 31st December, was:—523,148*l.* in 1841; 661,230*l.* in 1842; 1,067,976*l.* in 1843. On the 1st of January, 1844, the Bankruptcy Fund account was 1,506,407*l.*

The number of bankruptcies gazetted in England and Wales in 1842 was 1273, 1112 in 1843, and 1064 in 1844. About one-half of this number occurred in the metropolis and in Lancashire and the West Riding of Yorkshire.

The general rules and principles of the Bankrupt Laws of Scotland will be found in P. C., p. 399, in a separate article under this head. There is however a recent sequestration act for Scotland (synonymous with bankrupt act in England), the act 2 & 3 Vict. c. 42, passed August 17th, 1839. Its main features of distinction from the immediately previous act (54 Geo. III. c. 137) are these:—It enlarges the class of persons who may be subjected to the process: instead of being a process of which every step must be taken in the supreme court, the sequestration, being awarded there, is remitted to the sheriff's local court where the routine business proceeds under the sanction of the sheriff, who has an authority bearing a general resemblance to that of the commissioner in England. The winding up of the proceedings and the taking the process out of court require the sanction of the supreme judicature. Sequestration reduces the interest which will qualify a creditor to sue for the application of the act and abbreviates the proceedings.

The claim of persons coming within the 2 & 3 Vict. c. 41, are enumerated as any debtor 'who is or has been a merchant, trader, manufacturer, banker, broker, warehouseman, wharfinger, underwriter, artificer, packer, builder, carpenter, shipwright, inn-keeper, hotel-keeper, stable-keeper, coach-contractor, cattle-dealer, grain-dealer, coal-dealer, fish-dealer, lime-burner, printer, dyer, bleacher, fuller, calenderer, and generally any debtor who seeks or has sought his living or a material part thereof, for himself, or in partnership with another, or as agent or factor for others, by using the trade of merchandise, by way of bargains, exchange, barter, commission, or consignment, or by buying and selling, or by buying and letting for hire, or by the workmanship or manufacture of goods or commodities:' (§ 5) unless the debtor consent to the sequestration, he must have been bankrupt, or must have been sixty days in sanctuary within the space of a year, and must have transacted business in Scotland, and must within the preceding year have resided or had a dwelling-house in Scotland. The estates of a deceased debtor may under certain restrictions be sequestrated though he was not bankrupt, and did not come within the above classification. The debt of the petitioning creditor must be 50*l.*; if two petition, 70*l.*; and if three, 100*l.*

(*On the Law of Bankruptcy, Insolvency, and Mercantile Sequestration in Scotland*, by J. H. Burton, Esq., Advocate, 1845.)

The Irish law of bankruptcy has been gradually assimilated to the English law by several recent acts (6 & 7 Will. IV. c. 14; amended by 1 Vict. c. 48, and 2 & 3 Vict. c. 86). There is no separate court of bankruptcy; but there are two commissioners who are empowered to act by a commission under the great seal. There are no official assignees.

In 1841 an act was passed by Congress to establish a uniform system of bankruptcy throughout the United States of North America. The act came into operation in 1842.

In June, 1838, the French law of 1807 on bankruptcy and insolvency was abrogated, and an entirely new law was promulgated, which now forms Book III. of the Code de Commerce (Des Faillites et Banqueroutes).

BANKS. The object of this notice is to show the regulations under which banking institutions in this country are now placed.

Bank of England.—The act 7 & 8 Vict. c. 32, passed 19th July, 1844, provides for the complete separation of the ordinary banking business by the establishment of a distinct department of the bank, called the 'Issue Department,' the sole business of which consists in the issuing of notes under regulations contained in the act. The directors were required, on the 31st of August, 1844, to place to the credit of the Issue Department the sum of 14,000,000*l.*, of which 11,015,100*l.* consists of the debt owing by the public to the bank, and 2,984,900*l.* of Exchequer Bills and other government securities; and also so much of the bullion and coin as is not required in the banking department. The amount of securities thus carried to the credit of the Issue Department, with gold coin and gold and silver bullion (the silver not exceeding one-fourth of the gold), constitute the basis for regulating the issue of notes. For example, in the week when this plan came into operation, the amount of notes in circulation was 28,351,295*l.*, and the amount of securities and coin and bullion which the bank held was the same, consisting of the debt due to the bank by the government, 11,015,100*l.*; other securities 2,984,900*l.*, making 14,000,000*l.*; gold coin and bullion 12,657,208*l.*; silver bullion 1,694,087*l.*; the total being 28,351,295*l.* The amount of the securities may be diminished, but cannot be increased beyond the sum of 14,000,000*l.*, except in a specified case, which will be presently noticed. The expansion or contraction of the note circulation depends therefore upon fluctuations in the stock of coin and bullion. Persons may demand notes of the Issue Department in exchange for gold bullion at the rate of 3*l.* 17*s.* 9*d.* an ounce, but the cost of melting and assaying is at their expense. As bullion comes in, the issue of notes is increased; and a demand for bullion will cause a contraction in the issue of notes. Thus the principle of convertibility is effectually applied to the circulation of the bank by rendering its issues dependent on the supply of the precious metals. The Issuing Department is not to be allowed to circulate any notes beyond the 14,000,000*l.*, except in exchange for gold, without the express consent of three members of the ministry (the First Lord of the Treasury, the Chancellor of the Exchequer, and the Master of the Mint); and the profits on the circulation of the bank beyond the sum of 14,000,000*l.* issued on its own securities, are to be enjoyed by the public. The securities may also be increased beyond the sum of 14,000,000*l.* when any bank ceases to issue notes, and the Bank of England may then be authorised by an order in council to issue notes to an amount not exceeding two-thirds of the sum to which the bank which ceases to issue was limited. On the 4th of January, 1845, nine country banks had ceased to avail themselves of the privilege of issue. Their aggregate circulation was 160,435*l.* A return, of which a copy is given at the end of this notice, is required to be made weekly by the Bank to the Commissioners of Stamps for publication in the London Gazette.

By the act of 1844 a further claim has been made upon the bank on behalf of the public. The previous Bank Act (3 & 4 Wm. IV. c. 98) provided for a reduction of 120,000*l.* on the cost of managing the unfunded debt, but by the last act the sum of 180,000*l.* is in future to be deducted. The privileges of the bank may be abrogated or modified on giving twelve months' notice, after the 1st of August, 1855.

Private Banks.—Besides the enactments which relate to the Bank of England, the act 7 & 8 Vict. c. 98, contains very important provisions for regulating other banks and their issues. No new bank of issue can henceforth be established in England, and only those bankers are now allowed to issue notes who were issuers on the 6th of May, 1844; and should they cease to issue, they cannot resume this branch of banking business. The privilege of issuing ceases also if a bank which in May, 1844, had six partners or under, increases the number in the firm above six. The issues of each bank are limited to its average circulation for twelve weeks preceding April 27, 1844; and after the 10th of October following, the amount of issues on an average of four weeks was not to exceed the average circulation for the twelve weeks above mentioned. Banks which become united at any time may issue to the amount of their respective certified issues. Whatever amount is issued in excess by any bank is forfeited. All banks of issue are required to make a weekly return to the Commissioners of Stamps for publication in the London Gazette, of the amount of their notes in circulation on every day during the week, and of the average of the week. A like average for every period of four weeks is returned monthly; and the aggregate monthly issues of all the banks, distinguishing private from joint-stock banks, are also published in the London Gazette. The penalty for making a false return of issues is 100*l.*; and, with the consent of the Treasury, the Commissioners of Stamps may inspect bankers' books, under a penalty for refusal of 100*l.* By 3 & 4 Vict. c. 83, the returns of circulation were only required quarterly; by 4 & 5 Vict. c. 50, monthly; and by 7 & 8 Vict. c. 98, they are to be made weekly; and an annual return is to be published of the names of partners in banks, &c.

Joint-Stock Banks.—All banks which have more than six partners are termed joint-stock banks, and their establishment was first permitted by 7 Geo. IV. c. 46, passed in 1826; but they were not allowed to issue notes in London or within sixty-five miles of London; nor within these limits to accept bills for any less period than six months. Beyond these limits joint-stock banks might issue their own notes, and in all essential points they were on the same footing as private banks. Joint-stock banks increased so rapidly, that in January, 1839, there were established in England and Wales 108 banks, with 648 branches, and 32,142 partners, and a large number of private banks were thrown open to a joint-stock proprietary. Through the fault of the legislature in not providing regulations for their safe management, many of the joint-stock banks were conducted with a reckless disregard to sound principles of banking, which not only involved the shareholders in ruin, but were injurious to the general interests of the country. In 1836 a select committee of the House of Commons reported on the defects in the constitution of joint-stock banks. The law did not require a revision of the deed of settlement by any competent authority, and was not sufficiently stringent to secure the registration at the stamp-office of *bonâ fide* proprietors, who, having signed the deed of settlement, were responsible to the public. The amount of nominal capital varied in different banks from 100,000*l.* to 5,000,000*l.*, and in one case an unlimited power was reserved of issuing shares to any extent, while at the same time any bank might commence operations before any certain amount of shares was subscribed for at all. No rule was enforced with respect to the nominal amount of shares, which varied from 5*l.* to 1000*l.*, nor with respect to the amount of paid-up capital on each share, which varied from 5*l.* to 105*l.* Lastly, there was no regulation respecting the number of branches of any bank or their distance from the central bank; and the obligation of making their notes payable at the place of issue was disregarded. It is extraordinary that the mischiefs which ensued from the neglect of a few ordinary and simple legislative provisions were not foreseen; but nearly twenty years were allowed to elapse before a comprehensive act was passed 'to regulate joint-stock banks in England.' This is the act 7 & 8 Vict. c. 113, which received the royal assent on the 5th of September, 1844, on the last day of the session. On the same day, another act (7 & 8 Vict. c. 111) received the royal assent, entitled 'An Act for facilitating the winding up the affairs of Joint-Stock Companies unable to meet their pecuniary engagements;' and § 48 of 7 & 8 Vict. c. 113, enacts that every banking company of more than six persons in England shall be deemed a trading company within the provisions of this act. The act 7 & 8 Vict. c. 110, for the 'registration, incorporation, and regulation of joint-stock companies,' does not apply to banking companies.

By the new act for regulating joint-stock banks, such of these banks as are already in existence may be remodelled under its provisions. Every new joint-stock bank, before it can commence business, is required to present a petition to her majesty in council, signed by at least seven shareholders, praying for a grant of letters patent. This petition must set forth:—1, The names and abodes of all the partners of the proposed company. 2, The proposed name of the bank. 3, The place and street, &c. where the business of the bank is to be carried on. 4, The proposed amount of the capital stock, not being in any case less than 100,000*l.*, and the means by which it is to be raised. 5, The amount of capital stock then paid up, and where and how invested. 6, The proposed number of shares. 7, The amount of each share, not being less than 100*l.* each. The petition of the proposed Company, in which these particulars are set forth, will be referred to the Board of Trade, which will report as to the provisions of the act having been complied with; and her Majesty may then, if she so think fit, grant the letters patent prayed for. The deed of partnership must be drawn up in accordance with a form approved of by the Board of Trade, and in addition to any other provisions which may be introduced must contain specific provisions for the following purposes:—1, For holding ordinary general meetings at least once a year, at an appointed time or place. 2, For holding extraordinary general meetings on the requisition of nine or more shareholders who have at least twenty-one shares. 3, For the qualification and election of directors, and for general management. 4, For the retirement of at least one-fourth of the directors annually, and for preventing their re-election for at least twelve calendar months. 5, For preventing the company from purchasing any shares or making advances of money or securities for money to any person on the security of a share or shares in the bank. 6, For the publication of the assets and liabilities of the bank once at least in every month. 7, For the yearly audit of the accounts of the bank by auditors chosen at a general meeting of the shareholders, and not being directors at the time. 8, For the yearly communication of the auditors' report, and of a balance sheet, and profit and loss account to every shareholder. This deed must be executed by the holders of at least one-half the shares on which not less than 10*l.* on each share of 100*l.* has been paid up; but the banking business cannot be commenced until the deed has been executed by all the shareholders, nor until one-half at least of each share has been paid up, no portion of which can be repaid without the sanction of the Board of Trade. Under letters patent for a term of years not exceeding twenty the shareholders of a joint-stock bank may become one body politic and corporate with perpetual succession, a common seal, and power to purchase and hold lands of such annual value as shall be expressed in each letters patent.

The act relating to joint-stock banks contains some other provisions which are deserving of notice as improvements. Every year, between the 28th of February and 25th of March, a memorial is required to be transmitted to the Commissioners of Stamps, setting forth, amongst other particulars, the name, style, and firm of the banking company, the names and places of abode of the several members thereof, and of the directors, managers, and other officers; and this document may be inspected at the Stamp-office on payment of a fee of one shilling. A list of the registered names and places of abode of all the members of the company for the time being must also be printed and conspicuously placed for the use of the public in the bank. The manager or one of the directors is required to transmit from time to time to the Commissioners of Stamps an account of changes which have taken place in the list of directors, managers, officers, and shareholders. The Commissioners of Stamps are to give a certified copy of these memorials on payment of a fee of ten shillings. Persons whose names are in the memorial last delivered, are themselves or their representatives liable to legal proceedings, as existing shareholders. When joint-stock banks were first established, each shareholder was answerable to the extent of his whole property. By 1 Vict. c. 73, they were rendered liable only to the extent of their shares, but the liability did not extend to the shareholders as a body. By 7 & 8 Vict. c. 113, the liability of any shareholder extends equally to the whole body of shareholders as a company; but if execution upon any judgment against the company shall be ineffectual to obtain satisfaction, then any shareholder may be proceeded against. The acts of an individual partner were formerly binding on all the other shareholders, but it is only the acts of an individual director or other officer properly appointed which are now binding on the co-partnership.

The number of joint-stock banks in the United Kingdom on the 1st of January, 1845, was as follows: in England and Wales 114; Scotland 21; Ireland 13; besides 10 joint-stock colonial banks in London. Many of these banks are in a highly prosperous condition, and some have been well conducted from their first establishment. The London joint-stock banks are excluded by the private bankers from the clearing-house.

Banks in Ireland and Scotland.—No alteration has taken place in the constitution of the banking institutions of Scotland or Ireland since the article Banking, P. C., was written. In the speech from the throne on opening the session of 1845, her Majesty adverted to 'the state of the law in regard to the privileges of the Bank of Ireland, and to other banking establishments in that country and in Scotland,' as likely to engage the attention of Parliament.

The charter of the Bank of Ireland, which would have expired on the 1st of Jan., 1838, was renewed, but it may be withdrawn on twelve months' notice after 1st August, 1845. Its monopoly is far stricter than that of the Bank of England. No joint-stock bank can issue notes, or draw or accept bills, within sixty-three statute miles of Dublin, and beyond these limits they can neither draw nor accept bills for a less sum than 50*l.* nor for any sum upon demand. The district within 63 miles of Dublin comprises a population of 1,500,000, and the Bank of Ireland has here only established six branches, while in the various towns of Ireland beyond the 63 miles limit there are above one hundred branches of joint-stock banks. The Bank of Ireland has altogether twenty-four branches.

In Scotland there are no exclusive banking privileges enjoyed by any particular establishment, but both in Scotland and Ireland the currency of bank-notes under 5*l.* is allowed by law, and it is interference with this peculiarity of their banking systems which is most feared, especially in Scotland.

Statistics of Banks and Banking.—1. The Bank of England made quarterly returns of its circulation, deposits, securities, and stock of bullion, to the end of 1842; after which these returns were made monthly, until August, 1844, when a return in the form given below began to be made weekly:—

An account, pursuant to the Act 7th & 8th Vict., cap. 32, for the week ending on Saturday the 25th day of Jan., 1845:—

ISSUE DEPARTMENT.

	£		£
Notes issued . .	28,128,310	Government debt .	11,015,100
		Other securities .	2,984,900
		Gold coin & bullion	12,463,197
		Silver bullion . .	1,665,113
	28,128,310		28,128,310

BANKING DEPARTMENT.

	£		£
Proprietors' capital	14,553,000	Government securities, including Dead Weight Annuity	13,651,692
Rest	3,209,696	Other Securities .	8,561,399
Public Deposits (including Exchequer, Savings' Banks, Commissioners of National Debt, and Dividend Accounts)	2,787,253	Notes	7,418,075
Other deposits . .	8,714,052	Gold and Silver Coin	691,562
Seven-Day and other Bills . . .	1,058,727		
	30,322,728		30,322,728

The above bank accounts would, if made out in the form used up to August 16, 1844, present the following result:—

Liabilities.	£	Assets.	£
Circulation, inc. Bank post bills .	21,768,962	Securities	21,660,091
Deposits	11,501,305	Bullion	14,819,872
	33,270,267		36,479,963

The balance of assets over liabilities, being 3,209,696*l*., is stated in the above account under the head Rest.

The stock of bullion held by the Bank of England (both gold and silver coin being included in the term bullion) indicates various circumstances connected with the state of trade and with the general condition of the country; and the following table, which shows the stock of bullion in February and August in each year since 1823, is therefore given:—

	February. £	August. £
1824	13,810,060	11,787,430
1825	8,779,100	3,634,320
1826	2,459,510	6,754,230
1827	10,159,020	10,463,770
1828	10,347,290	10,498,880
1829	6,835,020	6,795,530
1830	9,171,000	11,150,480
1831	8,217,050	6,439,760
1832	5,293,150	7,514,000
1833	10,205,000	10,871,000
1834	9,225,000	7,303,000
1835	6,289,000	6,255,000
1836	7,787,000	5,250,000
1837	4,077,000	6,548,000
1838	10,471,000	9,540,000
1839	6,773,000	2,420,000
1840	4,311,000	4,299,000
1841	4,335,000	4,822,000
1842	5,602,000	9,570,000
1843	10,933,000	11,973,000
1844	16,322,000	15,227,000
1845	15,148,583	. .

Sometimes the stock of bullion properly so called exceeds the amount of coin, and sometimes the proportion is the reverse. In the four weeks ending Dec. 14, 1841, the amount of gold coin was 4,270,000*l*.; and of gold bullion 995,000*l*. In the four weeks ending Sept. 17, 1842, the amount of gold coin was 2,750,000*l*.; and the stock of gold bullion, which had been gradually increasing since December, 1842, was 7,106,000*l*. In January, 1844, the proportion of each was nearly equal. On the 4th of November, 1843, the bullion held by the Bank amounted to 12,036,000*l*., and consisted of gold bullion 5,992,000*l*.; gold coin 4,244,000*l*.; silver bullion 1,737,000*l*.; silver coin 63,000*l*.

2. The average circulation of 208 private banks and 72 joint-stock banks in England and Wales, for the twelve weeks ending April 27, 1844, was—

	£.
Private Banks . . .	5,153,407
Joint-Stock Banks . .	3,475,446
	8,648,853

This return was obtained, as already mentioned, with a view of fixing limits to the issues of notes. They cannot be increased beyond the amount certified in April, 1844. This total aggregate circulation of 8,648,853*l*. was divided amongst 280 banks in the following proportions:—

	£		£	Banks.
Circulating above	1,000	and under	2,000	2
„	2,000	„	5,000	16
„	5,000	„	10,000	39
„	10,000	„	20,000	81
„	20,000	„	30,000	49
„	30,000	„	40,000	30
„	40,000	„	50,000	21
„	50,000	„	60,000	13
„	60,000	„	80,000	12
„	80,000	„	100,000	10
„	100,000	„	150,000	4
„	150,000	„	200,000	1
„	200,000	„	400,000	1
„	400,000	namely	442,371	1
				280

The aggregate circulation of private and joint-stock banks, in England and Wales, for the four weeks ending Jan. 4, 1845, was—

	£
Private Banks . . .	4,427,711
Joint-Stock Banks . .	3,059,434
	7,487,145

Thus, allowing for banks which had ceased to issue since April, 1844, the circulation for the month ending Jan. 4, 1845, was 1,001,273*l*. below the amount allowed under the act 7 & 8 Vict. c. 32.

The circulation of private and joint-stock banks from 1834 to 1845, selecting one return in each year, has been as follows:—

Quarters ending March,	Private Banks. £	Joint-Stock Banks. £
1834	8,733,400	1,458,427
1835	8,231,206	2,188,954
1836	8,353,894	3,094,025
1837	7,275,784	3,755,279
1838	7,005,472	3,921,031
1839	7,642,104	4,617,363
1840	6,893,012	3,940,232
1841	6,322,579	3,644,258

After June, 1841, the returns were made every four weeks, pursuant to 4 & 5 Vict. c. 50; and the following are returns for one month in each of the following years:—

Four weeks ending	Private Banks. £	Joint-Stock Banks. £
April 2, 1842	5,289,050	3,047,656
April 1, 1843	4,716,506	2,862,986
March 30, 1844	4,983,646	3,502,363
Jan. 4, 1845	4,468,898	3,061,912

3. For the four weeks ending the 8th of February, 1845, the circulation of the banks of Scotland and Ireland was as follows:—

	£
Chartered, Private, and Joint-Stock Banks, Scotland	3,070,058
Bank of Ireland	3,983,050
Private and Joint-Stock Banks, Ireland .	3,115,065

The total circulation of all banks in the United Kingdom, including the Bank of England, was 35,827,294*l*. in February, 1845.

BANKS, SAVINGS'. [Savings' Banks, P. C. S.]

BANKS, JOHN, was an attorney in London. Deserting his profession to become a writer for the theatres, he is represented as having borne up with unabated enthusiasm and hope against a full share of the miseries incident to that precarious way of life. The seven tragedies which he left in print bear dates extending from 1677 to 1696. He must have died at some time in the reign of Queen Anne. Banks is one of those dramatists who have been despised by the critics for their literary faults; but whose works have given excellent scope to the skill of great actors, and have in their day been highly popular with the play-going public. The worst has been said of Banks when the censure of Steele in the 'Tatler' is repeated, that, in his best known piece 'The Unhappy Favourite, or the Earl of Essex,' there is not one good line. His style gives alternate specimens of vulgar meanness and of bombast, which has not so much as the merit of being original. But even his dialogue is not destitute of occasional nature and pathos; and the value of his works as acting plays is very considerable. It is admitted by Steele, that the play he speaks of was never seen without drawing tears; and the apt choice of a touching story, and the natural and dramatic arrangement of incidents, to which the success of that play was owing, were yet more admired by the great German critic Lessing, who bestows on the work an elaborate analysis. The 'Earl of Essex' kept its place on the stage till the middle of last century. It was then superseded by the plays of Jones and Brooke, who successively paid Banks the compliment of stealing from him all the best parts of his tragedy. Of his other works none was so popular: but even his extravagant 'Cyrus the Great' abounds in effective dramatic situations.

BANS. [Marriage, P. C.]

BARBA'REA (from a former name, Herb St. Barbara), a genus of plants belonging to the natural order Cruciferæ. It has a terete 2-edged pod, the valves convex, with a prominent longitudinal nerve; the stigma capitate, the seeds in a single row. Barbarea belongs to the first sub-order of Cruciferæ, Siliquosæ, which possess a linear or linear-lanceolate pod opening by two valves. The species of Barbarea are perennial herbs, [illegible] fibrous roots and erect stems. The flowers are yellow, arranged in racemes; the pedicels without bracts.

B. vulgaris, common Yellow Rocket, common Winter Cress, Herb St. Barbara, has the lower leaves lyrate, upper pair of lobes as broad as the large roundish subcordate terminal lobe, the uppermost leaf undivided, toothed; young pods obliquely erect; seeds scarcely longer than broad. It is a native, in damp moist places, of Great Britain and throughout Europe; also of North America. This plant has a bitter nauseous taste, and is sometimes cultivated as a spring salad. In Sweden the leaves are boiled and eaten. It is often cultivated in gardens, especially a double variety, which forms a handsome border-plant.

B. præcox, Early Winter Cress, has the lower leaves lyrate, upper pair of lobes as broad as the roundish subcordate terminal lobe, uppermost leaf pinnatifid, with linear oblong entire lobes. This plant is a native of France and Great Britain; it is abundant in North America. It is called in Germany *Amerikanischer Kraut*; in French, *Cresson d'Amerique*. It is also known in England as American Cress, Black American Cress, French Cress, and Belle-Isle Cress. It is used as a salad, and is more bitter than the common water-cress. It can be raised for eating all the year round. In cultivating, it should be grown from seeds, a quarter of an ounce of which will serve for sowing ten feet of drill. For winter and spring use they should be sown in the last fortnight of August or beginning of September, on a warm sheltered border. For summer use they may be sown every month or six weeks from March to August, a sunny or a shaded situation being chosen according to the season. They require water occasionally in dry and hot weather. In winter the plants should be sheltered by laying over them a few light twigs, and over these a layer of brakes, reeds, or straw. After the leaves are cut the stem should be allowed to remain for another gathering. The finest plants may be allowed to run to seed.

B. arcuata and *B. stricta* are two species described by Babington, and lately added to the British Flora. A few others are found in the northern parts of Europe and America. With the exception of the double yellow rocket, none of the species are worth cultivating as ornamental. This plant may be propagated by cuttings, suckers, or dividing the plants at the root.

(Don, *Gardener's Dictionary*; Babington, *Manual*.)

BARCKHAUSIA, the name of a genus of plants belonging to the natural order Compositæ, the tribe Cichoraceæ, and the subtribe Lactuceæ. It has many-flowered heads, a double involucre, the inner of one row, the outer of short lax scales; the fruits 4-cornered, all (or the inner ones only) gradually contracted into a long beak. This genus has several European species, two of which only are natives of Great Britain. The flowers are yellow or pale purple. Some of the species are cultivated in gardens, where they form a pretty and easily cultivable border-plant. The British species are—*B. taraxacifolia*, with rough runcinate-pinnatifid leaves, erect heads, bristly and downy involucre covering half the pappus, its outer scales ovate-lanceolate with a membranous margin, herbaceous bracts, the fruits all equally beaked. *B. fœtida*, with hairy runcinate-pinnatifid leaves, nodding unopened heads, hairy and downy involucre as long as the pappus, its outer scales lanceolate, acute, downy; the marginal fruits slightly beaked, shorter than the involucre, central ones with long beaks equalling it. The first species has a stem one or two feet high, yellow flowers, purple beneath, and is found in limestone districts. The second has a stem from six to twelve inches in height, with yellow flowers. It grows in chalky places in England, but is a rare plant.

B. setosa, a German species, has been lately found in several districts of Great Britain, but it appears most probable that this species has been introduced by means of clover and other seeds used for agricultural purposes.

(Koch, *Flora Germanica*; Babington, *Manual of British Botany*; *Phytologist*, vol. i.)

BARCLAY, WILLIAM, a civilian, father of the author of 'Argênis,' was born in Aberdeenshire, in 1546. In early life he attached himself to the court of Mary Queen of Scots, but the misfortunes of that princess closing the path to preferment, in 1573 he emigrated to France. With many other Scotsmen of the period, he studied civil law under Cujacius at Bourges. In 1578 he became professor of law in the then recently erected University of Pont à Mousson, of which his uncle Edmund Hay was the first rector. In 1600 he published a work in favour of despotic principles: 'De Regno et Regali Potestate, adversus Buchananum, Brutum, Boucherium, et reliquos Monarchomachos, Libri Sex.' Having quarrelled with the Jesuits, whom he charged with a design to attach his distinguished son to their order, he resigned his chair in 1603, and proceeded to England. He appears to have expected to find favour with King James. His defence of despotic power suited one of the leading opinions of this king. A denial of the temporal authority of the Pope harmonized with another. On this subject Barclay wrote a book against Bellarmin, posthumously published by his son in 1609, with the title 'De Potestate Papæ, an et quatenus in Reges et Principes seculares Jus et Imperium habeat,' which was subsequently translated into English. It appears however that Barclay's adherence to the Roman Catholic faith interfered with his receiving any promotion directly from James. In 1605 he was appointed Dean and Professor of Civil Law at Angers. In the same year he there published in 8vo. a commentary in the titles of the Pandects 'De Rebus Creditis' and 'De Jure-jurando,' dedicated to King James. In the same year he died at Angers. (Irving, *Lives of Scottish Writers*, i. 210-233.) A curious portrait of Barclay is occasionally met with, which brings a high price from collectors. It is surrounded by the armorial bearings of the families of the north of Scotland with which he was connected, and their names, *e. g.* Leslie de Balquhan, Durham de Grange, Innes de Inner-Marke, Gordone de Pitlurge, &c. On a scroll is the legend

> 'Stemmata quid faciunt? faciunt te sanguine clarum:
> At magis ingenii nobilitate micas.'

The whole is characteristic of a certain pomp and pride, both of ancestry and individual endowments, which seem to have been displayed by more than one member of this remarkable family.

BARCLAY, JOHN, was born, according to the portrait prefixed to his 'Argênis,' at Pont à Mousson in Lorrain. Winkelmann, who edited his 'Argênis,' at Nürnberg in 1776 with plates, says that the author was born at Aberdeen, but this writer appears not to have kept the circumstances of his life quite clear from those of his father, William Barclay. John studied at the college of the Jesuits in his native place, and the order, observing the dawning of his genius, attempted, according to their usual policy, to add so promising a name to their own illustrious list of brethren. This was opposed by the father, who in 1603 went to England accompanied by his son. He is said by Bayle to have written and printed, when nineteen years old, notes on the 'Thebais' of Statius. In 1604, when his father was paying court to King James, he presented that king with encomiastic verses, which are printed in the 'Delitiæ Poetarum Scotorum.' In the same year he dedicated to James I. part of the famous Satyricon generally known by the name of Euphormio, which he bestowed on himself as author. He professed a strong inclination to enter the service of the English king, but their adherence to the Roman Catholic faith was equally against his own and his father's promotion. He went with his father to Angers in 1605, returned for a short time to Britain, visited Paris in 1606, where he married Louise Debonnaire, and afterwards settled in London. He dedicated the second part of his satire to the Earl of Salisbury, with an encomium in which few have concurred. What will now however, perhaps, be considered the most interesting part of this curious work, is the fourth book, which in 1614 he published under the title 'Icon Animarum,' and dedicated to Louis XIII. It commences with remarks on the pursuits and character of man at the different ages of his life, and contains a series of sketches of the inhabitants of the various known countries of the world. He writes a clear lively style, and is full of matter. In his praise of England he dwells, like Fortescue, on the fertility of the soil, and appears, like him, to think that industry is rather a reproach than a credit to a people, and that the most illustrious condition of man is to live in a land where he does not require to exhaust his energies in labour. In the 'Icon' he speaks much of the maritime character of Britain, and the power the country is capable of exercising at sea. In the mean time, in 1606, Barclay published an account of the Gunpowder Plot: 'Series Patefacti divinitus Paricidii,' &c. In 1610 he edited his father's work 'De Potestate Papæ,' and in 1612 he defended the opinions of the work, and the memory of his father against the attacks of Cardinal Bellarmin and his followers. Of this work, called 'Pietas, sive publicæ pro Regibus ac Principibus, et Privatæ pro Gulielmo Barclaio Parente Vindiciæ,' he subsequently spoke with regret, as exposing him to the displeasure of his own church. In 1615 he passed through France, and settled in

Rome, where Bayle says he enjoyed the patronage of Paul V. He there in 1617 published 'Paraenesis ad Sectarios,' a book more likely to be acceptable to the Holy See than his others. In 1621 was published the first edition of the work by which his name has been best known, 'Argênis:' this is a romance full of incident and description. The style has received the commendations of the greatest scholars, and Grotius in allusion to it spoke of the author as 'Romam Romano qui docet ore loqui.' Scioppius and others however maintain that it contains many Gallicisms. It is generally published with a key to the real names supposed to be represented in fictitious characters. Thus Meleander is said to represent Henry III. of France; Poliarchus, Henry IV., &c. The difficulty however of finding parallels in real history for all the persons and events, suggests that this explanation has no better authority than analogy with the 'Satyricon,' in which real persons were undoubtedly represented under fictitious names. 'Argênis' appears to be entirely a romance, with occasional allusion to historical events. Its popularity was of long duration. The edition referred to in the beginning of this article is the eighteenth. The admiration of Cowper and D'Israeli have made the name familiar to modern English readers. In 1628 there was published an English translation of it in 4to. with the title 'John Barclay his Argênis, translated ovt of Latine into English: the prose vpon his maiesties command by Sir Robert Le Grys, Knight, and the verses by Thomas May, Esq.' Another translation appeared in 1636, and a third in 1772, with the title 'The Phœnix, or the history of Polyarchus and Argenis.' It has been repeatedly translated into French, and Italian and Spanish copies occur in catalogues. The author's latter days appear to have been strangely occupied. He cultivated, with the hope of great gain, bulbous-rooted plants, which from their being said to have no perfume and to be valuable only for the beauty of their colours, may be presumed to have been tulips. Notwithstanding his personal presence in an insalubrious tract where they grew, and his placing two fierce mastiffs as sentinels over them, a perfidious knave is said to have stolen his treasure and dissolved his golden dream. Barclay died at Rome, on the 12th of August, 1621, before he had completed his fortieth year.

(Dalrymple, *Life of John Barclay; Works referred to.*)

BARCLAY, JOHN, a Presbyterian clergyman, and founder of the small sect called Bereans, whose peculiar standard of faith is contained in the 11th verse of the 17th chapter of the Acts of the Apostles, where it is said of the Jews of Beroea "That they received the word with all readiness of mind, and searched the Scriptures daily, whether those things were so." He was born at Muthill in Perthshire, in 1734, and studied at the University of St. Andrews, where he took the degree of A.M. While attending the course of divinity taught at that university, he became conspicuous as a supporter of Dr. Archibald Campbell, a promulgator of doctrines which his enemies charged with savouring of Socinianism. In 1759 he was licensed as a probationer by the Presbytery of Auchterarder, so renowned in the late discussions in the Church of Scotland. He was for some time assistant to Mr. Jobson, minister of the parish of Errol in Perthshire; but after some acrimonious discussion, arising apparently from Barclay's inculcating his own peculiar views from the pulpit, that connection was broken. In 1763 he became assistant of the minister of Fettercairn in Angusshire. Here he became the great popular preacher and religious leader of the district, and attracted crowds of auditors from the neighbouring parishes. He appears to have carried to excess the prevalent characteristic of the Evangelical Presbyterians, of inveighing against the Roman Catholics and those Protestant sects which make the nearest approach to them. In 1766 he published a paraphrase of the Book of Psalms, with 'A Dissertation on the best means of interpreting that portion of Scripture." Some tenets supposed to lurk in this production called out the zeal of his presbytery, and proceedings were commenced against him, which however seem to have gone no further than a reprimand. The spirit of theological disputation being raised, he published pamphlets from time to time calculated to fan the flame he had created against himself. On the death of the clergyman to whom he was assistant, in 1772, the presbytery not only defeated his attempt to be appointed successor, but refused him the necessary testimonials for accepting a benefice elsewhere, and he then left the Church of Scotland, and became the leader of a sect of which a few congregations still exist. He preached for some time in Edinburgh, and subsequently in London and Bristol. In London he kept open a debating society, where he supported his doctrines against all impugners. He died on the 29th of July, 1798. He published several works in which he expounded his own peculiar doctrines, now read only by his followers. Like most sect-founders, he was a man of ardent and restless temper and strong dialectic powers. A memoir of him was supplied to Chambers's 'Biographical Dictionary of Eminent Scotsmen,' by a contemporary and admirer.

BA'RIUM, CHLORIDE OF—*Medical Properties of.*—This compound never occurs native, but is always obtained either by the decomposition of the native carbonate of barytes, or Witherite, as directed by the London Pharmacopœia, or of the sulphate, or heavy-spar, as directed by the Edinburgh College. This last seems the preferable mode, not only from the abundant occurrence of heavy-spar, but because the salt so procured is generally purer (Christison); and as it is more employed as a chemical test than in medicine at the present day, purity is an essential condition for its utility. It crystallizes in white, transparent, shining, right rhombic prisms, sometimes in double eight-sided pyramids, or, by rapid evaporation, in thin plates. (Geiger.) It is permanent at the ordinary temperature of the air, but efflorescent in a very dry atmosphere. Its specific gravity is 2·825. It is of easy solubility in water: 100 parts dissolve 43·5 at 60° Fahr.; at 212°, 78 parts. Pure alcohol does not dissolve any of it; rectified spirit, a minute quantity. The only officinal preparation is the watery solution, Liquor Barii Chloridi.

Chloride of barium possesses acrid-narcotic properties, its taste being irritating and burning. It resembles medicinally chloride of calcium, but is more potent; in poisonous doses its action is similar to arsenic, with this difference, that it requires a larger dose to destroy life, and while its local action is less marked, producing less disintegration of the stomach, it is more rapidly absorbed, and produces death more speedily. It is rarely employed as a means of self-destruction, or of intentional injury to others. Fortunately an efficient antidote exists in agents readily procured, and invariably efficacious if speedily administered. Any alkaline sulphate, such as Epsom or Glauber salts, or sulphuric acid greatly diluted, will instantly form an insoluble and harmless sulphate of barytes. Medicinally this compound is employed in very minute doses in various forms of scrofula. It possesses slight tonic powers, improves the appetite, and promotes absorption, reducing the glandular enlargements. It once enjoyed, chiefly from the testimony of Hufeland, a high celebrity. But, like many other muriates once confided in for the removal of scrofula, it has almost fallen into disuse, particularly since iodine has become known. Some practitioners, thinking that two agents which are thought singly to be of use, must do good when combined, have formed an iodide of barium. This salt has a disagreeable nauseating taste. It is given in the dose of the eighth of a grain, in some aromatic water, three times a day. An ointment is also formed of it.

Pure air, exercise, regular, and above all early hours, appropriate diet, and other points of regimen, such as warm clothing, will do more to eradicate scrofula than any medicines.

(Lugol, *On Scrofula*, translated by Ranking, 1844.)

BARKER, BENJAMIN, a landscape painter of Bath, and the brother of the more distinguished Thomas Barker. If the ability of a painter could be measured by the degree of notoriety he enjoyed, Benjamin Barker must rank low amongst able landscape painters. His works are little known beyond the circle of his acquaintances. He was however a painter of very great ability: his execution was most happy and natural, and he was equally happy in the spots which he selected for the subjects of his pencil. His subjects were chiefly taken from near Wick-Rocks, Claverton, Midford, Weston, and Hampton-Cliffs. The perfect fidelity of Barker's landscape, says a friend, 'is not more striking than the delicate feeling with which the aspect of what lay before him has been chosen.' He published a set of 48 views, engraved in aquatinta by Theodore Fielding. He died in March, 1838, aged 62, in the house of his son-in-law, at Totness in Devonshire. (*Art Union*, February, 1843.)

BARKER, EDMUND HENRY, was born in December, 1788, at his father's vicarage of Hollym, in Yorkshire. He entered in 1807 as a student of Trinity College, Cambridge; but, although he resided, and obtained a medal for Greek and Latin epigrams, he did not take any degree, having (it is said) scrupled to subscribe the bachelor's oath. Upon leaving the university, he became amanuensis to Dr. Parr, in whose house at Hatton he resided in that character for several years. He then married and settled at Thetford, in Norfolk. Of those researches and compilations which were the business of his laborious life, Thetford was the scene for nearly twenty-five years: and the mysterious capitals O. T. N., with which it was one of his whims to decorate his name in title-pages, were merely intended to indicate the town and county of his residence. The last few years of his life were marked by painful reverses of fortune. They were spent chiefly in London, where he died, after a short illness, on the 21st of March, 1839.

Mr. Barker's writings in classical philology and criticism were numerous. He was a constant and leading contributor to Mr. Valpy's Classical Journal, almost from its commencement till its close in 1829; and he furnished many papers also to other periodical publications. He edited, with English notes, for the use of schools, portions of several of the classics, both Greek and Latin; among which were works of Æsop, Cæsar, Tacitus, and Cicero, of Xenophon and Demosthenes. But his fondness both for accumulating and for bringing forth the fruits of his gatherings did not allow him to confine himself to classical subjects. He published a volume in which he believed himself to have disproved Sir Philip Francis's authorship of the Letters of Junius; he was the author of a letter addressed to Mr. Hughes in 1823 in support of the Greek cause; and he was the author, or rather the compiler or editor, of a curious but most painfully undigested mass of literary anecdotes and criticisms, devoted to the memory of his friend Dr. Parr, and entitled 'Parriana,' 2 vols. 8vo. 1828. His correspondence with foreign scholars engaged him also in the superintendence of several works of other men; the chief among which were, the English impression of Anthon's edition of Lemprière's Classical Dictionary, and of Noah Webster's English Dictionary.

But Mr. Barker's name has been known most widely, both for praise and censure, through his contributions to Greek lexicography. The latest work of this kind in which he engaged was the Greek and English Lexicon published in 1831, in which he was the coadjutor of Professor Dunbar of Edinburgh. But an undertaking at once more laborious and more unlucky was Mr. Valpy's spirited reprint of Henry Stephens' 'Thesaurus Graecae Linguae,' London, 1816-1828, 10 vols. fol. Although the editorship of this work was described as vested in more than one person, and although the names of the editors were never unequivocally announced, yet it was understood universally that the severe duties involved in the editorship were really performed by Mr. Barker almost without any assistance. The Index cost him three years' labour. In 1819, after the publication of a few parts, the work was most severely criticised in the forty-fourth number of the Quarterly Review. Mr. Barker himself maintained that the criticism was prompted by resentment, on account of strictures on an eminent scholar, which he had inserted in the Classical Journal, and reprinted in a volume entitled 'Classical and Biblical Recreations.' Accordingly, while Mr. Valpy answered the Review in his own Journal, Mr. Barker defended himself against his supposed assailant in an eccentric and desultory work called 'Aristarchus Anti-Blomfieldianus.'

It may be said, that during Mr. Barker's life he was neglected or censured by the leading scholars of our own country, while he enjoyed no inconsiderable reputation on the Continent. The low state of his celebrity at home was owing to several causes. Some of these will prevent him from being ever highly rated as a classical critic. He was, as is generally admitted, deficient in exact familiarity with several of those branches of philology in which lay the strength of Porson and his school; while in other points, such as Greek and Latin etymology, and information in history, politics, and geography, he was much behind the present state of knowledge. But his mind had inherent defects which no schooling could have quite eradicated. It was eminently deficient both in comprehensiveness of thought and in logical closeness of ratiocination; and his taste was as defective as his judgment. His merit was that of the collector, not that of the philosopher, or even the critic. But he earned faithfully, and deserves to obtain without reserve, such praise as may be challenged by unwearied and disinterested labour. No man worked harder than Mr. Barker: no man worked with a more single-minded desire for disseminating that which he believed to be valuable knowledge. Those who knew him personally, or from correspondence, allow that he was a kind and benevolent man.

BARKER, ROBERT, born at Kells, in the county of Meath, Ireland, was the inventor and patentee of panoramas. He practised originally as a portrait painter in Dublin and in Edinburgh. The first picture of the kind which he painted was a view of Edinburgh, exhibited in Edinburgh in 1788, and in London in 1789, but with indifferent success. His second panorama was a view of London from the Albion Mills, and it was exhibited, with complete success, in Castle Street, Leicester Square, and afterwards in Germany. He built, and opened in 1793, with a panorama of Spithead, the present panorama exhibition-rooms in Leicester Square, now the property of his son, who has surpassed his father in the same description of painting. He was assisted in many of his panoramas by his son, and by R. R. Reinagle, R.A., from whose sketches most of his foreign views were painted: as Rome, the Bay of Naples, Florence, Paris, Gibraltar, and the Bay of Algesiras. Nelson's battles of Aboukir and Trafalgar were also among his most popular panoramas. He died in London, in 1806.

BARLOW, FRANCIS, a native of Lincolnshire, in which county he was born, in the early part of the seventeenth century, about 1626. He was instructed by a portrait painter, but he preferred landscapes, birds, fishes, and animals, in which he excelled. He was particularly excellent in birds of prey, which he painted on the wing with great skill, particularly in drawing. As a colourist he was indifferent; on which account many of his works appear much better in engravings than as pictures. John Overton published 12 prints by Hollar, after Barlow, representing various sports, of hunting, hawking, and fishing. Barlow himself likewise engraved: he etched some of the plates of his own illustrations to Ogilby's translation of Æsop's Fables, and also part of the plates in the folio book of poems entitled *Theophila*, published for Edward Benlow in 1652. There is also a book of birds by Barlow, engraved by W. Faithorn: 'Diversæ Avium Species studiosissimè ad vitam delineatæ per Fran. Barlow, ingeniosissimum Anglum Pictorem. Guil. Faithorn excudit, 1658.'

Once, when sketching in Scotland, he saw an eagle endeavouring to fly away with a cat in its talons; but the cat struggled so much, that eagle and cat both fell to the ground together: this circumstance led him to engrave a plate of an eagle flying away with a cat. There is a copious list of his prints in Heineken's Dictionary.

Barlow was employed by several noblemen and gentlemen to paint ceilings, with hawking subjects, or other scenes of birds on the wing: the birds were painted on the clear sky. He painted also a few portraits, among them a half-length of General Monk, first Duke of Albemarle. Though he was very much employed, and had a considerable sum of money left him by a friend, he died poor in 1702.

(*An Essay towards an English School*, 1706; Walpole, *Anecdotes of Painting*; Strutt, *Dictionary of Engravers*; Heineken, *Dictionnaire des Artistes*, &c.)

BARRET, GEORGE, an Irish landscape painter of great celebrity in his time. He was born at Dublin in 1732, and commenced his career by colouring prints for a printseller of the name of Silcock. His first landscapes were painted from the estate of the Earl of Powerscourt near Dublin; and the earl was his first patron. In 1764 he obtained a 50-guinea premium from the Society of Arts in London; the first premium given by that Society for landscape. He was one of the original members of the Royal Academy, founded in 1768, and towards the close of his life he was Master Painter to Chelsea Hospital, an appointment which he procured through his friend Burke. He died at Paddington in 1784.

Barret's landscapes are bold and natural in design, but his colouring is somewhat peculiar and heavy. He painted also in water-colours, and executed a few etchings.

(Edwards, *Anecdotes of Painting*, &c.; Pilkington, *Dictionary of Painters*.)

BARRY, LODOWICK, was the author of a comedy called 'Ram-Alley, or Merry Tricks,' which was first printed in 1611, again in 1636, and will be found in the successive editions of Dodsley's Old Plays. Both for liveliness of incident, and for spirit and humour in dialogue and in character, it is one of the very best of our old English dramas. In regard to the author nothing is known with certainty. He is said however to have been an Irish gentleman; and the editors of the 'Biographia Britannica' have given his name a place in their work for the purpose of contradicting Anthony Wood, who insisted on making him a Lord Barry.

BARTAN, or BARTIN, River. [PARTHENIUS, P. C.]

BARTOLI, PIETRO SANTO, an Italian painter and engraver, born at Perugia in 1635. As an engraver he obtained a great reputation, more however from the subjects and the number of his prints than for any particular excellence of execution. He was the scholar of Nicholas Poussin, from whom he probably, in some degree, derived his great love of the works of antient art. As a painter he did very little beyond copying, in which he was so excellent, that even Poussin himself had difficulty in distinguishing between his own pictures and the copies made of them by Bartoli. Bartoli had a correct appreciation of the merits of Greek design, and though technically his prints have little excellence, they are in most cases true to their originals. His prints, mostly etchings, which amount to many hundreds, are chiefly from antient bassi-rilievi or paintings in the ruins in or about Rome and other Italian cities. He was also a printseller, and established a business in Rome, which was continued after his death by his son Francesco Bartoli. P. S. Bartoli died in 1700.

Winckelmann was a great admirer of his works, and recommends young artists to study them in order to acquire a proper appreciation of antient art. They are free, but slightly executed, and all in the same style. The following are among the principal collections executed by Bartoli:—'Admiranda Romanarum Antiquitatum ac Veteris Sculpturae Vestigia,' with remarks by Bellori; 'Romanae Magnitudinis Monumenta;' 'Veteres Arcus Augustorum triumphis insignes, ex reliquiis quae Romae adhuc supersunt;' 'Le Pitture Antiche delle Grotte di Roma e del Sepulchro de' Nasoni;' 'Gli Antichi Sepolchri, ovvero Mausolei Romani ed Etruschi, trovati in Roma;' and 'Recueil de Peintures Antiques imitées fidelement, pour les couleurs et pour les traits, d'après les dessins coloriés faits par P. S. Bartoli,' Paris, 33 pl. folio, 1757. Of the last work thirty copies only were published of the first edition: a second but inferior edition was published in 1787, with a few additional plates, but it is inferior to the earlier work. Bartoli executed a great variety of other works, single and in sets, from antient and modern works of art.

(Pascoli, *Vite de' Pittori, &c. Moderni*; Lanzi, *Storia Pittorica*, &c.; Heineken, *Dictionnaire des Artistes*, &c.)

BARTSCH, ADAM VON, a distinguished designer and engraver, born at Vienna in 1757. He was educated in the School of Engraving at Vienna, under Professor Schmützer, and distinguished himself in his sixteenth year by a set of engravings of all the gold and silver medals struck by order of the Empress Maria Theresa, through which he obtained the appointment of scriptor in the royal library. In 1781 he was appointed keeper of the prints of the royal collection, which led eventually to the publication of his well known work 'Le Peintre-Graveur,' in 21 vols. 8vo., 1803-21, the description of the greater part of the works of the principal engravers of Europe, and to which he now chiefly owes his reputation, though he is the author of several similar works on a smaller scale, but they are all more descriptive than critical. His etchings also are numerous, amounting to 505, dated from 1782 until 1815, including imitations of old etchings and drawings, prints from his own designs, and from the works of other masters. Bartsch added much to and completely rearranged the immense imperial collection of prints at Vienna.

In 1812 Bartsch was decorated with the order of Leopold, and in 1816 he was appointed principal Custos of the Imperial Library of Vienna: he had also the titular rank of hofrath, or aulic-councillor. He died at Vienna in 1821.

A complete catalogue of Bartsch's etchings was published by his son in 1818. He was the author of the following catalogues, published at Vienna:—'Catalogue raisonné des desseins originaux des plus grands maîtres anciens et modernes, qui faisoient partie du Cabinet de Prince Ch. de Ligne,' 1794; 'Anton Waterloo's Kupferstiche ausfürlich beschrieben,' 1795; 'Catalogue raisonné des estampes gravées à l'eau forte par Guido Reni et ceux de ses disciples, S. Cantarini, Jean André, Elizabeth Sirani, et Laurent Loli,' 1795; 'Catalogue raisonné des estampes qui forment l'oeuvre de Rembrandt et ceux de ces principaux imitateurs, composé par Gersaint, Helle, Glomy, P. Yver,' Nouv. ed. 1797; 'Catalogue raisonné de toutes les estampes qui forment l'oeuvre de Lucas de Leyde,' 1798; 'Catalogue raisonné de l'oeuvre d'estampes de Martin de Molitor,' Nürnberg, 1813; and 'Anleitung zur Kupferstichkunde,' 1821. He published also in 1797 an edition of the Triumph of the Emperor Maximilian I., with a French translation of the old German text, 'Le Triomphe de l'Empereur Maximilien I., en une suite de cent trente-cinque Planches,' &c.

(Nagler, in the *Neues Allgemeines Künstler-Lexicon*, who quotes the 'Kunstblatt' for 1821, No. 84, and the 'Literatur-und-Anzeigeblatt' for 1822, No. 17 ff.)

BARTSIA (in honour of John Bartsch, M.D., a friend of Linnæus), a genus of plants belonging to the natural order Scrophulariaceæ. It has a bell-shaped 4-fid calyx, a tubular ringent corolla, a pointed many-seeded capsule, the seeds compressed at the hilum, with winged ribs on the back. There is but one British species, the *B. alpina*, which has ovate, opposite, bluntly serrate, slightly clasping leaves. It is a rare plant, and only found in alpine pastures. The B. Odontites of Smith's English Flora is now referred to the genus Euphrasia, as *E. Odontites*. [EUPHRASIA, P. C. S.] *B. alpina* is found in subalpine regions, throughout Europe.

B. maxima has a branched stem, opposite lower leaves, alternate superior ones, oblong, bluntly and coarsely toothed; lower lip of corolla longer than the upper one, segments of the lower lip obtuse, equal in size. It is a native of Candia, and attains a height of one and a half or two feet. *B. Trixago* is a native of the south of Europe and Asia. *B. acuminata* is found in America. *B. viscosa* of Smith is now *Trixago viscosa*. It has opposite leaves, the upper ones alternate, ovate-lanceolate, sessile, acutely serrate. The genus Trixago differs from Bartsia, in its seeds being slightly angular, very minutely crenate-ribbed, with a basal hilum. Babington and Koch both adopt the genus Trixago, but the latter refers B. viscosa of Smith to the genus Euphrasia.

(Don, *Gardener's Dictionary*; Koch, *Flora Germanica*; Babington, *Manual*.)

BASAITI, MARCO, one of the best of the early Italian painters, was born of a Greek family in the Friuli, in the latter part, or probably about the middle, of the fifteenth century. He lived chiefly in Venice, where he was the rival of Gian Bellini, to whom he was even superior in some respects, especially in composition, in accessory groups, and in the management of the landscape or scene. He was perhaps inferior to Bellini in modelling the features, but he was quite equal to him in expression and in colouring, if not his superior in the latter respect. Some of Basaiti's works are still, for colour, among the most brilliant paintings extant. Of course tone, and some other accomplishments of the more distinguished painters subsequent to him, are only partially developed in the pictures of Basaiti. There are still several of his works in Venice, upon one of which, in the church of San Pietro di Castello, is the date of MDXX., and in the church of San Giobbe there is an excellent picture of Christ praying in the Garden, with the date 1510. The former must have been among the last works of Basaiti, for he was probably from his style a pupil of one of the Vivarini, of Bartolomeo, a supposition which is strengthened by the fact of his having finished a picture which Vivarini left unfinished through death, in the church of Santa Maria Gloriosa de' Frati. The subject is St. Jerome, with other saints, and the coronation of the Virgin above; and the following distich is written upon it, according to Moschini:—

> 'Quod Vivarino tua fatali sorte nequisti,
> Marcus Basitus nobile prompsit opus.'

It is painted in distemper, and therefore was probably an early work; for after 1473, when Bartolomeo painted his first oil picture, distemper was rapidly superseded. Vasari attributed this work to Vittore Carpaccio; Ridolfi states that Carpaccio finished it only, and that it was commenced by Guarino (Vivarino); and Zanetti repeats the error. There is also an Ascension of the Virgin, by Marco, in the church of Santa Maria degli Angioli; but his masterpiece is the Calling of St. Peter and St. Andrew, in the Academy of Venice, formerly in the old church della Certosa; it is marked MDXI. M. BAXIT. There is a repetition of it on wood in the Gallery of Vienna, marked, according to Mechel, 'Marcus Baxaiti f. 1515.' There is a beautiful Deposition from the Cross, by Basaiti, in the Gallery of Munich, cabinet xviii.

(Moschini, *Guida per la Città di Venezia*, 1815.)

BASE-FEE. [ESTATE, P. C.; RECOVERY, P. C.; TENANT-IN-TAIL, P. C.]

BASILIUS. [FATHERS OF THE CHURCH, P. C.]

BASILOSAURUS, the generic title proposed by Dr. Harlan for a large fossil animal, of which the reliquiæ were collected in tertiary strata on the river Washita in Louisiana. The animal was probably 70 feet long. Professor Owen has referred it to the Cetaceans, under the title of Zeuglodon Cetoides. (*Geol. Trans.*, vol. vi.)

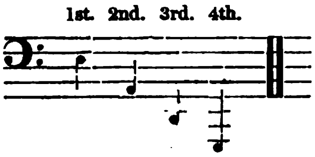
BASIN. In geology, depressions of the strata occasioned by synclinal dips are thus designated, especially such as are on a large scale. Thus the tertiary basins of London, Hampshire, and Paris, resting on chalk; the coal-basin of South Wales, resting on old red-sandstone, and, in a larger sense, the European basins between the Ural, the Scandinavian chains, and the Pyrenees, Alps, &c. Some of these basins are due to the original circumstances of deposition; others have acquired their configuration from elevations and depressions of particular geographical areas.

BASSO DI CA'MERA, a double-base, or *contrabasso*, reduced in size and power, but not in compass, and thus adapted to small or private rooms.

The dimensions of the body of this instrument are as follows:—

Length	3	feet.
Width above	16	inches.
Width below	21	do.
Depth under the bridge . . .	7½	do.
Length of strings from bridge to nut .	31	do.

It has four strings; two of gut and two covered with silver wire, all proportionably thicker than those of the violoncello, and tuned in 5ths, to the same literal notes as the violin, but two octaves lower than the latter. Ex.:—



Hence, and by referring to the article DOUBLE-BASS, it will be seen that this new instrument has a great advantage, in respect to compass, over the other; and in quality of tone it is far superior in chamber music, though neither powerful enough nor designed to supersede, or even to be used as a substitute for, the double-base in the full orchestra.

The *Basso di Camera*, in its present perfect state, owes its birth to Mr. T. W. Hancock, of Coventry Street, Haymarket, and was first introduced November 14, 1844, in Queen Square, Bloomsbury, at the residence of an excellent dilettante, to whose active research and zealous encouragement modern chamber music is more indebted than to any individual of the present age. Indeed, it is but justice to add, that the same gentleman was the first in this country to call attention to Mozart's operas, by having, early in the present century, had two or three of them privately got up by a few musical friends; from which time the fame of those unrivalled works gradually expanded, till the greatest of them, the *Don Giovanni*, was in 1817 produced at the King's Theatre, when, and not till then, the reputation of its author may truly be said to have reached its acme.

BASTARDY. Under the act of Elizabeth and later acts of parliament, down to the passing of the Poor Law amendment act in 1834, the usual practice was for the mother to apply for relief to the parish officers, by whom she was carried before the magistrates in petty session to be interrogated respecting the paternity of the child. An order of affiliation was then made, and the reputed father was ordered to contribute a weekly payment, or was bound to indemnify the parish against the future expenses of maintenance. 'In form, the proceeding was against the putative father for the indemnification of the parish; but in substance it was a proceeding of the mother against the putative father, the benefit of which accrued to her, and to which the parish was little more than a nominal party, except when it made good the father's default. It was in truth an action of the mother against the putative father, for a contribution towards the expenses of their common child, in which by a fiction of law, the parish was plaintiff.' (*On the law concerning the maintenance of bastards, by the Poor Law Commissioners*, Parl. paper, No. 31, Session 1834.) In this state of things, the Commissioners of Poor Law Inquiry (1834) recommended that the mother of a bastard should be rendered liable for its maintenance, but that she should be exempted from the punishment under 30th Geo. III. c. 51, and that all enactments charging the putative father should be repealed. The Bill for amending the Poor Law, brought in in 1834, as it ultimately passed (4th and 5th Will. IV. c. 76, §§ 72—76), enacted that the parish might still apply for an order upon the putative father, but this was to be done at the quarter sessions instead of the petty sessions; and corroborative evidence was required; and other difficulties and onerous conditions were thrown in the way, which showed that 'the object of the Legislature was to impede rather than encourage the applications to quarter sessions.' The number of bastards affiliated in England and Wales, in the years ending respectively 25th of March, 1835 and 1836, was 12,381 and 9,686. The practice of affiliation was therefore rapidly diminishing under the Poor Law Amendment Act, but it was alleged that the putative father was not punished, while the consequences fell solely upon the woman. In 1839, therefore, an act was passed (2 & 3 Vict. c. 85) which transferred the power of making orders in bastardy from the quarter sessions to any two justices in petty sessions, and facilitated instead of discouraged affiliations. Payments by putative fathers under orders in bastardy, have, under 2 & 3 Vict., c. 85, 'been limited to the cost of the relief actually given; they have been made bonâ fide to the parish, and therefore the parish has not been a purely formal party to the proceeding, and a mere skreen to the woman.' (*Report of Poor Law Commissioners*, Jan. 31st, 1844). The law respecting bastardy has been still more recently the subject of legislation, and by 7 & 8 Vict. c. 101, the principle of charging the putative father is totally different from that of any previous law on the subject. 'Formerly the remedy was intended exclusively for the parish: now the mother alone can obtain it. . . . . . Formerly the chargeability of the child, either in fact or in prospect, was the ground of the remedy: now the actual or probable chargeability of the child is made wholly immaterial.' (*Official Circular*, No. 39, Oct. 1, 1844.) The officers of all parishes and unions are deprived of the power of applying for orders of affiliation with regard to illegitimate children, and the mother alone is entitled to apply, at the petty sessions, for such order; but in case of the death or incapacity of the mother, the guardians of unions, or if there are no guardians the overseers, may enforce an order although they cannot apply for one, and payments are to be made to some person appointed by the justices to have the custody of the child, and not to the parish officers; and such person is to receive the child on the condition that it is not to be chargeable. Parish officers are guilty of misdemeanour for endeavouring to promote the marriage of a mother of a bastard, by threats or promises respecting any application to be made for maintenance. The mother of a bastard may summon the putative father before the petty sessions within twelve months after the birth of the child, for the purpose of affiliation, or at any time on proof of money having been paid to her in respect of such child. The justices may then make an order on the putative father for maintenance of the child and other costs, and enforce the same by distress and commitment; but not more than thirteen weeks' arrears can be claimed. The sum paid for maintenance is to be paid to the mother, and if she neglect or desert her offspring she may be punished under the Vagrant act (5 Geo. IV. c. 83). While unmarried or a widow, the mother is liable for the maintenance of the child until it is sixteen. Any person having the care of a bastard child under an order of maintenance, who maltreats it, or misapplies moneys paid by the putative father for its support, is liable to a penalty of 10*l.* on conviction before two justices. The putative father may appeal to the quarter sessions, as under the old law. All orders for the maintenance of a bastard cease after it has attained the age of thirteen, or on the marriage of the mother. Existing orders are to continue, but those made before August 14th, 1834, are to cease on the 1st of January, 1849.

In the Savings' Bank Act (7 & 8 Vict. c. 83) there is a clause under which the deposits of illegitimate persons who die intestate may be paid to their heirs, as if they had been legitimate; but in other respects the law relating to the succession and inheritance of bastards remains the same. By 6 Wm. IV. c. 22, the incapacity of bastards in England to dispose of their moveable estates by will was removed.

The late Mr. Rickman was the first who attempted to ascertain the number of illegitimate births in England. During the progress of the census of 1831, he obtained from the ministers of churches and chapels the number of bastards born in their parishes or chapelries in 1830. The number returned was 20,039. Under the Registration act (6 & 7 Will. IV. c. 86) no specific reference is made to illegitimate children, but the penalty for making a false statement, combined with the local knowledge of the registrars, in most cases prevents such children being registered as born in wedlock. Still there is no doubt that the registrar's returns will give something less than the real number of illegitimate children born. Of the births which escape the vigilance of the registrars, it is most probable that the proportion of these which are illegitimate is greater than in the total registered births. Still-born children are not registered in England, and here again the proportion is higher for illegitimate births than for births in wedlock. In Saxony the proportion of still-born children to 10,000 illegitimate births is 616, in 10,000 other births 464. Whatever may be the number of illegitimate births as they appear on the face of the register, it may safely be assumed that they are below the actual number. In the Registrar-General's fifth report (p. 10), it was stated that in 1841, out of 248,554 registered births in England 15,839, or 1 in 16, were illegitimate. The Sixth Annual Report issued in February, 1845, gives the total number of illegitimate births registered in England and Wales in 1841 and 1842. In 1841 the number was 35,294, and 34,796 in 1842, or 1 in 15 out of 517,739 births, whereas the returns on which reliance was formerly placed gave 1 in 20. In 1842 the number of illegitimate born boys was 17,810, and of females 16,986, or 21 boys to 20 girls: the proportion of other births is 20 boys to 19 girls. The number of females in England and Wales, between the ages of 15 and 45, was about 3,811,654 in 1841. Of these it is estimated by the Registrar-General, that 1,733,576 were married and gave birth in the above year to 489,894 children, and 2,078,078 were unmarried and gave birth to 35,294. The children born in wedlock were as 28·3 to 100 of the married women, and the illegitimate children were as 1·7 to 100 of the unmarried women.

Before any certain inference can be drawn as to the state of manners in any particular district, the relative number of married and unmarried women should be ascertained; but there are no means of arriving at this fact. The average number of illegitimate and other births for the whole of England is 6·7; but in Cumberland it is 11·4 per cent., and in some districts it ranges from 12 to 18·1 in 100, which latter is the proportion that exists at Wigan, in Lancashire. Nearly all the English towns are below the average of England. In France, Sweden, and most parts of the continent, the towns are above the average of the country.

The tables in the Sixth Report of the Registrar-General show that the highest proportion of illegimate births is in Cumberland, Nottingham, Lancashire, Herefordshire, Norfolk, and Cheshire; and the lowest proportion is in Middlesex, Cornwall, Surrey, Devon, Monmouth, and Warwick. The table showing the proportion for each county would occupy too much space; but grouping the counties into the following divisions, the results are as follows:—

Divisions.	Illegitimate Births.	Females married in 1842, to 100,000 living.	Illegitimate Births to 100,000 females living.	Illegitimate Births to 100 Births.
Northern Counties	6681	1511	609	8·8
North Midland .	2809	1368	494	7·7
York	3849	1457	484	7·2
Northern. . .	2059	1323	481	7·4
Eastern . . .	2552	1344	477	7·9
South Midland .	2569	1341	436	6·7
Western . . .	4234	1429	432	6·8
Welsh . . .	2204	1445	403	6·8
South Eastern .	2913	1351	369	6·4
South Western .	3001	1363	329	5·7
Metropolis . .	1925	1746	190	3·2

The proportion of illegitimate births in 100 births in parts of the metropolis and in towns, in 1841, was as follows:—In Rotherhithe, St. Luke's (Middlesex), Hackney, the Strand (Westminster), it is under 2 per cent.; in Bethnal Green, Islington, St. Saviour's and St. Olave's, Bermondsey, St. George's, Southwark, it does not exceed 2½; in St. George's in the East, Clerkenwell, Shoreditch, Lambeth, Greenwich, and Holborn, it is under 3; in Newington, St. George's, Hanover Square, Kensington, Chelsea, Camberwell, St. Pancras, and St. Giles's, it does not exceed 3½; in Liverpool it is 3·0; Hull, 3·8; in Birmingham, and in the city of Westminster, and in Whitechapel, London, it is 4·1; Plymouth, 4·2; Winchester and Bristol, 4·5; Oxford, 4·6; Derby, 4·7; Cheltenham, 4·9; Sheffield, 5; Northampton, 5·3; Leeds, 5·5; Chichester and Wakefield, 5·6; Manchester, 5·8; Bath, 6; Windsor and Leicester, 6·2; Salford, 6·4; Bedford and Brighton, 6·5; Lincoln and Doncaster, 6·7; Wolverhampton, 6·9; Kidderminster and Coventry, 7; Cambridge, 7·1; Peterborough, 7·4; Ipswich and Worcester, 7·6; Canterbury, 7·7; Maidstone, 7·9; Stockport, 8·1; York, 8·3; Devizes, 8·5; Aylesbury, 8·9; Huddersfield, 9; Halifax, 9·1; Salisbury and St. James's, Westminster, 9·3; Carlisle, 10; Romney Marsh, Tenterden, and Cranbrook, 10·5; Southwell, Mansfield, Preston and Whitehaven, 10·7; Macclesfield, 10·9; Norwich, 11·5; Nottingham, 12·2; Bolton, 12·5; Rhayader, 14·5; Brompton, Cumberland, 17·2; and the proportion at Wigan in 100 births was 18·1, or not far from one in 5. If the mortality of illegitimate children were the same as that of children born in wedlock, the number of illegitimate persons living would exceed one million for England and Wales. It is both a social and political evil when so large a proportion of persons exist in any society with ties of a different nature from those of the majority of the population. The condition of an illegitimate child is very frequently a hard one from the moment of its birth. Out of sixty-five persons murdered in England, in 1841, five were illegitimate infants or children under one year. We have no means of distinguishing the number of illegitimate children who die in England, but in Saxony 34 per cent. die under the age of one year; in Sweden, 27, and in Stockholm, 40 per cent., while the deaths of children of the same age born in wedlock average 26 per cent. in Saxony, 26 in Stockholm, and 16 in Sweden. The number of illegitimate children chargeable on the poor's rate in England was 65,475, in 1835; in 1839, 39,371; in 1843, 29,699.

The following table of the number and proportion of illegitimate births in one year in several of the principal countries and cities of Europe is derived from the best and most recent sources, and is given with details in the Sixth Report of the Registrar-General:—

States.	No. of Illegitimate births.	Proportion of 100 children born.	
		Legitimate.	Illegitimate.
Sardinia . . .	30,474	97·9	2·0
Sweden . . .	31,289	93·4	6·5
Norway . . .	12,111	93·3	6·6
England . . .	34,796	93·2	6·7
Belgium . . .	9,354	93·2	6·7
France . . .	69,928	92·8	7·1
Prussia . . .	42,129	92·8	7·1
Denmark. . .	6,020	90·6	7·1
Hanover . . .	5,487	90·1	9·3
Austria . . .	101,821	88·6	9·8
Würtemberg .	8,859	88·2	11·3
Saxony . . .	10,512	85·0	11·7
Bavaria . . .	30,729	79·4	20·5
Cities.			
London . . .	1,925	96·8	3·2
Genoa . . .	2,665	91·9	8·0
Berlin . . .	4,472	85·0	14·9
Frankfort . .	652	82·7	17·2
St. Petersburg .	1,809	81·2	18·8
Turin. . . .	6,867	81·0	18·9
Paris	11,527	71·1	28·8
Stockholm . .	5,409	59·3	40.7
Vienna . . .	21,763	53·8	46·1

BATAVIAN REPUBLIC. [Netherlands, P. C., p. 159.]

BATHYCLES (Βαϑυκλῆς), a celebrated antient statuary or sculptor, of Magnesia on the Maeander in Lydia. Though his time is uncertain, several scholars have attempted to establish it. Bathycles was the artist who made the throne of the Amyclæan Apollo at Amyclae near Sparta. But Pausanias, from whom we learn this, abstains from giving us any information as to the period of Bathycles in a very singular manner, and for which it is difficult to assign a reason. He says, in his notice of this work:—'I shall not mention the master of Bathycles, or in what reign the throne was made; but I saw the throne, and I will describe it as it is.' Many scholars suppose that Bathycles was contemporary with Crœsus, because that king sent some gold to the Lacedæmonians, which they expended in beautifying the Amyclæan Apollo; but it does not follow that they constructed the throne upon this occasion. It may have been made long before, and Heyne, in his essay 'Ueber den Thron des Amycläus,' is of opinion that it was made long before the time of Crœsus, chiefly from the peculiar mythological character of the subjects of the sculptures which adorned it. If we could depend upon the critical judgment of Pausanias, which we cannot, a remark that he makes in the following chapter, speaking of the statue of the god himself, might have considerable weight in controverting the opinion of Heyne; he there says—'Bathycles did not make the statue itself: it is antient, and is made without art;' where the idea of antient is clearly opposed to the period of Bathycles. Thiersch, substantially agreeing with Heyne, places Bathycles in the 29th Olympiad, contemporary with Archilochus. This was at the close of the second Messenian war; a period which has much in its favour. During the war, Aristomenes, the general of the Messenians, plundered Amyclae: the Spartans therefore, at the successful completion of the war, might naturally make some votive demonstration from the spoils, to conciliate the god of Amyclae, and avenge the outrage upon his shrine or temple. Yet why should Pausanias not mention such a circumstance; or why was there no allusion to such trophies in the designs upon the throne? These questions present difficulties, yet probability appears rather to favour the earlier period than the later. The early period, about 665 B.C., is not so early that it could not have been recent in the opinion of Pausanias when compared with the period of the statue of the god itself; Lydia also was already famous for its artists, and Lacedaemon was without native artists. But in the later period, about 565 B.C., Lacedaemon, as well as other towns of the Peloponnesus, had its own artists of name. On the top of the throne Bathycles represented himself and his assistants. Quatremère de Quincy, in his 'Jupiter Olympien,' has given a view of the god and his throne, designed from the description of Pausanias.

The Bathycles who left a cup for the wisest man was a different person; he was of Arcadia, and lived certainly in the time of Solon, but it does not follow that he was an artist because he made a bequest of a cup. Voss and Sillig suppose that Bathycles the sculptor lived even after the time of Solon, and that the presence of himself and assistants in Lacedaemon is accounted for by the Persian conquest of Lydia.

(Pausanias, iii. 18 and 19, iv. 18; Heyne, *Antiquarische Aufsätze*; Thiersch, *Epochen der Bildenden-kunst unter den Griechen*, 1829; Sillig, *Catalogus Artificum*.)

BATO'NI, POMPE'O GIRO'LAMO, one of the most distinguished painters of the eighteenth century, was born at Lucca in 1708. His father was a goldsmith, and Pompeo had thus an early opportunity of displaying his ability for design. He established himself very early in Rome, where he studied Raphael and the antique, and kept himself at first by copying celebrated pictures, but in a few years he obtained the first name in Rome, and with the exception of Mengs, lived there until his death, for forty years, without a rival: he died in 1787.

Batoni was equally excellent in portrait and history. His historical works are chiefly Scriptural and from the lives of the saints; he painted also many single pictures of saints of both sexes. His portraits, which are admirably modelled, are extremely numerous, and among them are many of the highest personages in Europe. He painted three popes, Benedict XIV., Clement XIII., and Pius VI.; also the Emperors Joseph II. and Leopold II. of Austria, the Emperor Paul of Russia, and many others of inferior rank. He excelled in drawing, in tone, and in colour; his execution also was often extremely elaborate; but in composition he was considered inferior to Mengs, though equal to him in expression. He was less philosophical also in his subjects than Mengs, but he surpassed Mengs in every technical excellence except mere academical drawing. They were both eminently academic, and Batoni has sometimes been honoured with a title bestowed more generally upon Maratta, that of 'the last of the Romans.'

Several cities of Italy possess altar-pieces by Batoni, and there are also many of his works in Germany and other foreign countries; some of his best works are at Lisbon and at St. Petersburg. His principal work at Rome is the Fall of Simon Magus, now in the church of Santa Maria degli Angeli at Rome, but painted originally to be copied in mosaic for one of the altars of St. Peter's: the mosaic has never been executed. Batoni was a Cavaliere and a Ritter of the order of Maria Theresa. His friend Car. O. Boni wrote a eulogium upon him shortly after his death: 'Elogio di Pompeo Girolamo Batoni,' Rome, 1787.

(Fiorillo, *Geschichte der Mahlerey*, &c.; Lanzi, *Storia Pittorica*, &c.)

BATRA'CHIDA, FOSSIL. The number of fossil Reptilia referrible to this division is gradually enlarging, though still very small. To the anourous Batrachians we must, with Jäger and Professor Owen, refer the Labyrinthodonts of the new red-sandstone series of Warwickshire and Wirtemberg (including perhaps the Cheirotheria whose foot-prints ornament the red-sandstones of England and Germany); while the tertiary fossil of Oëningen (which Scheuchzer imagined to be a human skeleton) is determined by Cuvier to be analogous to the Newt of Europe, and the Menopoma of North America. Remains of frogs and salamanders occur in the tertiary brown coal-beds of the Rhine Valley.

BA'TRACHUS, an architect and sculptor of Laconia, who lived in the time of Augustus. Pliny tells a story of Batrachus and his fellow-countryman Saurus. He says—Being very rich, they built at their own cost two temples to Jupiter and Juno at Rome, enclosed by the porticoes of Octavia, hoping for an inscription; but this being refused them, they introduced their names in another manner, by carving a lizard (Saurus) and a frog (Batrachus) in the centre of the Ionic volutes of the columns, one in each volute. There is still at Rome, in the church of San Lorenzo, a column with an Ionic capital of this description, in which the reptiles are well executed. The story is improbable, and perhaps originated in the peculiar nature of the ornaments; or the architects derived their names from the reptiles, rather than the reptiles their images from the names of the architects.

(Pliny, *Hist. Nat.* xxxvi. 4. 11; Winckelmann, *Werke*, i. 379; Thiersch, *Epochen der Bildenden-kunst*, &c.)

BATTERIES, ELECTRICAL AND GALVANIC. An electrical battery is a number of cylindrical vessels of glass, each precisely similar to the usual Leyden jar, the open top being covered by a plate of wood, into which is screwed the foot of a brass pillar which terminates at the top with a ball of the same metal, and at bottom with a chain which descends to the lower part of the jar inside; and both the inside and outside of each jar are lined with tin-foil to within two or three inches of the top. These are contained within a wooden box, whose interior is lined with tin-foil; a piece of wire passes through the foil and the side of the box, and carries on the exterior of the latter a ring, to which should be affixed a chain descending to the table or ground.

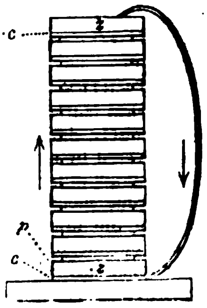
The ball, or knob, at the top of every jar is perforated in order that it may receive the brass rod or system of bars by which the tops of all the jars are to be connected together; the rods are terminated with brass balls, and one of these, or a ball at the upper extremity of a pillar forming part of the system, is presented to the conductor of the electrical machine when the battery is to be charged. This kind of battery was first proposed by Gralath, a German, in 1747; and the manner of charging and of discharging it differs in no respect from the manner of performing the like operations with a single jar.

The quantity of electricity in a jar or battery is directly proportional to the superficies of the coating and to the degree of intensity; and the latter is in the inverse ratio of the thickness of the glass. The particles of vitreous or positive electricity which, by the machine, are excited in the conductor and, with that, on the interior surfaces of the jars, exert, through the glass, attractive powers upon the resinous or negative electricity which, by that attraction, are brought from the earth to the exterior surfaces of the jars: this accumulation within the jars continues till the repulsive powers of the particles are great enough to counteract the power of the machine to supply fluid through the conductor: the charge of the battery is then a maximum. The power of a battery is estimated by the quantity of metallic wire which it will ignite or melt. The battery consisting of 100 jars, which was made by Cuthbertson for the museum at Haarlem, and which contained 550 square feet of coating, ignited 655 inches of iron wire $\frac{1}{150}$ inch diameter.

The batteries in which electricity is excited by the chemical action of a fluid upon a metal, or of two metals upon one another, are called galvanic or voltaic, and are of various kinds: it is intended here to describe only those which are most frequently used.

The simplest combination which can be formed for the production of an electrical current by such means is that of a plate of zinc and a plate of copper placed, generally, in vertical positions and parallel to one another in a vessel containing a diluted acid, the upper edges of the metals being connected by a copper wire. In this state a current of positive electricity passes from the zinc, through the acid, to the copper, and from the latter, along the wire to the zinc: at the same time a current of negative electricity passes from the zinc, along the wire, to the copper, and from thence, through the acid, to the zinc. It is evident that the quantity of fluid furnished by a combination of this kind will be proportional to the superficies on which the acid can act; and an apparatus designated a battery, which may be said to consist of two plates only, one of zinc and the other of copper, was executed for the London Institution. Each plate is 50 feet long and 2 feet wide, and the two are coiled together upon a cylinder of wood, so as to leave everywhere an interval between the two metals: in that interval rope-bands of horse-hair pass round with the coils so as to keep the metals asunder. A cylindrical vessel contains the diluted acid; and when the battery is to be used, the coils of metal are lowered by machinery into the vessel.

But it is more convenient, for the purpose of obtaining the electrical fluids in abundance, to combine together a considerable number of small plates of zinc and copper, alternately, with the acid between them; and that which is called the voltaic pile is a battery of this kind. Under GALVANISM and VOLTAISM (P. C.) are explanations of the electrical action, and we here merely describe the construction of the pile. A circular plate of zinc, *z*, usually about 1⅓ inch diameter and $\frac{1}{10}$ inch thick, is laid upon and generally soldered to a very thin plate of copper *c*, of equal diameter; and any convenient number of these are placed above one another, with the copper side undermost in all: between every two compound plates is a circular piece of paper *p*, or cloth moistened with diluted sulphuric acid; and the whole column or pile is made to preserve a vertical position by being formed within three pillars of glass or baked wood, which are connected together by having their extremities inserted in boards, of which the lower one serves as a base for the column. The paper or cloth should be rather less in diameter than the plates of metal; and no moisture should be allowed to escape over the edges of the plates.



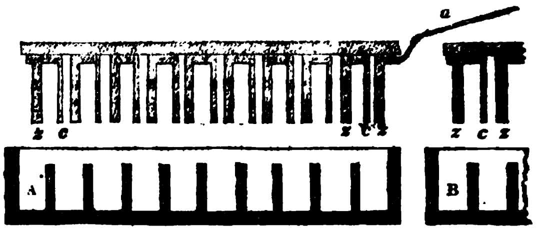
In this state the lowest plate of zinc attracts the positive electricity from the copper below it, and this continually receives a supply from the earth through the table, or the base of the pile; the quantity thus attracted is conveyed to the copper plate immediately above, through the moistened cloth, the latter serving as a conductor: again, the zinc in the second plate attracts electricity from the copper below it, and, at the same time, receives that which is transmitted to the latter from the zinc in the lowest plate. Thus the quantity of positive electricity in the zinc of the second plate becomes nearly twice as great as that which is in the lowest plate; and the process continuing, the quantity in the zinc of each plate above may be conceived to be such a multiple of that which is in the lowest plate as is expressed by the number of the compound plate from the bottom of the pile. There is consequently obtained a current of positive electricity passing upwards from the zinc, through the acid, to the copper; and if a copper wire be made to pass from the top of the uppermost zinc plate to the copper in the lowest plate, the same current will return downwards, so that a circulation of the fluid will continue till the energy of the pile is exhausted. At the same time there is a current of negative electricity passing down the pile from the copper, through the acid, to the zinc, and returning upwards along the wire.

If a second pile be formed, the plates in it may be placed in a reverse order, the copper side above and the zinc side below: if a third pile be formed, the order may be the same as in the first pile; if a fourth, the same as in the second; and so on: then, in uniting them together, a metal wire passes from the copper at the bottom of the first pile to the zinc at the bottom of the second; another wire passes from the copper at the top of the second to the zinc at the top of the third, and so on.

When a wire connects the opposite ends of one pile, or of a system of piles, the circuit is said to be complete: it is said to be broken if there are two separate wires, one proceeding from the copper at bottom, and the other from the zinc at the top. If an animal body were in connection with the farther extremities of the wires it would complete the circuit, and experience shocks.

The opposite extremities of the pile, or of the wires which are in contact with them, are called the poles of the battery. As the current of positive electricity seems to issue from the zinc at the top of the pile, that extremity is called the positive pole of the battery; at the same time the negative electricity seems to issue from the copper at the bottom, and therefore the terminating copper plate is called the negative pole. These designations are reversed when a single pair of plates separated by an acid is mentioned. In that case, since the positive electricity passes from the zinc plate, through the acid, to the copper plate, and that the wire passes through the air from the edge of the copper to that of the zinc plate; it is evident that the positive electricity will flow from the copper, and therefore the copper is the positive pole of the combination; the negative electricity flowing at the same time along the wire, from the zinc, the latter is the negative pole.

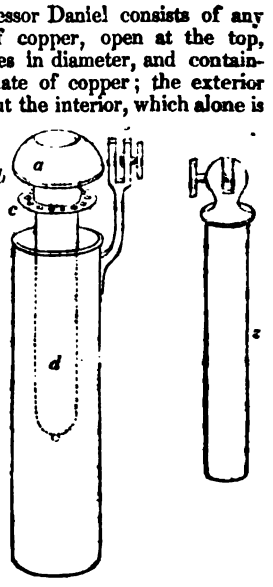
That which, till lately, was most generally used is called the trough-battery, because the acid is contained in cells formed in a rectangular trough, usually of glazed earthenware, by nine or more parallel partitions of the same material which permit no communication between one cell and another.



As many pairs of plates, zinc and copper, of equal superficies, as there are partitions, are provided; the two plates of each pair are soldered or fastened together at their upper extremities, so that they may be parallel to one another; and all are united together by a rod of wood, so that they may at once be placed into or removed from the cells. The bridges or connections between the zinc and copper plates stand directly over the partitions, so that there is a copper and a zinc plate in each separate cell, except at one extremity of each trough, in which, till two troughs are connected together, the cell has only a zinc plate. When one trough is to be connected with another, in order to increase the battery, a slip of copper, as at *a*, soldered at the top of a zinc plate, is bent and made to enter the cell B, containing only a zinc plate at one end of the preceding trough. In order to form the complete circuit, one extremity of a wire is made to enter the cell A, for example, which is the positive end, and the other extremity is brought to the opposite end of the trough, or series of troughs, where it is placed in contact with the copper slip, as *a*: the positive current then flows along the wire from the extremity first mentioned to the other.

That which has been just described is designated Mr. Children's battery, and Dr. Wollaston proposed, as an improvement upon it, to have in each cell a zinc plate between two of copper; for thus both surfaces of each zinc plate would become efficient in producing the electric current, and the power of the battery would be increased by one half. The battery at the Royal Institution is of Mr. Children's kind; it contains 2000 pairs of plates, each 8 inches long and 4 inches deep, and with it Sir Humphry Davy made his principal discoveries.

The battery invented by Professor Daniel consists of any number of cylindrical vessels of copper, open at the top, about 16 inches high and 3 inches in diameter, and containing a saturated solution of sulphate of copper; the exterior surface of each may be painted, but the interior, which alone is efficient in producing electricity, is made bright. On the top of the cylinder is placed a hemisphere *a* of wood, through which, in the direction of the axis of the cylinder, is a perforation above an inch in diameter; and to its base is attached a short tube *b* of copper, less in diameter than the cylinder, and carrying at its lower extremity an annular plate *c* of copper, in which are pierced several small holes. When the wooden cover is placed on the cylinder its base rests on the top of the latter; and the part of the cylinder between the short tube and the annular plate is filled with crystals or pieces of sulphate of copper, which, gradually dissolving, preserve the strength of the solution in the lower part of the cylinder.



To the interior of the short tube is affixed one end of a piece of ox gullet *d*, about the same length as the copper cylinder, and having its lower extremity tied so that the whole forms a membranous bag; this is to contain diluted sulphuric acid (eight parts water to one of acid). A rod of zinc *z*, about the same length as the cylinder, an inch in diameter, and terminating at the upper extremity with a brass ball, is passed through the perforation in the wood, down the interior of the membrane, so that its shoulder rests on the top of the wood; the surface of the zinc being previously covered with an amalgam of mercury. Instead of a membrane, a bag of paper or canvas, or a vessel of porous earthenware, may be used.

If now, a connection, by means of a wire or metallic rod, were made between the ball at the top of the zinc rod and the top of a stem *e* which rises from one side of the copper cylinder, the zinc will be corroded by the sulphuric acid and the electric fluid will pass to the copper through the acid, the membrane and the solution in the cylinder. [Voltaism, P. C.]

The battery invented by Mr. Groves consists of several porous vessels containing strong nitric acid, and, in each, a rod or plate of platinum; each of these vessels is placed between two plates of zinc within a trough in which is diluted sulphuric or muriatic acid. The rod of platinum holds the place of the plate of copper in Children's battery and constitutes the negative pole of each combination; the zinc plate being the positive pole.

The battery used at first by Professor Wheatstone for his electrical telegraph was formed nearly on the same principle as that of Mr. Daniel. A small outer vessel contained a solution of sulphate of copper, together with the plate of copper which formed the negative pole; within this, a small porous cell contained diluted sulphuric acid, and at the bottom was an amalgam of zinc and mercury, which constituted the positive pole. An electro-magnetic apparatus is now employed for the telegraph.

BATTUS, the generic title proposed by Dalman to replace the name Agnostus, which Brongniart gave to some minute trilobate Crustacea which occur in the Silurian limestones of Norway, Wales, &c.

BAUMANNSHÖHLE, one of the bone-caverns in Franconia. (Buckland, *Bridgwater Treatise.*)

BAYSE. [Garonne, P. C.]

BAZHENOV, VASSILI IVANOVITCH, an architect distinguished among the native artists of Russia, and first vice-president of the Academy of Fine Arts at St. Petersburg, was born at Moscow, March 1 (13), 1737. While yet a boy, he is said to have manifested a decided taste for drawing houses and buildings, which was his favourite amusement, and in which he endeavoured to improve himself by studying the churches, monasteries, and other public structures of that antient capital, his earnestness in such task standing him in lieu of practical method. In 1751 he began to attend the School of Architecture at Moscow, which was then under the direction of Prince Uchtomsky, who in 1775 placed him in the then recently established Moscow University, in order that he might study modern languages. Three years afterwards, on the Academy of Fine Arts being opened at St. Petersburg, and youths who gave indications of superior talent being required as pupils, Bazhenov was one of the first. After pursuing his studies there, under Tchevakninsky, with distinguished success, he was sent to Paris in 1761, where he became the pupil of Duval, and would have obtained the gold medal at the Academy of Architecture, but for his belonging to the Greek Church, wherefore in lieu of it he was rewarded by a diploma of merit, signed by the three eminent architects, Leroi, Sufflot, and Gabriel. Proud of his having obtained such distinction as had never before been conferred on any Russian, the St. Petersburg Academy bestowed on him the degree of 'Adjunct,' and sent him forthwith (October, 1762) to Rome. While in Italy he was elected member of the Academy of St. Luke, and of those of Florence and Bologna.

On his return to St. Petersburg, in May, 1765, he was taken into the immediate service of the Empress Catherine, who found him constant employment in various architectural projects and schemes which she had conceived, and among others that of entirely rebuilding the Kremlin at Moscow, clearing the whole site, and erecting upon it a palace that should surpass every monument of antient or modern times. In magnitude it certainly would have done so, for the façade would have been upwards of four thousand feet in extent, and some idea may be formed of the pomp and magnificence contemplated by Catherine and her architect, from the estimate for the state staircase alone, which was to be entirely of Italian marbles, amounting to five million rubles. Even the model itself—which is still preserved in the Kremlin—cost no less than thirty-six thousand rubles. Nevertheless, although all preparations had been made, and the first stone of the intended edifice was laid with great solemnity on the 1st (13th) of June, 1773,—on which occasion Bazhenov delivered an oration, composed by Sumarokov [Sumarokov, P. C.],—the works were shortly afterwards interrupted, and never resumed. Still, if greatly diminished in consequence of his plans not being carried into execution, the fame attending so vast a project is not inconsiderable of itself,—as is evident from the renown which one great English architect has derived from what, but for unpropitious circumstances, would have been his greatest work; therefore, alike in fate, Inigo Jones's Whitehall and Bazhenov's Kremlin may be allowed to share alike in fame.

In 1776 he began for the Empress a summer palace, in the Gothic style, at Tzarishtino, but Catherine, who in the meantime had withdrawn her favour from Bazhenov, was so far from being satisfied with the building, that she afterwards ordered it to be completely altered by Kozakov. Her successor Paul however restored him to his former appointments, bestowed on him an estate with a thousand peasants, lavished various honours upon him, and employed him to erect the palace at Gatchina, that at Pavlovsky, and several government buildings at Cronstadt. But the most magnificent structure which he executed for the Emperor Paul was the St. Michael or Marble Palace at St. Petersburg, the vast and massive pile within whose walls the unfortunate Paul was assassinated, and which, judging from the very minute description given of it by Kotzebue, must originally have been most sumptuous; but all its internal splendour has now disappeared, it having been converted into a military school for engineers. Bazhenov is also said to have been associated with Voronikin [Voronikin, P. C.] in building the Kazan church, at St. Petersburg. Bazhenov died of paralysis, at St. Petersburg, August 2 (14), 1799. He left a great number of architectural drawings and designs, which the emperor ordered to be published, but Paul's own death, shortly afterwards, frustrated that intention. Bazhenov himself published a Russian translation of Vitruvius, 1790-97, in four volumes 4to.

(Snegirev, *Slovar Ruskikh Pisatelei.*)

BEACHES, RAISED, a term introduced into modern geology to characterise a very numerous class of gravelly, sandy, and shelly deposits, which have been once parts of the sea-bed, and have been raised to constitute dry land in very modern geological periods. It is scarcely possible to assign exactly the limits of these formations, even by the aid of the organic exuviæ which they contain: for while some raised beaches contain only species now living in the adjoining sea, others include one or more extinct species, and thus conduct by insensible gradations from the almost modern shell-beds of the raised shores of the Forth and the Clyde and the variously elevated shell accumulations of Uddewalla and other points of Sweden, to the still richer and more antient (though still to be called Newer Pleiocene) deposits of Sicily. The term Pleistocene (*most* recent), which has come into use, meets this difficulty but feebly, and in fact only draws an arbitrary or epochal line, instead of the soft gradations of long periods which really appear in nature. Nearly all the British, Irish, and European shores furnish examples in abundance: as the shores of the Forth and Clyde, the coasts of Yorkshire and Lancashire, the coasts of Cornwall and Devon, of Wexford, Normandy, Sweden, and the Mediterranean.

BEALE, MARY, an English portrait painter of the seventeenth century, about whom Vertue collected some interesting details from some journals or pocket-books kept by her husband, of which he saw seven. She was the daughter of the Rev. Mr. Craddock, minister of Walton-upon-Thames, and was apparently taught painting by Sir Peter Lely. The first date concerning her works in these pocket-books is 1672; when Lely's visits to her, and his praises of her copies from Correggio and Vandyck, are noticed. In the same year she painted portraits of the Bishop of Chester, Lord and Lady Cornbury, and Dr. Sydenham, besides others; and she received in that year, for paintings, 202*l.* 5*s.*

Sir Peter Lely painted for Mr. Beale portraits of Dr. Tillotson and Dr. Stillingfleet, in Mr. Beale's house, in the presence of his wife, in order, probably, that Mrs. Beale might see his method of painting. Sir Peter (then Mr. Lely) received for the two paintings 30*l.*, of which he took 28*l.* 19*s.* in lakes and ultra-marine. In 1674 Mrs. Beale made 216*l.* 5*s.* by her paintings. It seems a Mr. Manby painted some landscape backgrounds in some of her portraits, for which he was paid in colours of Mr. Beale's making. He was paid two ounces of lake, and one and a half of pink, for a landscape to the portrait of the Countess of Clare. In 1677 she received 429*l.* for pictures; a very large amount. And among the portraits of this year were one of the Earl of Clarendon, and many others of the nobility. She was paid 5*l.* for a head, and 10*l.* for a half-length in oil. In 1681 Dr.

Burnet presented Mrs. Beale with a copy of his History of the Reformation; she appears to have been highly esteemed by the clergy; many distinguished members of that body sat to her. Mr. and Mrs. Beale appear to have been very charitable: from some notes at the end of one of the pocket-books they gave two shillings in the pound to the poor. Her husband, Charles Beale, had an employment in the Board of Green Cloth; he was also a painter and, according to his journals, a colour-maker. Mary Beale died in London in 1697, aged 65, and was buried under the communion-table in St. James's Church. Her husband and two sons survived her. One son, Bartholomew, studied under Dr. Sydenham, and practised as a physician at Coventry; the other, Charles, who was born in 1660, was a painter, and died in London. Her pictures, says Walpole, have much nature, but are heavy in colour. Several of her portraits have been engraved by R. White, P. Vanderbanc, and A. Blooteling. Archbishop Tillotson's has been engraved by White and by Vanderbanc; and the latter engraved that of Archbishop Tenison. Walker painted Mrs. Beale's portrait; and several poems were addressed to her, under the name of Belesia, by Dr. Woodfall.

(Walpole, *Anecdotes of Painting*, &c.; *Essay towards an English School.*)

BEAUMONT, SIR GEORGE HOWLAND, was the seventh baronet of the antient family of the Beaumonts of Stoughton Grange, Leicestershire. He was born in 1753, was educated at Eton, a distinguished amateur of the arts and friend of artists, possessed himself considerable skill as a landscape painter, and is, hitherto, one of the most munificent donors to the British national collection of pictures. He was mainly instrumental in the establishment of the National Gallery; in furtherance of which object he promised to contribute part of his own collection at Coleorton Hall: he accordingly presented to the National Gallery sixteen paintings, chiefly landscapes—a landscape and figures by N. Poussin; Hagar and the Angel, Narcissus and Echo, the Death of Procris, and a study of trees by Claude; a view of Venice by Canaletto; a large landscape and figures by Rubens; a landscape and figures by Both, called Morning; a landscape and figures, called the Return of the Ark, by S. Bourdon; the Villa of Mæcenas, and the Niobe, of Wilson; a portrait of a Jew, and a sketch of the Descent from the Cross, by Rembrandt; a profile of a man by Sir Joshua Reynolds; Pylades and Orestes by West; and the Blind Fiddler by Wilkie. Sir George was one of Wilkie's earliest patrons and best friends. There are also two of his own landscapes in the National Gallery—a small piece on wood, and Jacques contemplating the Wounded Stag, from 'As you like it.' These two pictures were presented by Lady Beaumont after the death of Sir George. He died in February, 1827, without issue. Lady Beaumont, who was the granddaughter of Lord Chief Justice Willes, survived Sir George little more than two years; she died in July, 1829. Sir George was an active member of the Society of Arts.

(Burke, *Dictionary of the Peerage*, &c.; Cunningham, *Lives of the most eminent Painters*, &c., and *Life of Sir David Wilkie*; *Catalogue of the Pictures in the National Gallery.*)

BECCAFU'MI, DOME'NICO, a very celebrated painter of Siena, of the sixteenth century. According to Vasari, he was born at Siena in 1484, and died there in 1549; others give the respective dates as 1470 and 1551. His real name was Mecherino: that of Beccafumi he derived from his patron Lorenzo Beccafumi, who placed him as a boy with Capanna, an obscure painter, to learn painting. He occupied himself chiefly in copying, and he was especially attracted by some pictures by Pietro Perugino, whose style he acquired, and never lost, notwithstanding a subsequent sojourn in Rome, and the opportunities he had of improving himself from the recent works of Michelangelo and Raphael in the Vatican. He was in Rome during the Pontificate of Julius II., but remained there only two years. He painted in distemper and in oil; better in the former style, and his small figures are superior to his larger ones. Latterly when the fame of Michelangelo in Tuscany attained its extreme height, Beccafumi seems to have felt a necessity for invigorating his own style, and he accordingly forsook his original softness of design for a species of clumsy plumpness, and his heads became harsh and ugly. He was correct in perspective, was fond of reflections and foreshortenings, and excelled all his Sienese contemporaries in energy of composition; in other respects he was surpassed by his great rival Razzi. His best works are in Siena; he executed some at Florence, at Pisa, and some at Genoa for Prince Doria. He executed also some of the designs of the foot-pavement of the cathedral of Siena; which work was commenced by Duccio di Buoninsegna, according to Vasari, but in which, as Von Rumohr has shown, he was mistaken. The designs of the foot pavement are a species of *niello*; the outlines of the figures are cut into the stone, and filled up afterwards with a black cement. Those of Beccafumi have been engraved by Andreani and Cosati. Beccafumi cast also a few works in bronze, and is said to have executed some woodcuts, which, with the prints after his designs by other masters, are enumerated by Heineken.

(Vasari, *Vite de' Pittori*, &c.; Lanzi, *Storia Pittorica*, &c.; Heineken, *Dictionnaire des Artistes*, &c.; Rumohr, *Italienische Forschungen*; Brulliot, *Dictionnaire des Monogrammes*, &c.)

BECHERA, a genus of fossil plants proposed by Count Sternberg. Bechera charæformis occurs in the strata of Coalbrookdale. In this genus Sternberg included the Gyrogonites, or fossil Charæ of the tertiary strata of the Isle of Wight.

BECKFORD, WILLIAM, celebrated for his great wealth, talents, and eccentricities, was the only legitimate child of Alderman Beckford, of London, who died on the 21st of June, 1770, in his second mayoralty, within a month after his famous exhibition at court, when, after presenting a city address to George III., and having received his majesty's answer, he made the reply which may be read on his monument in Guildhall. The alderman had several natural sons, to each of whom he left a legacy of 5000*l.*; but the bulk of his property, which consisted chiefly of large estates in Jamaica, and also of the estate of Fonthill, near Hindon, in Wiltshire, went to his son by his wife, who was then a boy about nine years old, and is said to have thus come into a revenue exceeding 100,000*l.* He had already, before his father's death, attracted notice among the alderman's distinguished friends and visitors, by his liveliness and intellectual precocity; and the promise thus given was fulfilled by a little work which he published in 1780, entitled 'Biographical Memoirs of Extraordinary Painters,' which was in fact a satire upon certain living English artists, and the common slang of connoiseurship. He had visited Paris, and mixed in the society of that capital, in 1778, when he met Voltaire, who gave him his blessing; but he set out on what was properly his first continental tour in June, 1780, and traversed, between that date and May, 1781, part of Flanders, Holland, Germany, and Italy. In 1782 he made a second visit to Italy, and in 1787 another to Portugal and Spain. Meanwhile he had, in 1783, married the Lady Margaret Gordon, daughter of Charles, fourth Earl of Aboyne, and had the following year been returned to parliament as one of the members for Wells. In 1784 also he published his remarkable Arabian tale of 'Vathek,' in French. More than fifty years afterwards he told the writer (understood to be Mr. Cyrus Redding) of a series of articles entitled 'Recollections of the Author of Vathek,' the first of which appeared in the 'New Monthly Magazine' for June, 1844, that he wrote the work at one sitting. 'It took me,' he said, 'three days and two nights of hard labour. I never took off my clothes the whole time. This severe application made me very ill. . . . Old Fonthill had a very ample, lofty, loud-echoing hall, one of the largest in the kingdom. Numerous doors led from it into different parts of the house, through dim winding passages. It was from that I introduced the hall—the idea of the Hall of Eblis being generated by my own. My imagination magnified and coloured it with the Eastern character. All the females in Vathek were portraits of those in the domestic establishment of old Fonthill, their fancied good or ill qualities exaggerated to suit my purpose.' An English translation of the work afterwards appeared, the author of which Beckford said he never knew; he thought it tolerably well done. In the next parliament, which began in 1790, he sat for Hindon; but in 1794 he accepted the Chiltern Hundreds, and again went abroad. He now fixed himself in Portugal, where he purchased an estate near Cintra, and built the sumptuous mansion, the desertion and desolation of which some years afterwards Byron has described in the first canto of his 'Childe Harold,' in the lines beginning—

> "There thou too, Vathek! England's wealthiest son,
> Once formed thy Paradise."

On his return to England he occupied himself with the embellishment of his house at Fonthill; but in 1801 all the splendid furniture was sold by auction, and this dispersion was followed the next year by a similar sale in London of the proprietor's collection of pictures. These proceedings however were only preliminary to the commencement of a much more magnificent collection of books, pictures, curiosities, rarities, bijouterie, and other products of art or ingenuity, and the erection of a new building at Fonthill, the most conspicuous feature of which was a tower of great height. Mr. Beckford sat again for Hindon in the short parliament of 1806, and also in that which met in 1807; and he continued to reside chiefly at Fonthill till 1822, when he sold his estate and house there, with all the contents of the latter, to Mr. Farquhar, for, it was underderstood, the sum of 350,000*l.* His outlay upon the property had been, according to his own account, about 273,000*l.*, scattered over sixteen or eighteen years. The reason he assigned to the writer of the 'Recollections' for disposing of it was the reduction of his income by a decree of the court of Chancery, which had deprived him of two of his Jamaica estates. 'You may imagine their importance,' he added, 'when I tell you that there were 1500 slaves upon them.' Soon after this the great tower, which had been hastily and slightly constructed, and not long finished, fell to the ground. It was above 260 feet high. Mr. Beckford now retired to Bath, where he erected another lofty building on the eminence called Lansdowne, to the north of that city. Till now his literary reputation with the general public had rested on his early tale of 'Vathek;' but in 1834, after an interval of fifty years, he again appeared as an author by the publication of an account of his first continental tour (in 1780), in a series of letters under the title of 'Italy, with sketches of Spain and Portugal,' 2 vols. 8vo. Lond. He told the writer of the 'Recollections' that these 'Sketches' were 'drawn up from notes very inefficient in themselves,' but that his memory supplied what was wanting. It has always been understood however that they were written many years before their publication: indeed in his Preface he observes that the letters had 'remained dormant many years,' and that most of them 'were written in the bloom and heyday of youthful spirits and youthful confidence, at a period when the old order of things existed,' &c. 'Perhaps,' he adds, 'as they happen to contain passages which persons of acknowledged taste have honoured with their notice, they may possibly be less unworthy of emerging from the shade into daylight than I imagined.' The vivacity, polished sarcasm, and graphic power of these letters were instantly and keenly felt; and their appearance from the press was followed the same year by the republication of the 'Memoirs of Extraordinary Painters,' and the next by another volume entitled 'Recollections of an Excursion to the Monasteries of Alcobaça and Batalha' (in Portugal), made in June, 1794. It is distinguished by the same qualities with the previous volumes on Italy. From this time Mr. Beckford continued to live in retirement till his death on the 2nd of May, 1844. He left two daughters, the eldest of whom, Susan Euphemia, was married to the Marquis of Clydesdale in 1810, and is the present Duchess of Hamilton. Of the tale of 'Vathek,' which has been often reprinted, Byron, a good judge on such a subject, has pronounced that 'for correctness of costume, beauty of description, and power of imagination,' it far surpasses all other European imitations of the Eastern style of fiction.

BEDSTEAD. Bedsteads for domestic use, of whatever form, are most commonly made of wood, and of somewhat massive construction; but the much smaller space occupied by light bedsteads of iron and brass, their consequent superiority in favouring that free ventilation which is so important to health, and the great advantage which they possess in not harbouring vermin, have led to their very extensive introduction of late years in the dormitories of barracks, hospitals, and other public establishments; while the elegant lightness of some bedsteads of the last-named material, and the great facility with which they may be taken to pieces, packed in a very small compass, and put together in an exceedingly short time, recommend them very strongly for camp and travelling use, as well as, in many cases, for articles of household furniture. Another class of bedsteads which claims notice, comprises those ingenious contrivances which have been devised for the comfort of invalids, and to facilitate the necessary surgical operations upon patients with fractured limbs, or such as have wounds requiring frequent dressing and careful shielding from the injuries incidental to even the most careful removal of the body. By means of such inventions, several of which, having been proved by experience to be efficient, have been rewarded by the Society for the Encouragement of Arts, Manufactures, and Commerce, and described in their 'Transactions' (vols. xxix., xxxii., xxxix., and xlix.), the position of a bed-ridden patient may be varied in every conceivable way with little or no exertion to himself, and the offices of the attendant and the surgeon may be performed with the greatest possible facility. Even these however have failed in one important point; for however perfect their mechanical arrangements may be, they cannot prevent the distressing consequences which arise from the unequal pressure of a body reduced to a state of extreme debility upon a bed which, however soft, cannot supply a uniform support to every portion of its surface. In many cases where the primary disease or injury has been insufficient to destroy life, mortification and death have ensued from this unequal pressure, notwithstanding the utmost care and the use of air-cushions and down-pillows to mitigate the evil. A painful case of this character having come under the notice of Dr. Arnott, led him to the invention of the hydrostatic or water bed, which consists of a trough lined with thin sheets of metal, and partially filled with water, upon the surface of which floats a sheet of water-proof India-rubber cloth, of sufficient size to completely line the trough when empty, and secured to its upper edge in such a way as to prevent the escape of the water by capillary action. Upon this sheet is laid an ordinary soft feather-bed or mattress, which, floating on the yielding surface of the water, affords a support to the patient comparable only to that afforded by the water of a bath. Every point of the uneven surface of the body having, as it were, its separate column of support, the pressure is so equally distributed as to afford the patient comfortable rest, and effectually to prevent the formation of sores upon the most prominent points. The depth to which the body will sink in such a bed may be regulated by the thickness and buoyancy of the mattress, and any unusual position may be obtained by placing light and bulky cushions or folded blankets under such parts of the body as it may be desired to elevate, just as the position of a body floating in water may be affected by the use of buoys. The mass of water prevents the approach of cold air from beneath, and also, by its non-conducting properties, does not allow of the dispersion of heat downwards, so that, contrary to what might, at first sight, be expected, the hydrostatic bed is a warm one; but as the impermeability of the India-rubber cloth impedes the escape of perspiration, care should be taken, when the patient is unable to leave the bed daily, either to lay a water-proof cloth above the mattress to receive the moisture which would, without it, descend through the mattress, and becoming condensed on the floating sheet below it, would render the bed damp and unwholesome; to lay a blanket, which should be frequently changed, to collect the perspiration which descends from the bed; or to place a layer of small pieces of cork, the interstices of which may afford a degree of ventilation between the mattress and the floating sheet. The perfect adaptability of the surface of such a bed to whatever may be laid upon it, allows the dressing of wounds, the application of poultices, and the performance of other offices of the sick chamber, without disturbing the patient. A full account of this admirable invention, the author of which gave it to the public without taking out a patent, is given in No. 26 of the *Penny Magazine* (Old Series), from the fifth edition of Dr. Arnott's *Elements of Physics.*

BEDSTRAW. [Galium, P. C. S.]

BEECHEY, SIR WILLIAM, R.A., one of the most successful of the recent English portrait-painters, was born at Burford in Oxfordshire, in December, 1753, and was originally articled to a conveyancer at Stow. But having a strong love for painting, he determined to pursue it as a profession, and he obtained admission into the Royal Academy in 1772. Though with many able rivals, some of whom were the most eminent painters of the English school, Mr. Beechey early distinguished himself, and was elected an Associate of the Royal Academy in 1793, and was appointed in the same year portrait painter to the queen, of whom he painted a whole-length.

In 1798 he executed his principal work, a large equestrian picture of George III., the Prince of Wales, and the Duke of York, attended by Generals Dundas, Sir W. Fawcett, and Goldsworthy, reviewing the Third and Tenth Dragoons; for which he was elected a Royal Academician and knighted by the king, being the second artist upon whom George III. conferred that honour: the first was Sir Joshua Reynolds. West however had declined the honour. This picture is now at Hampton Court.

From this time Sir William was much occupied, and he painted the majority of all the persons of distinction, rank, and fashion of his time, including several portraits of nearly all the members of the royal family. Among his portraits are also those of Lord Nelson, Lord St. Vincent, Sir W. Hamilton, Lord Cornwallis, Mr. Addington, afterwards Lord Sidmouth, John Kemble, &c. His portraits generally gave satisfaction, especially in their attitudes and expression, which are the most difficult departments of portraiture. His colouring was gay and light, and his earlier pictures were well modelled; but his latest works are negligently executed. There is a portrait of Nollekens by Sir William Beechey in the National Gallery. He died at Hampstead in the month of January, 1839, at the age of 86. He was twice married, and left a numerous family. Captain Beechey, R.N., who was one of Sir E. Parry's lieutenants in his second polar expedition, is the son of Sir William Beechey.

(*Art-Union Journal*, February, 1839.)

BEGARE'LLI, ANTO'NIO, a celebrated modeller of Modena, where he was born about 1498. Who his master was is not known, but he was probably Guido Mazzoni, or Giovanni Abati, the father of Niccolo. He was the friend of Correggio, and is said not only to have instructed that celebrated painter in modelling, but to have even modelled many figures for him to facilitate his labour in the painting of the cupola of Parma, of which the numerous and strong foreshortenings rendered models necessary. There are few of the works of Begarelli left; the principal is the Descent from the Cross in the church of Santa Margherita, containing many figures in the round rather larger than life, and of which, or some others, Michelangelo, says Vasari, remarked, 'Se questa terra diventasse marmo, guai alle statue antiche'—'If this clay were to become marble, woe to the ancient statues:' an extravagant compliment, which the figures do not warrant, in the opinion of Fiorillo, and no doubt truly. There is a tradition that three of the figures of this work were modelled by Correggio, but probably without foundation. He died in 1565.

(Vedriani, *Vite di Pittori, &c. Modenesi;* Tiraboschi, *Vite, &c. Modenesi;* Fiorillo, *Geschichte der Mahlerey*, &c.; Lanzi, *Storia Pittorica*, &c.)

BE'HAM, HANS SEBALD, a very celebrated German painter and engraver of the sixteenth century, whose name has been corrupted into all shapes by many foreign and some German writers. He was born at Nürnberg in 1500, and was one of the best of Albert Dürer's scholars, and was a man of great ability; but his profligacy was, according to tradition, equal to his ability. He was forced, through his bad character, to leave Nürnberg, and he settled in Frankfort, but not to reform, for he here set up a wine-shop and brothel, and is reported to have been drowned by the authorities about 1550, on account of his extreme depravity. This is the account of Hüsgen, who says that it was the practice to condemn various kinds of criminals, and among them pimps, to be drowned: he refers to Lersner's 'Chronik.' Doppelmayr says he went to Frankfort in 1540, and died there in 1550. The particular nature of Beham's depravity is not mentioned further than that he published obscene prints at Nürnberg, and kept a wine-shop and brothel at Frankfort. He must have been however very industrious from the number of his works; and his depravities must have been such as were not inconsistent with industry in his art. As a painter he is scarcely known. His name is written Boehm and Beham by good authorities, and some maintain that his name was Sebald only; but most of his prints, or those attributed to him, are marked with a monogram of H. S. P. and H. S. B. in upright capitals intermingled.

His prints consist of woodcuts, and of etchings and engravings on copper. Those marked with the P. were, according to Sandrart, his earlier works; and those with the B. from about the time that he went to Frankfort. His first instructor was his cousin Bartholomew Beham, likewise a pupil of Albert Dürer, and also of Marcantonio in Italy. Heineken enumerates 392 prints by Beham, including 58 woodcuts, and 21 done after his designs by other engravers. Bartsch describes even 430, of which 171 are woodcuts. He is reckoned among the so-called little masters, from the extreme smallness of their prints. His prints are much in the style of those of Aldegrever; occasionally correct in drawing, but generally, especially in the draperies, in the Gothic taste. His engravings are superior to his cuts and etchings. His cousin, Barthel or Bartholomäus Beham, was an excellent painter for his period. He was a pupil of Albert Dürer, and was sent by the duke Wilhelm of Bavaria to study in Italy, where he died, says Sandrart, in the prime of life, and, according to Doppelmayr, in 1540, which is also the last date upon his works: he was born about 1496.

Barthel Beham was extremely laborious and careful in his paintings; but if it be true that he studied in Rome in the later years of Raphael's time, his taste at design is no credit to him. Yet his picture in the Pinakothek at Munich, of the resuscitation of a woman by touching her with the cross, is one of the masterpieces of the old German school. The act takes place in the presence of the empress Helena and a crowd of spectators; and the picture has the following inscription: 'Crux Christi ab Helena reperitur, a Macario, mortua suscitata, adprobatur. Anno CCXLIII.' There is in the same collection a picture in a similar style of Marcus Curtius leaping into the Gulf. Barthel was also an engraver, and, according to Sandrart, assisted Marcantonio in his prints after Raphael. There is a print of Charles V. by Barthel Beham, which Vasari seems to have attributed to Marcantonio. His prints are better drawn than Hans Sebald's, but they are not nearly so numerous: they probably do not exceed 70. Many are from Greek and Roman history and mythology. Sandrart says that some of the prints which bear the name of Marcantonio were executed entirely by Beham.

(Sandrart, *Teutsche Academie*, &c.; Doppelmayr, *Historische Nachricht von den Nürnbergischen Künstlern*, &c.; Hüsgen, *Artistisches Magazin*, 1790; Heineken, *Dictionnaire des Artistes*, &c.; Bartsch, *Peintre-Graveur;* Brulliot, *Dictionnaire des Monogrammes*, &c.)

BELEMNITE'LLA. The group of Belemnites which occurs in the chalk formation, and which is marked on the anterior and ventral face by a long narrow fissure, is thus named generically by D'Orbigny. To this group belong B. mucronatus, B. granulatus, B. mammillatus, &c. in Europe, and B. Americanus in the United States, if this last be really distinct from B. mucronatus.

BELEMNITES. To the history of this singular group of cephalopodous fossils the progress of careful research has lately added very important facts. In addition to the circumstances attending the discovery of some traces of the general form of the animal at Solenhofen, and of the ink-bag and horny laminæ at Lyme and Whitby, we have to record the almost complete restoration of the Belemnite animal from specimens laid open in the cutting of the Great Western Railway, near Chippenham in Wiltshire. The Oxford clay here excavated afforded to Mr. Pratt and the Marquis of Northampton admirable specimens of the phragmacones and laminar plates, outlines of some of the soft parts of the body and arms, and the form and arrangement of the hooked appendages of the arms. Indeed one of Mr. Pratt's specimens reveals the place and size of the eyes, the funnel or breathing-tube, the tendinous parts of the mantle, and the lateral fins, the ink-bladder, and ink-duct. (Owen, *Hunterian Lectures*, 1843.) Professor Owen, to whom the finest specimens of these discoveries were submitted, has found a strong resemblance between the fossil animal and the group of recent Sepioid animals called Onychoteuthis, on whose arms are not the usual cusps, but slender horny hooks. The arms, eight in number, were equal, slender, and furnished with hooks through all their length, alternating in a double row. The fins appear round, and a little behind the middle of the body, as in Sepiola; the caudal extremity pointed, enclosing the fibrous guard, the anterior extremity of the laminar plate, under which the ink-bag is placed, nearly transverse, and not arched so as from analogy with the sepiosteum might have been expected. The Belemnitic animal—a dibranchiate eight-armed cuttle—must, in some instances, to judge from specimens of the fibrous conical extremity, have reached (arms included) four or more feet in length, and its figure appears favourable for swift motion. In the lias deposits whole shoals of some of the species appear to have perished together, and we have found about the cones many indications of the presence of animal substances.

. The geological distribution of the Belemnites has been largely examined. In 1835 Professor Phillips presented to the British Association at Dublin a full account of the structures and mode of occurrence of the British species: assigning names and characters to the principal groups which occur in the cretaceous, upper oolitic, lower oolitic, and liassic strata. M. d'Orbigny has lately published results perfectly accordant, derived from a full investigation, especially of the species occurring in France. It thus appears that in the first place Belemnites are confined as a group to the mesozoic strata; that many species allied to the B. compressus of Voltz, B. penecillatus of Blainville, and B. paxillosus of Schlottheim, belong to the lias; that others allied to B. ellipticus of Miller, B. quinquesulcatus of Blainville, B. Aalensis of Voltz, belong to the lower oolite series; that others allied to B. sulcatus of Miller, B. Altdorfensis of Schlottheim, abound in the period of the Oxford clay; while B. mucronatus, B. quadratus, B. Listeri, B. attenuatus, and others now ranked as Belemnitella by D'Orbigny, characterise the cretaceous strata. The investigations entered into on this subject are yet incompletely published; but the reader may refer with advantage to the Treatises of Blainville and Voltz, to Buckland's Bridgwater Treatise, D'Orbigny's 'Palæontologie Française,' and to Owen's 'Hunterian Lectures.' Figures illustrating several points occur in Mantell's 'Medals of Creation,' vol. ii.

BELL, DR. ANDREW. [Schools, Primary, P. C.]

BELL, GEORGE JOSEPH, a writer on law and jurisprudence, was born at Fountainbridge near Edinburgh, on the 26th of March, 1770. He was educated at Edinburgh, and became a member of the faculty of Advocates in 1791. In 1804 he published, in two volumes 8vo., 'A Treatise on the Laws of Bankruptcy in Scotland.' In 1810 he published an enlarged edition of the same work in 4to., with the title 'Commentaries on the Laws of Scotland, and on the Principles of Mercantile Jurisprudence considered in relation to Bankruptcy, Competitions of Creditors, and Imprisonment for Debt.' A fifth edition of this work was published in 1826, in two large 4to. volumes, with the title 'Commentaries on the Laws of Scotland, and on the Principles of Mercantile Jurisprudence.' 'Bell's Commentaries' is perhaps, next to Erskine's 'Institute,' the best known and most amply consulted work on the law of Scotland. Until the late alterations in the bankruptcy law there [Bankruptcy, P. C. S.], it was the leading authority in that department of the law, and it continues to afford light on so much of the practice of the old act as has not been superseded; while in the other departments of mercantile law—vendor and purchaser, shipping, insurance, &c., it is still a work of the highest authority. The author's task was one of peculiar difficulty, as previous commentators had generally limited their elucidations to those parts of the law of Scotland which affect succession and the commerce in landed property; and a commentary on mercantile law necessarily involved not only a statement of the results of decisions in Scotland, but also a view of those generic distinctions in principle which frequently made decisions on like questions in commercial law in England and Scotland so different from each other. One of the useful results of Mr. Bell's labours has been an assimilation, without any violent distortion of principle, of the practice of the commercial law of Scotland to that which has long existed in England. Of the Commentaries, Sir Samuel Romilly said, 'I consider it as one of the best, if not the very best law-book that has been published in my memory.' On the 27th of May, 1819, after the publication of the third edition of his work, the author received the thanks of the Faculty of Advocates. Mr. Bell wrote 'Principles of the Law of Scotland,' which has gone through several editions; 'Illustrations of the Principles of the Law of Scotland;' and several minor works. He was at the head of a commission of inquiry appointed in 1823, in consequence of whose report, and of Mr. Bell's active exertions, very important organic changes were made in the administration of civil justice in Scotland. In 1821 he was appointed Professor of Scots Law in the University of Edinburgh; and in 1831 a principal clerk of session. He had married, in 1806, Barbara, daughter of Charles Shaw, Esq., of Ayre. He died on the 23rd of September, 1843.

BELL, SIR CHARLES, was born at Edinburgh in 1774. He was the son of a clergyman of the Scottish Episcopal Church, settled for many years in a small cure at Doune, in the county of Perth. The three elder sons, Robert Bell, John Bell, and George Joseph Bell, all attained eminent positions in life: the first was a distinguished writer to the signet in Edinburgh; the second attained the highest rank in his day as a surgeon; and the third long occupied the chair of Scots Law in the Edinburgh University. The youngest brother, Charles, did not receive quite the same academical advantages of education as his brothers, in consequence of the death of his father when he was very young. But as he himself said well in after-life, 'My education was the example set me by my brothers;' and most gratefully he always acknowledged the lessons which his mother bestowed on him, her favourite child. At the High School of Edinburgh Charles made no marked figure. It was under the eye of his brother John, whose profession he had adopted, that he first gave evidence of his great talents. He became a first-rate anatomist, and lectured to some hundred pupils on that science while comparatively a boy. His internal consciousness of ability, however, and the ambition inseparable from it, led him to long for increased opportunities of exertion, and in the year 1804, at the age of thirty, he removed to London. Perhaps the bitter dissensions then raging in the Edinburgh Medical School, in which his brother John was deeply involved, had some effect in prompting him to this escape to a new scene.

At the outset, the prejudices against Scotsmen which Johnson, Churchill, Wilkes, and others had so illiberally fostered, seem to have stood in the way of Charles Bell in London, but he overcame them in time, and became intimate with Sir Astley Cooper, Abernethy, and other great surgeons of the day. His work on the 'Anatomy of Expression,' published in 1806, did much to give him a name in London; and most deservedly so, that treatise being acknowledged by Wilkie, and many illustrious painters, as having deeply influenced their own studies and practice in drawing the human figure. Nevertheless, though advancing by slow yet sure degrees as an operative practitioner, Bell was forced to begin lecturing in a very humble way, having yet obtained no aid from association nor any connexion with the chief medical schools. In the same year (1807) in which he entered on this course, he published his first edition of his 'System of Operative Surgery,' a work which was rendered valuable by its practical character: no single operation was described theoretically, but all from full personal experience. At this period, in some beautiful letters to his brother George Joseph Bell, he describes the dawning upon his mind of those discoveries in the nervous system, which will form his noblest monument in the judgment of posterity. But he also grieves most bitterly, in this correspondence, over the neglect with which the public, generally, treated these early speculations. We may once for all observe, regarding this series of fraternal letters, that if no other proof of the writer's genius existed, they would form in themselves satisfactory testimony to his abilities. His frequent aspirations 'to be chief of his profession in character' indicate a man of no common stamp.

In 1811 he married Miss Shaw, a lady who brought happiness to his hearth, and several of whose relatives have become eminent in their various departments. John and Alexander Shaw (the latter only now living) obtained high reputation as surgeons and anatomists under the eye of their brother-in-law; Patrick, another of the family, is now a distinguished member of the Scottish bar. To Alexander Shaw we owe an able vindication of the just claims of Bell in the field of anatomical and physiological discovery. In the same year (1811) Bell became connected with the Hunterian School in Windmill Street; and in 1814 he was appointed surgeon to the Middlesex Hospital, an institution which he subsequently raised to the highest repute, and which he justly boasts, in 1836, of leaving 'with full wards, and 120,000*l.* in the funds.' It was both from his extraordinary skill as an operator, and from his style of lecturing—which, though not especially eloquent, was striking and suggestive—that his labours were crowned with success, both as regards the patients and the pupils of the Middlesex Hospital.

Bell had already been engrossed by the consideration of cases in Military surgery, when our wounded troops came home from Spain. The battle of Waterloo revived his enthusiasm in this branch of his art, and he visited the battle-field immediately after the battle. Bell did great service to the wounded by his surgical skill on the occasion of his visit, as the 'Life of Sir Walter Scott,' and other authorities more direct, fully prove.

In 1821 Bell produced his first well-known paper on the 'Nervous System' in the Philosophical Transactions. It was read before the Royal Society, and, almost contrary to the long-disappointed author's expectations, excited immediate and wide attention. Fortunately for him, the main views there laid down had been printed in a pamphlet, and issued for distribution among his friends in 1811; for various persons, recognising now the value of the discovery, soon came forward to claim the merit of it. As to this point, the work of Mr. Alexander Shaw, with the recent testimonies of the Royal Society and the College of Surgeons of London, have set the disputed question at rest. Even before he left Edinburgh, Bell, as his letters of the date prove, had obtained a glimpse of the great truths which were afterwards materially evolved by him. In working out these discoveries, he might use the services of pupils; but none of them have established any just claim to the praise due to these great discoveries. Before the time of Bell, all nerves were held to be alike in character, and were considered simply to give more or less nervous susceptibility to any organ, in proportion to the numbers in which they were there distributed. Bell discovered and showed, that the nerves were naturally distinguished among themselves and clearly classified; and that the nerves of sense (whether peculiar or general), and those of motion, were totally distinct in their character and origin. As regards the brain, he exemplified this fact strikingly by his experiments on the nerves of the *senses*, so specially called. A prick to a common nerve of the orbit of the eye produced pain, as he demonstrated; a similar touch on the optic nerve gave no pain, but an impression of a flash of light. He found the difference betwixt the peculiar and primary nerves of hearing and taste, and those which give to the organs of these senses the ordinary kind and degree of feeling, and to their muscles the power of motion or contraction. He, in fact, laid bare, for the first time, the great fact of a distinction existing in the nature and quality of the nervous energy, which before his discourses had been all huddled together under one interpretation. As respects the body and spinal marrow, Bell discovered a division of the nerves, perfectly analogous to that detected by him in relation to the brain. The common nerves distributed over the animal trunk fulfil the two grand functions of giving sensation and motion. On cutting a spinal nerve, the older anatomists found both feeling and motion to be lost by the part which is thence supplied with nervous energy, and they concluded that the nerve carried both qualities conjointly. But Bell looked deeper into the matter, and he was rewarded by the discovery, that the two roots, by which the spinal nerves are connected with the vertebral medulla, derive and bear from them different qualities—the anterior root conveying the motor power, and the posterior that of sensation or the sensor power. Following up his inquiries, he discovered, likewise, the special nerve of respiration, and others with particular qualities, as to which before his time not even a conjecture had been made.

It is impossible in a brief sketch to advert to all the great practical results consequent on these discoveries. The puzzling cases which often occurred, where sensation or motion were singly or severally lost, became clear to the eyes of competent practitioners; and operators received a warning and guidance which may have already saved the lives of many persons. Before quitting this subject—in which Bell may be named as a discoverer equal even with Harvey—we ought to point to one of his practical inferences from his own views, which establishes the existence of a sixth sense—that by which we attain our knowledge of distance, size, weight, form, texture, and resistance of objects. Two of his Essays, 'On the Nervous Circle,' and 'On the Eye,' have reference to this theory. The basis of it is, that the nerves of sensation play the part of reporters on the motor nerves, and indicate to the central seats of perception the condition of things within the influence of these nerves, thus forming the sixth or muscular sense.

Numerous were the hints which the genius of Bell threw out to the profession about this time, in lectures and short essays. The operation for the cure of squinting, for example, by division of the contracted muscle of the orbit, had occurred to him long before it was thought of by the German who now has the credit of the discovery, as letters before us fully prove. The existence of a vital attraction betwixt the solids and fluids of the body was also an idea of Bell, now propounded by others as new. But his discoveries on the nerves certainly established his reputation. In 1824 the London College of Surgeons offered to him their senior chair of anatomy and surgery, which he accepted; and his lectures, which were received with great applause, formed the basis of a work entitled 'Animal Mechanics,' published in 1828—1829, by the Society for the Diffusion of Useful Knowledge. Two other works, which combine high scientific knowledge with such a popularisation of the subjects as fitted them to ordinary capacities, followed soon afterwards; the one is the 'Bridgewater Treatise on the Hand,' and the other 'Illustrations of Paley's Natural Theology,' an accompaniment to Lord Brougham's work on that subject. In the mean time Bell was in the first rank of his profession, and had an ample attendance on his lectures, not only of pupils, but of men his seniors in practice. On the Continent he was even more highly estimated. Cuvier, Larrey, and other illustrious men of science, vied with one another in testifying their admiration of his talents and his labours. On the accession of William IV. he was one of those selected for the honour of knighthood with Herschel, Brewster, and others. When the London University (now University College) was established, he was offered the chair of Physiology, and he accepted the offer; but after a short period he gave in his resignation. For some time subsequently, he chiefly pursued his private professional practice, with a reputation firmly established. He had still the same ardent desire, which was the passion of his youth, to prosecute experimental physiology; and, accordingly, when an offer of the chair of Surgery in the Edinburgh University was made to him, he accepted it, though after much doubt and reluctance. His regret at quitting his London friends was great, but it was overbalanced by the hope of spending his latter years happily among those friends who had been dear to his youth, and still more so by the expectation of being again placed in a position to renew with effect his scientific studies.

Sir Charles Bell removed to Edinburgh in 1836, having been absent thirty-two years. His opening lecture as Surgical Professor was brilliantly attended by professional and non-professional men of eminence; and he subsequently fulfilled all the high anticipations formed respecting the conduct of his class. But he soon found that Edinburgh was not the field in which he could work out his experimental projects, either by means derived from his own exertions or through patronage. He had 'meditated a splendid work on the Nervous System,' he says in one of his letters, but he did not find means for its accomplishment; and the only great work which he did finish was a new edition of his 'Anatomy of Expression,' largely increased and improved by his observations on an Italian journey undertaken by him in one of the intervals betwixt his sessions at college. In the summer of 1842 Sir Charles set out on a journey to London. He reached the seat of Mr. Holland, of Hallow Park, on the 27th of May, where he died on the night of his arrival. His death was not altogether unexpected. He had recently suffered much from *angina pectoris*, a disease of some standing in his case. It was aggravated, there is reason to believe, by disappointments consequent on his settlement in Edinburgh; and also by anxieties connected with the New Medical Reform Bill, much of which he believed to be at variance with the interests of that profession and science to which he was so strongly attached.

BELL-CASTING. Under Bell, P. C., have been given a few of the most interesting points connected with the history of these instruments; under Alloy, P. C., the relative proportions of copper and tin contained in them; and under Founding, P. C., the broad principles which govern the casting of metals in general. A few details concerning the practical application of these principles to bell-casting will complete the subject.

The casting of common house-bells or hand-bells differs in nowise from the processes relating to small castings in metal generally; but for church-bells the case is otherwise. The production of a *sonorous* quality, in addition to many of those which pertain to all large castings in mixed metal, gives occasion for many scrupulous arrangements in the management of the foundry. There is only one such foundry in London, and very few in the country generally.

A bell-foundry must have a furnace which will contain many tons of metal, for the whole of the casting for one bell is made at once. In 1835, for instance, Messrs. Mears cast the new Great Tom of Lincoln, intended to replace the old Great Tom; it weighs 12,000 pounds, being somewhat heavier than the great bell of St. Paul's Cathedral; and the whole of this ponderous mass of metal was melted at one time and in one furnace. This Great Tom, though smaller than the bell of St. Paul's, is heavier, on account of its greater thickness.

The arrangements as to the central core or mould for casting a large bell are thus made:—Contiguous to the furnace is a pit, deeper than the height of the bell. In the centre of this pit is built up a rough mass of brickwork, somewhat smaller than the interior of the bell; and this is coated externally with a mixture of earth and horse-dung, applied in successive layers, and worked smooth by gauges until the *exterior* of the core presents exactly the same size and shape as the *interior* of the intended bell. When the prepared core is thoroughly dried by means of fires, a second coating of composition is laid on of the same thickness as the intended bell; this coating, which is called the 'model,' is formed of earth and hair, and is, like the former, brought to a very smooth and correct surface by gauges, the exact counterpart of the exterior of the bell. A third coating is next applied, called the 'shell,' much thicker than the others, and formed of a somewhat different composition. A little tan-dust is sprinkled on the first coating, or core, before the second, or model, is applied; and also on the latter, before the outer coating, or shell, is laid on. When all is well dried, the 'shell' is lifted off from the 'model,' and the model is picked or cut off from the core piecemeal. If we suppose the core, the model, and the shell to be three hemispherical cups placed one within another, and the middle one to be removed, it will serve to illustrate how a vacant space comes to be formed between the core and the shell; and when we further bear in mind that the exterior of the core gives the internal form to the bell, and the interior of the shell the external form, the object of the whole arrangement will be clearly seen.

This internal cavity of the mould, between the core and the shell, is that into which the metal is to be poured. The casting-pit is filled up with loam or earth, to the level of the top of the mould; a shallow channel is cut in the loam from the furnace to an orifice communicating with the vacant space in the mould; and two other orifices are left for the escape of air as the melted metal enters. Meanwhile the metal is being melted in the furnace. The tin employed is in the form of blocks, brought from Cornwall; while the copper is old ship-sheathing and other fragments. These are melted in a reverberatory furnace, by the heat of billets of wood, a kind of fuel less injurious to the metal than either coal or coke. All being ready, the earth which stops an orifice in the lower part of the furnace is knocked or dug away, a narrow jet instantly pours out from the opening, and a stream of liquid fire (for so it seems to the eye) runs along the channel in the loam, and flows into the mould, bubbling and hissing, and giving forth greenish sparks. When the mould is full, the metal is allowed to remain till perfectly cool; the loam is then removed, the external 'shell' lifted or cut from the bell, the bell lifted off the core, and the core pulled down. If the bell be very large, it alone occupies the pit; but if of smaller size, such as from three or four to ten or twelve hundredweights, six or eight may be cast in one pit at one time.

The tone of a bell depends conjointly on the diameter and the thickness; a small bell or a thick bell giving, relatively, a more acute tone than one which is either larger or thinner. Hence the founder regulates the diameter and thickness according to the musical pitch of the tone which the bell is to yield; but as this cannot be rigidly attained by casting only, the bells (say a set to form chimes) are attuned by chipping away some of the metal with a sharp-pointed hammer; reducing the diameter at the lower edge when the tone is too low, and reducing the thickness at the part where the hammer strikes when the tone is too acute.

While these sheets are passing through the press, the public journals announce the completion, by Messrs. Mears of Whitechapel, of a bell intended for the south tower of York Minster. It is larger than any other in the United Kingdom, its weight exceeding twelve tons. It is seven feet seven inches in height, with a diameter of eight feet four inches. It is seven tons heavier than the 'Great Tom' of Lincoln, and five tons heavier than the 'Old Tom' of Oxford. The metal took twelve days to cool. The clapper weighs between three and four hundredweight. The cost is about 2000*l.*

BELL-METAL. [Bell-Casting, P. C. S.]

BELLA, STE'FANO DELLA, a celebrated Italian etcher on copper, born at Florence in 1610. He worked until his thirteenth year in the shop of Orazio Vanni, a goldsmith, when his own inclination, and some instruction he received in painting from his master's son, Gio. Battista Vanni, and in engraving from Cantagallina, induced him to give up the intention of following the business of a goldsmith, and to follow the arts. He accordingly applied himself to painting under Cesare Dandini, but he eventually adopted etching as his profession, being attracted by the prints of J. Callot, a distinguished pupil of Cantagallina.

Some of Della Bella's works having attracted the notice of Lorenzo de' Medici, the brother of the grand-duke Cosmo II., that prince sent him to complete his studies in Rome, where he remained three years, and etched many views of the city. After his return from Rome, he went in the suite of the Tuscan ambassador to Paris, and remained there eleven years, and executed many of his best etchings, by which he obtained a great reputation. His subjects are battles, sieges, animals, sea-pieces, landscapes, and ornaments. They are executed with freedom, with great delicacy, and are also well drawn, and he had a fertile and happy invention. Cardinal Mazarin wished to retain him at Paris, and offered him the situation of drawing-master to Louis XIV., then a minor and a child. But he returned to Florence about 1647, and undertook that office to the prince Cosmo, afterwards grand-duke Cosmo III., a post which he held until his death in 1664. He was one of the best masters of the etching-needle, and has been surpassed by few in the number of his works; their number is given differently by different writers, but they probably amount to about 1500; and though he did so much, what he did he did well. Before his death he grew melancholy: his last works were six etchings of the Havoc of Death, which however he did not quite complete. There is a portrait by Della Bella in the Pitti palace of the grand-duke Cosmo III. His own portrait by Stocade has been engraved by Hollar.

One of his most valued etchings is a large view of Pont-Neuf, Paris, which, as originally issued in 1646, is very scarce.

(Gandellini, *Notizie Istoriche degl' Intagliatori*, &c.; Heineken, *Dictionnaire des Artistes*, &c.; Huber, *Manuel des Amateurs*, &c.)

BELLE'ROPHON, a genus of fossil shells, rich in species, which occur exclusively in the Palæozoic formations, is in the Silurian strata, Devonian rocks, and mountain limestone. It has been generally referred to Cephalopoda, and considered analogous to Argonauta; but D'Orbigny has given reasons for ranking it with the Heteropodous Mollusca, and comparing it with Carinaria.

BELLI'NI, VINCENZO, a modern composer, of considerable celebrity, was born in 1806, at Catania, in Sicily. His two immediate progenitors were musical men, one a Maestro di Capella rather distinguished in his own country Bellini was educated in the Conservatorio at Naples, under Zingarelli, and in that city, before he had completed his twentieth year, he produced an opera, 'Bianca e Fernando,' at the theatre San Carlo. The following year he wrote for the Scala at Milan 'Il' Pirata;' and this was succeeded by 'La Straniera' at the same, 'La Sonnambula' at Naples, 'I Capuletti ed i Montecchi' at Venice, 'Norma' at Milan, 'I Puritani' for the Théâtre Italien at Paris, &c. Having undertaken to compose a grand opera for the Académie Royale de Musique, he retired to Pateaux near Paris, under the hope of recruiting his strength for the task; but pulmonic disease had made too great progress in his frame to be arrested, and he died on the 23rd of September, 1835, within a fortnight after he had quitted the French metropolis.

Bellini's moral character stood high, and his manners and compositions were in strict accordance;—agreeable, tender, and elegant. He rarely attempted the brilliant, and never aspired to the sublime, or even the lofty. A sweetness of melody, a fitness of harmony, and an adaptation of the sound to the sense, characterise all those of his works which have come under our notice. His constitutional tendencies seem to have been adverse to that vigorous exertion of mind which in a more healthy state he might have exhibited: and (as we have elsewhere observed), we are willing to believe that had he not been cut off in almost his youth, his ambition would probably have led him to attempt something that might have secured to him the privilege of being heard in future times, for in most of his productions are traits of genius, and in none that are known to us are there any violations of good sense. He was very fortunate in his *libretti*, or dramas, and equally so in the performers for whom he wrote. The subjects he chose were interesting, and placed before the public by a body of actors and singers who were able and willing to do them every possible justice.

Sig. Bellini received the order of St. Francis from the King of Naples, and the cross of the Legion of Honour from Louis-Philippe. His remains were honoured by a grand solemnity in the church Des Invalides, and deposited in the cemetery of Père la Chaise.

BELLIS (from *bellus*, pretty), a genus of plants belonging to the natural order Compositæ, and to De Candolle's suborder Corymbiferæ, tribe Astoroideæ, subtribe Asterineæ, division Astereæ, and subdivision Bellideæ. It has a receptacle without scales, flowers of the ray ligulate, pistilliferous in one row, those of the disk hermaphrodite tubular, the involucre composed of two rows of equal obtuse scales, the receptacle conical, the fruit compressed without pappus. De Candolle enumerates five species belonging to this genus. One of them, the *B. perennis*, is the common daisy, and is a native of Great Britain and throughout Europe. It has obovate-spathulate single-ribbed crenate-dentate leaves. It is an exceedingly common plant on banks and in pastures in Europe. It blossoms nearly all the year round, and is constantly found with opened flowers from March to October. It is subject in its wild state to varieties, sometimes all the florets are found ligulate, more rarely they are all tubular. There are several varieties of the common daisy cultivated in gardens. There is a double variety called large-double, another double-quilled, and a proliferous variety known by the name of hen and chickens. These varieties assume various colours from deep red to pink and white. They are easily cultivated, and form pretty plants for edges and borders, and continue in blossom a long time.

B. sylvestris and *B. annua* are natives of Europe, but are not cultivated. The genus *Bellium* closely resembles Bellis, it differs however in possessing a pappus surrounding its fruits. The species are found in the south of Europe, and appear like small species of Bellis.

(Babington, *Manual;* Loudon, *Cyclopædia of Plants.*)

BELLOWS. [Blowing-Machines.]

BELONO'STOMUS, a genus of fossil fishes established by Agassiz. The British species (four) occur in the lias, oolite, and chalk; the foreign in the oolite of Pappenheim.

BELO'PTERA (Blainville), the shelly portion of a fossil cephalopod, intermediate between Belemnites and Sepia. It occurs in the French tertiary strata, and includes B. Cuvieri, B. compressa, and B. belemnitoidea (Blainv.). Mr. Morris adds B. anomala and B. longirostrum, from the English tertiaries.

BELOSE'PIA (Voltz). In this genus M. Voltz ranks two of the species (B. Cuvieri and B. compressa) which form part of the Beloptera of Blainville.

BEOWULF. [Saxon Language and Literature, p. 490.]

BERBERRA, or BURBURRA, is a commercial place in Africa, situated on the southern shores of the Gulf of Aden, and nearly opposite the British settlement of that name, in 10° 27′ N. lat. and 45° E. long. It is built at the head of a small inlet, which affords excellent shelter from all the prevailing winds throughout the year. The town consists of an assemblage of rude huts of various forms, round, oval, and square, generally about six or seven feet in height, built with sticks covered with mats or skins. These huts are erected in November, or as soon as the first caravan arrives, and are dismantled at the breaking up of the fair in the month of May, when the greater part of the materials are taken away. Very few persons remain on this part of the coast during the north-east monsoon, owing to the suffocating hot winds, which in June, July, and part of August, blow with great violence. The permanent inhabitants are a few Banians and some chiefs of the neighbouring tribes, who have houses of a larger size, which are divided into apartments.

The trading season commences about the end of October or beginning of November, when the first caravans from the interior arrive on the coast, and bring with them materials for constructing the huts, and immense droves of sheep, which are immediately embarked for the Mocha market before they have time to fall off in flesh, as there is no pasturage for them about Berberra. After the beginning of November caravans arrive daily, and also vessels from all the neighbouring countries. The March cafila however is the principal, and frequently consists of two thousand camels. These caravans bring ghee, coffee, sheep, myrrh, benzoin, gum Arabic, elephants' tusks, gold-dust, slaves, ostrich feathers, dry hides, and also an article called *wurs* in Arabia, which is described as something like saffron in appearance, and is used in that country as an ointment for cooling the body; it is also mixed with flour and made up in cakes, in which state it is said to be very palatable. Among the slaves are many Christians from the neighbourhood of Shoa in Abyssinia. The vessels which visit this place come from Bussorah, Muscat, Cutch, Bombay, Mangalore, Masulla, Aden, Mocha, and Jiddah: they import blue and white cotton-cloth, Indian piece-goods, European prints, silks, silk thread, shawls, red cotton-yarn called *shumlah*, beads, sugar, rice, iron, copper, wire, zinc, dates, and a few smaller articles.

The country at the back of Berberra is inhabited by the Somaulis, and affords neither pasturage nor cultivation to a distance of ten miles, the soil consisting of a coarse sand or gravel. Berberra is the harbour of Harrar, a large town in the interior, which according to some accounts is twenty days journey from Berberra, whilst others reduce the distance to five or six days' journey. It is also visited by six or seven tribes inhabiting these parts of Africa.

(Ethersey's *Information on the town of Burburra*, in the *Transactions of the Bombay Geographical Society*, vol. i.; and Barker's *Extract Report on the probable geographical position of Harrar, with some information on the various Tribes in the Vicinity*, in 'London Geographical Journal,' vol. xii.)

BERENI'CEA, a celluliferous coralline, of which B. diluviana is an example, fossil in the oolite of Wilts.

BERGKALK, in Geology, the German term for our mountain limestone.

BERGLER, JOSEPH, a distinguished recent historical painter, born at Salzburg, in 1753. He was instructed by his father, and gave such early evidence of talent, that he was sent, in 1776, to complete his studies in Italy, by the prince-bishop Cardinal Firmian of Passau. In Italy he studied oil and fresco five years with Martin Knoller at Milan; in Rome he was acquainted with Mengs, Canova, and Gavin Hamilton; and Cammacini, Tischbein, and Volpato were his contemporary students there, where he remained altogether six years; but in the interval he went to Parma, and obtained the great prize of the Academy in 1784 for a picture of Samson delivered by Dalilah to the Philistines. He returned to Germany and settled in Passau in 1786, when he was appointed painter to the prince-bishop Cardinal Auersperg. During his stay at Passau until 1800, he painted several excellent altar-pieces for the churches of neighbouring towns, some of which have since been burnt. In 1800 Bergler was made director of the Academy of Prague, and his ability and activity combined enabled him to educate several very able scholars, who still adorn the Bohemian capital with their works; and he himself furnished altar-pieces for many of the churches of Prague and its vicinity: one of his principal works at this time was a large picture of Hermann and Thusnelda, from Klopstock's 'Hermannsschlacht.' He died at Prague in 1829. He had great facility of execution, but his chief excellence consisted in his colouring, not so much in the carnations, as in a general effective composition of colour. He has also etched many of his own designs with great ability.

(Dlabacz, *Künstler-Lexicon für Böhmen;* Nagler, *Neues Allgemeines Künstler-Lexicon*, in which he quotes Hormayr, *Archiv.* for 1823; Göthe, *Winckelmann und sein Jahrhundert.*)

BERGMEHL (mountain-meal), a Norwegian earth, rich in microscopic fossils. [Infusoria, Fossil, P. C. S.]

BERNADOTTE. [John, King of Sweden, P. C. S.]

BERNIER, FRANÇOIS. This 'most curious traveller,' as he is styled by our historian Gibbon, was born at Angers, then the capital of the province of Anjou. The year of his birth has not been ascertained, and very little appears to be known about him, until after his return from the East, and the first publication of his travels. Voltaire supposes that he was born in the year 1625. But it seems quite as probable that he was born eight or ten years later. He studied medicine as a profession, and after taking his degree of doctor at Montpellier, being, as he tells us himself in the first page of his book of travels, excited by the desire of seeing the world, he went over to Palestine and thence into Egypt. This was in the year 1654. He lived more than a year at Cairo; caught the plague, and had the rare good fortune of recovering from that fearful disease. Being in Egypt, he became very desirous of visiting and examining the Red Sea; and, while on the shores of the Red Sea, a favourable opportunity presented itself for going into the East Indies. In all the countries of the East, a medical practitioner may travel very well, and live as well as the best, without any money. Bernier's purse seems always to have been very light. He lived twelve years in India, and during eight of these years he resided chiefly at Delhi as physician to the great Mogul Emperor of Hindustan, Aurungzebe. [Aurungzebe, P. C.] The favourite and prime minister of that prince, the Emir or Omrah Danichmend, who is described as a patron of science and letters, patronized the ingenious and no doubt very useful Frenchman, and took him along with him when he marched with an immense army to the conquest of Cashmere. Bernier has left us the best accounts of that war, of the march of this immense force, and of the beautiful country which it subdued. The army was like an immense moving city. The guard of cavalry consisted of 35,000 men, and the guard of infantry of 10,000; it was computed that the camp contained 150,000 horses, mules, and elephants; 50,000 camels, 50,000 oxen, and between 300,000 and 400,000 persons. The correctness of Bernier's description of the country has been recognised and praised by every European traveller that has visited Cashmere since his time. Mr. George Forster, who was there in 1783 or 1784, says in a letter that 'his description of Cashmere is as lively as it is just;' that 'Monsieur Bernier enjoyed advantages which have fallen to the lot of few Asiatic travellers, and, happily for the learned world, his talents amply improved them.'

Returning to France, his native country, Bernier began to publish. His first work, entitled 'History of the last Revolution of the States of the Great Mogul,' appeared at Paris in the year 1670, in two very humble 12mo. vols. This was followed by 'Continuation of Memoirs of the Empire of the Great Mogul,' which was published at Paris in the year 1671 in one vol. 12mo. These works got him nicknamed 'The Mogul.' The books contained a vast deal of information that was altogether new to Europe at that time, and they were written with great spirit, and with that admirable brevity and simplicity which distinguished many of the old French travellers, but from which the modern travellers of that nation appear to have wholly departed. They at once made him famous in Paris, and they soon became universally known. They were soon reprinted, as one work, and under the altered title of 'Travels of François Bernier, Doctor in Medicine of the Faculty of Montpellier, containing the description of the States of the Great Mogul, of Hindustan, of the Kingdom of Cashmere,' &c. These travels have been rather frequently reprinted, and have been translated into most European languages. Our first English translation, in two volumes, 8vo., bears at the foot of the title-page 'London, 1672.' The translator who 'Englished out of French,' was not very competent to the task: 'les gentils du pays' (the Gentiles or Pagans of the country) he renders 'the country gentry.' There is a modern translation by Mr. Irving Brock, which appears to be carefully and correctly done. It is in two vols. 8vo., and was published in London in the year 1826. There is a modern French edition of the original in 2 vols. 8vo., Paris, 1830.

Bernier's travels contain much valuable history: they describe the causes of that important revolution which raised Aurungzebe to the throne of Hindustan; and as the author was personally engaged in the scene of action, and an eyewitness of many of the principal events, which he relates in such simple and interesting language, the narrative is the more valuable and trustworthy. Major Rennell (Memoir for illustrating the Map of Hindustan) calls Bernier 'the most instructive of all East India travellers.' He did not begin to write about Cashmere until he had resided more than three months in the country. Besides Forster and Moorcroft, Mr. G. T. Vigne, the latest of our English travellers in that beautiful country, bears testimony to the accuracy of Bernier's descriptions. Mr. Vigne and two other travellers, the Baron Carl von Hugel and Mr. John Henderson, who met in the valley of Cashmere in the month of November, 1835, set up an engraved tablet to commemorate the names of the European travellers who had previously visited the vale (taking care not to omit their own three names): the list was short, and ran thus:—Bernier, 1663; Forster, 1786;[*] Moorcroft, Trebeck and Guthrie, 1823; M. Jaquemont, 1831; Dr. Wolff, 1832. Of all these European travellers into Cashmere, only three, Bernier, Dr. Wolff, and Mr. Vigne, lived to return to their native country. (*Travels in Kashmir, Ladak, &c.*, by G. T. Vigne, Esq., F.G.S., 2 vols. 8vo., London, 1842.) M. Jaquemont, a very ingenious French traveller, does not omit to praise his old countryman, whose simplicity of style he would have done well to imitate.

Although it was what some call the golden age of Louis XIV., Bernier does not appear to have tasted of the patronage and bounty of the court. It should seem that he depended greatly on the hospitality of Madame de la Sablière, who was, in morals, another Ninon de Lenclos, but who had the merit of relieving the poverty and helplessness of the exquisite La Fontaine. Bernier is also said to have had *des liaisons particulières* with Ninon de Lenclos herself. In the house of these two ladies, or these two French Aspasias, he met all the French wits and savants of the day, as St. Evremond, Boileau, La Fontaine, Fontenelle, &c. Bernier was made to shine in society, but that artificial Parisian society appears to have spoilt him, or to have deprived him of his simplicity. St. Evremond said of him that, from his countenance, his person, his manners and conversation, he deserved to be called 'le joli philosophe' (the pretty or charming philosopher). His philosophical treatises have long been neglected or forgotten. It is said that he took to writing them for the instruction and amusement of Madame de la Sablière, who dabbled in geometry, astronomy, and the natural sciences, as well as in the belles-lettres. Gassendi's philosophy was then in vogue; but his works were rather too difficult and too voluminous for ladies and wits. In 1674-5 Bernier published an abridgment of the philosophy of Gassendi. In the second part of this abridgment he treats of the systems of Ptolemy, Copernicus, and Tycho Brahe, and gives a refutation of judiciary astronomy. (In the Lyon edition, which is the only one we have seen, the whole of this abridgment of Gassendi fills 8 vols. 12mo.) This work was much read or very much praised at the time. He wrote a memoir on the quietism of the Indians, which was inserted in the 'Histoire des Ouvrages des Savants,' 1688. His other things seem mostly mere jeux-d'esprit. His jokes against the Aristotelian philosophy ('Ariet donné en la grande chambre du Parnasse pour le maintien de la philosophie d'Aristote') are given in the 'Menagiana.' Boileau is said to have assisted in this joke. In 1682 Bernier published 'Doubts of Bernier on some of the principal chapters of his Abridgment of the Philosophy of Gassendi' (Paris, 1 vol. 12mo., 1682). The copy of this volume in the Library of the British Museum has at the bottom of the title-page, apparently in Bernier's handwriting, 'à Monsieur Bayle.' Bayle had good-humouredly exposed a somewhat laughable mistake which Bernier had committed in translating from Gassendi's Latin; but he had also cited Bernier as a traveller with commendation. (Bayle, *Dictionnaire Historique*, &c.) He also wrote a treatise on Free-will, 'Traité du Libre et du Volontaire,' which was published at Amsterdam, in 1685. In his 'Etrennes à Madame de la Sablière,' writing again in his natural manner as a traveller, he gives a charming description of the grand canal of Languedoc. Bernier's moral philosophy, in his latter years, was that mixed epicurism and scepticism which was then becoming fashionable at Paris, and which has since had so very long a reign in France. He declared that he doubted of his own philosophy and of all philosophies, and that after philosophizing for thirty or forty years he knew not what to make of it. According to St. Evremond, in a letter addressed to Ninon de Lenclos, Bernier said to him one day, in confidence, that he thought that abstinence from sensual pleasures was a great sin. St. Evremond and his friends of both sexes very practically illustrated that they believed in Bernier's theory. Bernier visited England in 1685, and died at Paris on the 22nd of September, 1688. It is reported of him, by Racine the younger, that his death was caused by a stroke of cutting raillery, made at a dinner party by the president D'Harlay, and that the old epicurean died of a broken heart. But these stories are very doubtful.

(*Biographie Universelle*; Bernier's own Works and Prefaces: Gibbon; and the other authors cited in the article.)

BERVIC, CHARLES CLEMENT BALVAY, the most distinguished engraver of France during the French revolution, was born at Paris in 1756. He was the pupil of J. G. Wille, and in 1784 was elected a member of the French academy of painting. A large full-length portrait of Louis XVI. which he engraved in 1790, from the picture by Callet, is one of the finest engravings that has ever been produced. It is distinguished for excellent drawing, extreme softness of tone, and a true effect of colour, but is rather defective in force. It is entitled 'Louis XVI., Roi des François, Restaurateur de la liberté, présenté au Roi et à l'Assemblée Nationale.' After the execution of the king, Bervic, wishing to escape suspicion, and at the same time preserve the plate, cut it in half, thus attaining both objects. The half plates were reunited after the restoration, and beautiful impressions were again taken from it; but the earlier impressions are much more valued, and command very high prices. Müller of Stuttgard engraved the same picture.

Other masterpieces of Bervic's graver are the Rape of Deianira, and the Education of Achilles, after Guido and Regnault; La Demande Acceptée, and Le Repos, after Lépicié; and the antient group of the Laocoon, an admirable production.

Through a weakness he was some years before his death forced to give up the practice of engraving, and he confined himself to teaching engraving. He died in 1822. He was a member of the French Institute, and Chevalier of the order of St. Michel, of the Légion d'Honneur, and of the Réunion.

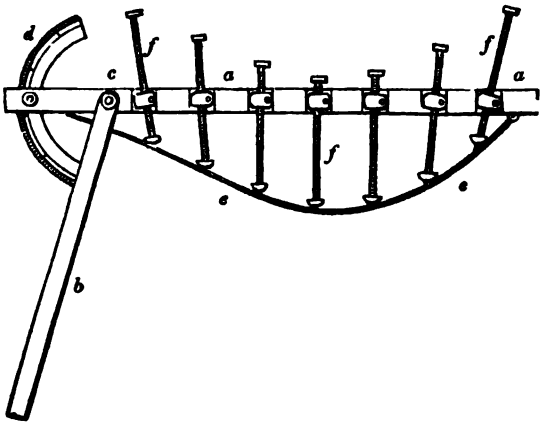
(Huber, *Manuel des Amateurs*, &c.; Bartsch, *Peintre-Graveur*; Joubert, *Manuel de l'Amateur d'Estampes*; Gabet, *Dictionnaire des Artistes*, &c.)

BERYX, a genus of fossil fishes of the family Percoideæ (Agassiz). B. ornatus occurs in the chalk of Sussex. Mantell figured it, under the title of Zeus Lewesiensis, in the 'Geology of Sussex.' Two other species occur in the British chalk.

---

[*] Mr. Vigne and his two friends appear to have made a mistake in this date; Forster travelled in the years 1783 and 1784.

BEVEL, or BEVIL, is, according to Nicholson's 'Architectural Dictionary,' the name applied both to the oblique angle formed by two surfaces which meet at either more or less than a right angle, and to the instrument employed by carpenters and joiners for taking and transferring such angles. The common carpenter's bevel consists of a straight wooden stock, mortised at one end to receive a thin blade, which is usually formed of steel, and attached to the stock by a pin in such a way that it may be turned to any required angle, and secured by a tightening screw. This kind of bevel may be described as an adjustible T-rule, the transom of which may be placed at any required angle with the stock. In some cases the pin or pivot which connects the blade with the stock passes through a slot or long opening in the blade or transom, so that its arms may be made of unequal length. Hebert describes, in the 'Engineer's and Mechanic's Encyclopædia,' vol. i. p. 165, an instrument of the bevel kind for gauging, and transferring to work or paper, an oblique angle of which one side is curved, consisting of two rulers, *a* and *b*, pivoted together at *c*, and capable of being set to any angle by means of the brass arc *d*, which is attached firmly to the ruler *b*, and passes through a mortise or slit in *a*, in which it may be secured at any point by means of a binding screw. The adaptation of the instrument to a curved surface is provided for by a flexible blade or riband of steel *e*, secured to the ruler *a* at one end, but capable of being made to assume and retain any simple curve by means of the series of screws marked *f f*, which pass through nuts or mortises attached to the ruler *a*, and press against the steel riband by a kind of swivel joint which provides for the various angles of contact formed by the riband and the screws.



Where many articles have to be worked to the same angle, it is desirable to use a fixed bevel, made to the required angle, especially where one or both of the limbs are curved. When the interior angle of the bevel is that used by the workman, such an instrument is sometimes called a *joint-hook*: a familiar instance of its use in this way is in working the intradoses and radiating beds of arch-stones, which, for circular arches, will be alike in every part of the arch.

BEWICK, THOMAS, justly called the reviver of wood-engraving, was born at Cherryburn, near Newcastle-upon-Tyne, in 1753. He evinced an ability to draw from his infancy, and was accordingly, at the usual age, apprenticed to Ralph Beilby, an engraver of Newcastle, who had some reputation in that city. Dr. (then Mr.) Hutton consulted Beilby upon the best method of engraving the diagrams to his treatise on Mensuration; the engraver strongly recommended that they should be cut in wood, for various reasons, and by Thomas Bewick. Accordingly, in 1770, the work appeared, with complete success; and was followed by several other mathematical works.

Bewick now attempted works of much higher pretensions. He designed a set of illustrations to Gay's Fables, and for one of the cuts, the 'Old Hound,' he obtained, in 1775, a premium for the best wood engraving offered by the Society of Arts. The work was published in 1779. In 1784 Mr. Saint published a set of 'Select Fables,' with cuts by Bewick. After these works he commenced, in partnership with his old master Mr. Beilby, to prepare a 'General History of Quadrupeds,' which was completed in 1790, went through several editions, and obtained Bewick a great reputation. The designs in this work are by Bewick and his brother John, who was his pupil; and they are all executed with great natural truth, and in a free correct manner. The cuts themselves are superior to anything that was ever done in the same style before, and are inferior only to the best cuts of the present day in mechanical execution and clearness of line. As works of art they still have the advantage. His History of Quadrupeds was followed, in 1795, by Goldsmith's 'Traveller' and 'Deserted Village,' Parnell's 'Hermit,' and Somerville's 'Chase.' The 'Chase' was the last work in which Thomas was assisted by his brother; all the cuts were executed by Thomas, but the designs were by John. John Bewick died of consumption in 1795, aged 35. In 1797 Thomas published his 'History of British Birds,' which is his best serial work: his birds are superior to his quadrupeds. This is also the last work he undertook in partnership with Mr. Beilby. They dissolved partnership during its progress.

Bewick had a numerous school, and was latterly much occupied in teaching; and in his last works was greatly assisted by his son Robert and other able pupils, of whom Harvey and Clennel have since particularly distinguished themselves in the same line of art.

The most considerable of Bewick's latest works are 'The Fables of Æsop and others,' and his 'British Fishes.' His very last work was a cut of an old horse, for the head of a paper against cruelty to animals. He died in 1828, aged 75; and is said to have left a very full autobiography of himself, which is written with great simplicity. His masterpiece is considered a large cut of a bull of the antient Caledonian breed, from Chillingham Park; a proof of this cut on vellum is worth about 20 guineas. Bewick's services are fully discussed in 'The History of Wood Engraving, with Illustrations by J. Jackson;' and there is a memoir of him, of considerable detail, in the 'Gentleman's Magazine' of 1829.

BIDENS, a genus of plants belonging the natural order Compositæ, the suborder Corymbiferæ, tribe Senecionideæ, subtribe Heliantheæ, division Bidentideæ. It has monogamous discoidal heads sometimes radiant; the florets, of the ray neuter ligulate, of the disk, hermaphrodite, tubular; the receptacle flat; the involucre of two rows, the outer row spreading; the branches of the style surmounted by short cones; the fruit compressed, angular, rough at the edges, the angles terminating in 2-5 stiff retrorsely hispid bristles. The genus has been named Bidens from the two bristles which most frequently surmount the teeth. A great number of species belonging to this genus have been described, but they are generally inconspicuous weeds. They have been found in Europe and North and South America. Two are natives of Great Britain in marshy and watery places, *B. bipartita* and *B. cernua*. The latter is the Cereopsis Bidens of Linnæus.

(Babington, *Manual*; Lindley, *Natural System*.)

BIGBONE LICK, a place in Kentucky (U. S.), where great numbers of fossil mammalia occur in a dark-coloured marshy soil, covered by gravel and resting on blue clay. The bones of Elephas primigeneius and Mastodon maximus are very numerous. With them lie bones of Megalonyx Jeffersonii, Bos bombifrons, Bos Pallasii, and Cervus Americanus.

(Rogers, *On American Geology*; *Brit. Assoc. Reports for* 1834.)

BIGNO'NIA, a genus of plants named by Tournefort after the Abbé Bignon, librarian to Louis XIV. It forms the type of the monopetalous order of Exogens, Bignoniaceæ. It has a campanulate 5-toothed rarely entire calyx; the corolla with a short tube, a campanulate throat, and a 5-lobed bilabiate limb; the stamens four, didynamous, with the rudiments of a fifth; lobes of the anther divaricate; stigma bilamellated; capsule siliqui-formed, 2-celled, with the dissepiment parallel with the valves; the seeds in two rows, imbricate, transverse, with membranous wings. Nearly one hundred species of this genus of elegant plants have been described. They are usually climbing shrubs furnished with tendrils, with opposite, single, conjugate, ternate, pinnate, or digitate leaves. The flowers are mostly in terminal or axillary panicles. The corollas are trumpet-shaped, and are coloured variously, white, yellow, orange, purple, violet, or rose.

All the species of this genus are splendid plants while in blossom, and deserve a place in every collection. Most of them are climbers, and adapted for training up rafters and pillars, but they only grow freely in stoves. A mixture of loam and peat is best adapted for their growth, and cuttings will strike readily under a hand-glass in heat, either in mould or sand. The species known by the name of this genus which is most abundant in our gardens is the *Bignonia radicans*. This and some other species of Bignonia are now referred to the genera Spathodea [SPATHODEA, P. C. S.] and Tecoma [TECOMA,

P. C. S.]. It is one of the few species capable of living in the open air against a wall in this country.

B. æquinoxialis, has square glabrous branches, glabrous conjugate leaves, oblong lanceolate leaflets, simple axillary tendrils, 2-flowered peduncles, terminal ones racemose, follicles linear. It is a native of Guiana and the island of Arrowabisch. It is applied by the negroes to swellings of the feet, with which they are troubled.

B. Leucoxylon is a tree, and has quinate leaves; ovate-lanceolate, acuminate, glabrous leaflets; terminal, solitary or twin flowers. This plant is a native of Jamaica, on the banks of rivers. It has white flowers, not unlike those of *Datura Stramonium*, which come out before the leaves. The wood is of a green or yellow colour, and is sometimes brought into the market under the name of ebony. It is said to be an antidote to the poison of manchineel.

B. Chica is a climbing plant, and has abruptly bipinnate leaves; conjugate elliptic-ovate, acuminate, deeply cordate, glabrous leaflets; axillary pendulous panicles. It grows on the banks of the Orinoco. A red matter is extracted from its wood by the Indians, with which they paint their bodies. It is called *Chica*, and some has been used in this country as a dye.

B. alliacea has tetragonal branches, conjugate leaves, coriaceous elliptic leaflets, simple tendrils, axillary 5-flowered peduncles, a 5-toothed calyx. It is a native of Guiana and the West Indies. It has large white flowers, and is distinguished from all the other species by its peculiar garlic odour; hence the French name *liane à l'ail*.

(Don, *Gardener's Dictionary*; De Candolle, *Prodromus*; Burnett's *Outlines*; *Cyclopædia of Plants*.)

BILDERDYK, WILLEM, ranked by his countrymen among the first—by some as the very first modern poet and writer of Holland, and also distinguished by his varied erudition, was born at Amsterdam in 1756. His studies at Leyden took a very extensive range, for besides philosophy and languages—most of the modern languages included—he applied himself to history, archæology, jurisprudence, divinity, medicine, and geology; and appears, in short, to have left scarcely any branch of science untouched. If there seems to be somewhat of the marvellous in this account of his studies at so early an age, it is not lessened by their being of a kind to indicate more of the laborious scholar than of the poetical enthusiast. It was in the character of poet however that he made his début in 1776, when his 'Invloed der Dichtkunst,' &c. ('The Influence of Poetry on States and Governments'), obtained the prize from the Leyden Society of *Kunst door Arbeid*. The subject was hardly one which a youthful poet would have selected for himself, though one for which Bilderdyk must have been better prepared than most others. Genius usually breaks forth urged on by inspiration of a different kind from that produced by the hope of obtaining premiums and prize-medals; and if Bilderdyk's did not, it was perhaps in some degree a foreboding of his future career, which, it must be confessed, was rather too much in accordance with the motto of his first Leyden patrons—'Kunst door Arbeid,' or 'Art through Industry,' since, though his productions manifest great industry, ability, and superior mastery of language, he rarely soars into the more elevated regions of imagination.

His poem on the 'Love of Fatherland' obtained him a second prize the following year; and in 1779 he published his translation of the 'Œdipus Tyrannus' of Sophocles, intended to exhibit to his countrymen the genuine form and spirit of Greek dramatic poetry, in opposition to the spurious classicality of French models, by a servile imitation of which they had enervated both their language and their taste. About 1783 he began to practise at the bar at the Hague, yet without renouncing his literary occupations, for it was about the same time that, in conjunction with Feith, he undertook not merely to re-edit and illustrate with an historical commentary Van Haren's 'Geuzen' [NETHERLANDS, P. C., p. 161], but to reshape the work itself by dressing it up in more poetical language—treatment not a little singular for a contemporary production whose author was just dead. Thus renovated, the poem first appeared in 1784; and not very long afterwards an estrangement took place between Bilderdyk and Feith in consequence of differences of political opinion, the former being attached to the House of Orange, the other to the republican party. Towards the end of 1786 the unsettled state of public affairs induced Bilderdyk to quit Holland and seek an asylum in Germany, where he supported himself by teaching, as he did subsequently in England. This self-imposed exile lasted nearly twenty years, during the first half of which his muse was silent. It was not till 1799 that he produced two volumes of miscellaneous pieces entitled 'Mengelpoesie,' containing a poem on astronomy and some translations from Ossian. In 1803 first appeared his 'Buitenleven,' or 'Rural Life,' which is considered by some almost as his masterpiece; yet, great as are its intrinsic merit and its excellence of execution, it has no claim to originality, being no more than a free and spirited imitation of Delille's 'L'Homme des Champs.' The same may be said of a subsequent translation by him of the whole of 'Fingal.' On his return to Holland he was received as one whom the nation had reason to be proud of, and was taken into favour by Louis Napoleon (then just made King of Holland), who was desirous of rendering himself popular with his new subjects, and appointed Bilderdyk not only his instructor in the Dutch language, but also president of the Institute founded by him at Amsterdam, upon the model of the French one. He was thus all at once placed in comparatively prosperous circumstances, and his literary reputation was not a little increased also by his 'Ziekte der Geleerden' (the Maladies of Literary Men), a subject equally repulsive and unpoetical, but so treated as to be of powerful though painful interest. He next attempted tragedy, and produced several pieces of the kind, which, although unsuccessful upon the stage, are marked by great poetical beauties. They were published in 1803, in three volumes, and among them are two by his wife, viz. 'Elfrida,' and 'Iphigenia in Aulis.' In 1809 he was thrown into great affliction by the loss of several of his children, and in the following year the abdication of Louis Napoleon deprived him of his pension, and he was again in very embarrassed circumstances, and so continued till the return of the Prince of Orange, when they began to improve. A year or two afterwards he removed to Leyden, where, as he had done all along, he continued to put forth one new production of his muse after another. The noblest of them all however, his 'Ondergang der Eerste Wereld,' or 'Destruction of the First World,' did not appear till a later period. So far from betraying any decline of intellectual power, this fine poem displays more of imagination and invention than any of his former ones, and had it been completed, it could hardly have failed to place the name of Bilderdyk beside those of Milton and Klopstock, but unfortunately he proceeded no further than with five books of it. On the 16th of April he lost his second wife, Catherina Wilhelmina, a lady of considerable literary attainments: besides the tragedies already mentioned, she wrote, among other things, a poem on the battle of Waterloo, and translated Southey's 'Roderic.' Bilderdyk did not survive her very long, for he died at Haarlem in the following year, December 18, at the age of seventy-five. Among the numerous MSS. he left behind him was a history of Holland, which has since been edited by Tydemann.

BILL CHAMBER, a department of the Court of Session in Scotland, in which one of the judges officiates at all times during session and vacation. The youngest judge is lord ordinary on the bills during session; the duty is performed by the other judges, with the exception of the two presidents, by weekly rotation during vacation. All proceedings for summary remedies, or for protection against impending proceedings, commence in the Bill Chamber—such as interdicts (or injunctions against courts exceeding their jurisdiction), a procedure which frequently occurred during the recent discussion in the Church of Scotland as to the veto question; suspensions of execution against the property or person, &c. The process of sequestration or bankruptcy issues from this department of the court. By far the greater number of the proceedings are sanctioned by the judge as a matter of form, on the clerks finding that the papers presented ask the usual powers in the usual manner; but where a question of law is involved in the application, it comes into the Court of Session, and is discussed as an ordinary action. The Lord Ordinary on the bills is the representative of the court during vacation. A considerable proportion of his duties are regulated by 1 & 2 Vict. c. 86.

BILL OF EXCHANGE. The general law on the subject is the same in Scotland as in England, with few exceptions. In Scotland it is not held that to make a bill negotiable, it must contain negotiable words. The laws restricting the negotiation of bills under 5*l.* do not apply to that part of the country. It is usual, there, to protest both foreign and inland bills, both for non-acceptance and non-payment. When protest has been duly taken and recorded, and when the other requisites of negotiation are complied with, and there is no flaw on the face of the bill, it may be executed immediately against the parties liable, by 'summary diligence,' as if it were the decree of a court.

BILL IN EQUITY. [Pleading, P. C.]

BILL IN PARLIAMENT. [Parliament, P. C.]

BILLARDIE'RA, a genus of plants named after Jean Jacques Julien Labillardière, a French botanist, who visited Syria, and afterwards New Holland, in D'Entrecasteaux's expedition, and wrote the 'Novæ Hollandiæ Plantarum Specimen,' in two volumes, 4to. The genus belongs to the natural order Pittosporaceæ, and has a calyx of 5 acuminate sepals, 5 petals with approximate claws, which are convoluted at their edges, forming a campanulate flower; an elliptical berry terminated by a style. The species are called Appleberries; and George Don enumerates eight. They are climbing shrubs, natives of New Holland and Van Diemen's Land. The fruit which they bear is eatable.

B. longiflora has climbing branches, the younger ones scarcely pubescent; the leaves lanceolate, entire; the pedicels 1-flowered, glabrous, one half shorter than the flower; the berries almost globose, torose, glabrous. This plant is 'a fast grower and abundant flowerer; and when in fruit its fine blue berries make a handsome appearance.' (Loudon.)

The other species are desirable shrubs for the conservatory. They thrive well when planted in an equal mixture of loam and peat. Cuttings will readily root in sand under a bell-glass. They may be also raised from seed, which they produce in abundance.

(*Cyclopædia of Plants;* G. Don, *Gardener's Dictionary.*)

BILOCULI'NA. [Foraminifera, Fossil, P. C. S.]

BINCK, JACOB, a celebrated old German engraver and painter, and one of the so-called little masters, was born about 1500, in Cologne; some authorities make him, incorrectly, a native of Nürnberg. He at all events lived some time in Nürnberg, and was probably the pupil of Albert Dürer. Sandrart says he studied with Marcantonio at Rome; all the accounts of him, however, are little better than conjectures. In 1546 Binck appears to have been living at Copenhagen as portrait painter to Christian VIII. of Denmark. Later he was living at Königsberg in the service of Duke Albert of Prussia, who sent him in 1549 on a commission to the Netherlands. In 1550 he was employed again by Christian VIII., to select a fit spot for the erection of a fortress in Holstein. He probably died at Königsberg, in the service of Albert of Prussia, about 1560.

Bartsch describes ninety-eight prints by Binck, including one woodcut. There are many other prints attributed to him, which are marked J. B., but these according to Bartsch belong to some other artist, who probably is the same who studied, according to Sandrart's account, at Rome. Binck's monogram is made of J. C. and B. intermingled, the C signifying Coloniensis, 'of Cologne:' in one print the word Coloniensis is written in full. Many of his prints have been copied, with a view to profit by the deception, as is the case with the works of other celebrated masters. Binck's drawing is superior to that of the little masters generally, but his style is very similar to that of Barthel Beham.

The initials J. B. answer to several of Binck's contemporaries, as Johann Burgmair, Joachim Brechtel, Jacob Beutler, Johann Brosamer, and Julio Bonasone. His monogram is also very like that of Hans Baldung, the difference being only that between a G. and a C., both generally indistinctly expressed. Binck's works, according to the collection of Mariette, amount to 200; their subjects are various.

(Heineken, *Dictionnaire des Artistes*, &c.; Huber, *Manuel des Amateurs*, &c.; Meusel, *Neue Miscellaneen Artistischen Inhalts*, No. 8; Bartsch, *Peintre-Graveur;* Brulliot, *Dictionnaire des Monogrammes*, &c.)

BINOMIAL EQUATION. [Equation, Binomial, P. C. S.]

BIRD, JOHN, a celebrated mathematical instrument maker in the last century, died March 31, 1776, aged sixty-seven years. He 'was brought up a cloth-weaver in the county of Durham. What first occasioned him to turn his thoughts to the art, in which he afterwards so much excelled, was his accidentally observing, in a clockmaker's shop, the coarse and irregular divisions of the minutes and seconds on a clock dial-plate. These offended him much. He divided another plate with great neatness and accuracy, and amused himself for some time with dividing and engraving dial-plates for the clockmaker. He engraved all the figures upon his own instruments. He came to London in the year 1740, and certainly was in business for himself in the year 1745.' (Ludlam, in work presently cited, Preface.)

Bird began his career in London by dividing astronomical instruments both for Graham and Sisson; and afterwards carried on business in the Strand. His celebrated Greenwich quadrant, of eight feet radius, was mounted February 16, 1750, and was used both by Bradley and Maskelyne. Another instrument was erected at Oxford Observatory. His last work was the mural quadrant for the Ecole Militaire at Paris, with which D'Agelet and the two La Landes determined the declinations of 50,000 stars. The Greenwich Quadrant was described by Lemonnier in his *Description et Usage*, &c., Paris, 1774. In 1767 he received 500*l.* from the commissioners of longitude, on condition that he should take an apprentice, instruct other persons as required, and furnish, upon oath, descriptions and plates of his methods. These were published by the commissioners aforesaid, under the following titles:—'The method of dividing astronomical instruments,' &c., 1767; 'The method of constructing mural quadrants, exemplified by a description of the brass mural quadrant at the Royal Observatory at Greenwich,' &c., 1768.

In 1786, Mr. Ludlam, of St. John's, Cambridge, who was one of the persons appointed by the commissioners to inspect Bird's methods, published his 'Introduction and Notes on Mr. Bird's Method of Dividing, &c.' This treatise had been read to Bird, and bears his certified attestation of its correctness. This attestation is a model of sulky assent, as follows:—'When I wrote my tract on the constructing and dividing of astronomical instruments, I thought I expressed myself so as to be understood by any common workman a little used to this business. What difficulties the *learned* may find in it, I know not; if my friend can satisfy their scruples, so much the better. All I can say is, that he has nowhere mistaken my meaning; and if he can (by what he has written) make those understand my method of dividing who otherwise would not, he will not lose his labor.—John Bird.'

The explanation of the improvements on Graham's method of dividing, which has made the name of Bird celebrated throughout the astronomical world, has been given in Graduation, P. C.

BIRD, EDWARD, R.A., an excellent English *genre* painter, was born at Wolverhampton in 1772. As he evinced a strong inclination for drawing, his father, who was a clothier, apprenticed him to a tea-board manufacturer of Birmingham, with whom it was Bird's business to paint the boards. His labours in this way were highly profitable to his employer, who wished to retain Bird in his service after the expiration of the term of his indentures, but Bird preferred trying his fortunes in the world as an artist, and he accordingly set up as a drawing-master at Bristol. In 1807, when he was in his thirty-fifth year, he exhibited some paintings at Bath, which were much admired, and sold for thirty guineas each. These were succeeded by a piece called Good News, which established his reputation. Other good works succeeded, as the Choristers Rehearsing, and the Will; the first was purchased by William IV., the second by the Marquis of Hastings, and the Royal Academy elected Bird an Academician. He now exhibited his masterpiece, the Field of Chevy Chase the Day after the Battle, which was purchased by the Marquis of Stafford for 300 guineas. The same nobleman purchased his next picture, the Death of Eli, for 500 guineas, and he obtained by it also a prize of 300 guineas awarded by the British Institution. The picture however was not the artist's: it was the joint-stock property of three gentlemen of Bristol, who had commissioned Bird to paint it for 300 guineas, and the 500 for which the picture sold at the exhibition was divided among them. The profitable result of their speculation led them to give Bird a second commission, but the painter declined their further patronage.

In 1813 Bird was in London, and was introduced to the Princess Charlotte, at Warwick House, by his friend Mr. Murphy, to whom the Princess said—'Mr. Bird is a very well-bred man—he has a natural politeness about him.' She appointed him her painter, and he presented the princess with the Surrender of Calais, one of his favourite pictures. This visit to London produced a great change in his taste; he was no longer satisfied with the humble character of his usual subjects; he accordingly forsook the truths and beauties of rural and domestic life, in pursuit of the imaginary greatness of religious and historical subjects—the Fortitude of Job, the Death of Sapphira, the Crucifixion, and the Burning of Ridley and Latimer, and even the Embarkation of Louis XVIII. for France, which at most could be but a costume show. This last undertaking was a great misfortune to Bird: he required the portraits of many persons of rank, native and foreign; the prevailing upon these persons to sit was a trouble and a difficulty which Bird had never contemplated. He completely failed in his attempt, and this disappointment probably had some share in hastening his death. He died in 1819, in his forty-eighth year, leaving his pageant unfinished. His fate may serve as a warning to future artists who leave the paths of nature, simplicity, and truth, to picture the empty pageants of state ceremonies.

Of the kind of picture by which he gained his popularity, he executed several which have not been mentioned—as the Blacksmith's Shop, the Country Auction, the Gipsy Boy, the Young Recruit, Meg Merrilies, the Game at Put, and some of his earliest works, as the Village Politicians, and the Poacher, in six scenes.

'Towards the close of his life,' says Allan Cunningham, 'Bird's looks grew dark and melancholy; but this was less the fault of his mind than of his fortune; he felt that the world of fashion which he had worshipped was making its own return—neglecting while it praised, and spurning while it caressed him.'

He was buried with all the honours of the city in the cloisters of Bristol Cathedral. Three hundred gentlemen followed his body to the grave: his son, a child of seven years of age, was the chief mourner. The expense of the funeral was borne by his widow, a singular instance of illiberality on the part of the mourners, if, as reported, the funeral was made public by their express desire, and against the inclination of Mrs. Bird. Another version however states that Mrs. Bird voluntarily took upon herself the expense, and declined the offered assistance of the gentlemen who attended the funeral.

(Cunningham, *Lives of the most eminent British Painters*, &c.)

BIRDE (or Byrde, or Bird), **WILLIAM**, who is numbered among the most celebrated of our ecclesiastical composers, was born about the year 1540, and educated as one of 'the children' in the chapel of Edward VI., probably under the 'famous Thomas Tallis,' whose pupil he certainly was at an early period of his life. In 1563 he was chosen organist of Lincoln Cathedral, and in 1575, conjointly with Tallis, became organist to Queen Elizabeth, as well as gentleman of her chapel. He died in 1623. Birde seems to have been highly esteemed, both in his private and professional capacity. Peacham, in his 'Complete Gentleman,' speaks of him with great reverence, as does his pupil Morley, in his 'Introduction.' (Burney's *Hist.* iii. 83.) That he was great in his art, at a time however when that art exhibited more of study than genius, his compositions afford indisputable evidence. His complete Service, together with three Full Anthems, published in Boyce's 'Collection,' prove his musical learning, which is further evinced in his 'Cantiones Sacræ,' or sacred songs for many voices, printed, under letters-patent from Queen Elizabeth, in junction with his master Tallis [Tallis, P. C.], and recently republished by the 'Society of Musical Antiquarians.' He also contributed largely to 'Queen Elizabeth's Virginal-Book,' 'a magnificent folio manuscript curiously bound in red morocco,' now in the British Museum, containing nearly seventy pieces for the organ and virginal. [Virginal, P. C.] Among these are 'The Carman's Whistle,' an air with variations by Birde, which, if actually and well executed by 'the virgin queen,' shows that her majesty was as completely mistress of her instrument as of her bishops. Indeed, to perform this, even in the present day, puts the skill of a good player to a somewhat severe test. He also published other works, chiefly with Latin words—for it is conjectured that he was not a very sincere adherent to the Reformed religion—all of them displaying deep study, and a profound knowledge of florid counterpoint. But he is now generally known—is, in fact, well known everywhere—by his canon 'Non nobis, Domine,' a unique composition, which has rather gained than lost by the operation of time, formed as it is of materials so enduring, that in spite of the love of novelty, which in music is so influential, it has maintained its ground during nearly two centuries and a half. Some attempts have been from time to time made, particularly on the Continent, to tear so valuable a leaf from Birde's laurels, but he is still left in full possession of this, his richest, never-fading ornament.

BIRKBECK, GEORGE, M.D., was born January 10, 1776, at Settle, in Yorkshire, where his father was a merchant and banker. At the age of eight he was sent to school at the village of Newton, Lancashire, where he remained till fourteen, when he was placed with Mr. Dawson of Sedbergh, a man of considerable mathematical attainments, who had once been a shepherd; and he read the classics with a relative, Mr. Robert Foster. He displayed an early predilection for mechanical and scientific subjects, which led him to select the medical profession as his pursuit. He commenced his medical studies at Leeds, and at the age of eighteen repaired to Edinburgh, where he remained one session, and the following winter became a pupil of Dr. Baillie in London; but at its close he again went to Edinburgh, and at the termination of his fourth session took his degree. His reputation in the university was already considerable, and he had formed a friendship with Brougham, Jeffrey, Sidney Smith, F. Horner, and others who afterwards attained eminence. While at Edinburgh he was put in nomination for the professorship of the Andersonian Institution at Glasgow, and his election was carried by a considerable majority. In November, 1799, he commenced his first course of lectures at Glasgow on Natural and Experimental Philosophy. There was at that time no maker of philosophical instruments at Glasgow, and he was obliged to have his philosophical apparatus made by ordinary workmen. He had employed a tinman to construct a model of a centrifugal pump; and it was in the cellar which formed the workshop, while surrounded by the workmen who had made it, but were ignorant of its use, that he was first struck with the idea of giving a gratuitous course of lectures for the scientific instruction of the mechanics of Glasgow. In March, 1800, he communicated his wishes on this subject to the trustees of the Andersonian Institution, who regarded the proposal as visionary, and nothing was done during the session. At its close Dr. Birkbeck returned to Yorkshire, and in preparing the prospectus of his courses for the ensuing session, he announced his intention of establishing a class 'solely for persons engaged in the practical exercise of the mechanical arts, men whose education in early life has precluded even the possibility of acquiring the smallest portion of scientific knowledge.' In the style of these lectures he promised that he would study 'simplicity of expression and familiarity of illustration.' On his return to Glasgow a printed invitation was circulated in the different manufactories, which contained an offer of tickets for the admission of the most intelligent workmen in each manufactory into the mechanics' class at the Andersonian Institution. The number who accepted this offer was not large, and the first lecture was attended by only seventy-five persons; but it gave so much satisfaction, and excited such general interest, that at the second lecture the number was increased to two hundred; at the third lecture above three hundred mechanics were present; and at the fourth above five hundred; and as the theatre of the Institution would not accommodate many more persons, it became necessary to limit the number of tickets. At the close of the course his class of mechanics presented him with a silver cup. Dr. Birkbeck continued his lectures to them for the two succeeding seasons; and in 1804 he relinquished the professorship, and was succeeded by Dr. Ure.

In May, 1806, Dr. Birkbeck married a lady named Lloyd, the daughter of Samuel Lloyd, Esq., of The Farm, near Birmingham, and settled in London, where he soon obtained a good practice as a physician. In March, 1807, his wife died, and he did not marry again until 1817, when he was united to the youngest daughter of Henry Gardner, Esq., of Liverpool.

While in active practice in London as a physician, Dr. Birkbeck had few opportunities of following up the labours which he had commenced at Glasgow for the advancement of scientific knowledge amongst artisans; but it was a subject which he had always at heart. In 1820 he gave a gratuitous course of seventeen lectures at the London Institution. In February, 1823, the mechanics of Glasgow who attended the lectures at the Andersonian Institution, as a mark of respect for his character, and in gratitude to him as the 'liberal-minded projector and founder' of the mechanics' class, asked his consent to allow his portrait to be taken. In July of the same year they resolved to establish a school for their own instruction, to be called the Glasgow Mechanics' Institution. Many circumstances now tended to a general development of Dr. Birkbeck's favourite plans. In 1821 a School of Arts had been established at Edinburgh, through the exertions principally of Mr. Leonard Horner. In the 'Mechanics' Magazine' for October 11, 1823, a paper appeared, entitled 'Proposals for a London Mechanics' Institute.' Dr. Birkbeck was at this time engaged in preparing an Essay on the Scientific Education of the Working Classes, and he wrote to the 'Mechanics' Magazine' (of October 18th), offering information and every assistance in his power in the formation of the projected institution. He was soon actively engaged in this object, and on the 11th of November, 1823, presided at a public meeting at the Crown and Anchor, which was attended, amongst others, by Dr. Lushington, Jeremy Bentham, David Wilkie, and Cobbett: Lord Brougham, who had attended the preliminary meetings, was absent from other engagements. The question of enabling persons engaged in the mechanical arts to acquire scientific knowledge was now fully brought before the public in London; and after another meeting, on the 2nd of December, the first officers of the 'London Mechanics' Institution' were appointed on the 15th of December. Dr. Birkbeck was elected president, which office he filled till his death; and his son has since been annually elected to the same post. At the formation of the institution Dr. Birkbeck generously lent the sum of 3700*l.*, for the purpose of building a lecture-room, &c. On the 20th of February, 1824, he delivered an inaugural address on the opening of the institution, which was followed by a lecture by Professor Millington.

Dr. Birkbeck's professional and scientific pursuits, and his services in various ways, in connection with objects of public utility, were continued to the last. He died December 1, 1841, at his residence in Finsbury Square, London, of a severe internal disease which occasioned great suffering. He left a son by his first wife, and two sons and two daughters by his second wife, who survived him. His funeral was attended by a large procession of the working classes, the members of the Mechanics' Institute and other societies, the committee of the Polish refugees and a number of Poles; and among the private carriages was that of the Turkish ambassador. Altogether about a thousand persons were present. The writer of a notice of Dr. Birkbeck in the 'Gentleman's Magazine,' February, 1842, has the following remarks on his character and personal appearance:—'He was mild and equable in his temper and disposition, benevolent in spirit, and possessing great suavity of manners. He spoke with singular neatness and fluency; and his ideas were as clear as his language. Whenever he appeared among the mechanics he was welcomed as a father and a friend; he was highly appreciated by a very large circle of private friends, and was held in great esteem by the most eminent public and literary and scientific men of the day. As a politician, he belonged to the Whig school. He possessed a reflective, beneficent countenance, a venerable and very unpretending aspect.'

(*Mechanics' Magazine*, vol. i., 1823; *London Mechanics' Register*, vol. i., 1825.)

In April, 1842, a meeting of the friends and admirers of Dr. Birkbeck was held at the Freemasons' Tavern, London, for the purpose of adopting some plan of testifying the public gratitude to his memory for his long and active services. Lord Brougham took the chair; the Bishop of Ripon, Lord John Russell, and many other eminent friends of the diffusion of knowledge were present, and a resolution was passed in favour of founding by subscription, in University College, London, a Birkbeck professorship of machinery and manufactures, including the application of chemistry and other branches of natural philosophy to the arts; and that it should be incumbent on the professor to lecture in the country in vacation. This professorship has not yet been established.

BIRKENHEAD, a town on the Cheshire side of the river Mersey, which is rapidly rising into importance. It is opposite Liverpool, and the distance from one bank of the river to the other is 1340 yards. Birkenhead owed its origin to the foundation of a Benedictine priory in the reign of Henry II. The prior enjoyed the right of ferry across the river. Birkenhead was extra-parochial and a chapelry in the parish of Bidstone; but by a local act it is constituted a township under the government of commissioners. In 1843 an act was obtained for including the township of Claughton-cum-Grange, and part of the township of Oxton, within the jurisdiction of the commissioners, which now extends over an area of about 1300 acres. In 1833 an act was passed for paving, lighting, watching, and otherwise improving Birkenhead, for regulating its police, and for establishing a market; and in 1841 another act was obtained for supplying the town with water and for lighting it with gas. In 1842 the town commissioners were empowered by act to purchase the manorial rights, &c. pertaining to the antient ferry at Woodside, which is the nearest ferry to Liverpool; and in 1844, under another act, they purchased Monk's Ferry. In 1844 they obtained an act of still greater importance, under which a tidal basin, docks, and other extensive accommodations for trade and shipping are now in progress. The magnitude of these works may be inferred from the following abstract, which is taken from the estimates: New market, 20,000*l.*; townhall, 10,000*l.*; park, 25,000*l.*; docks in Wallasey Pool, 400,000*l.*; dock warehouses (by a private company), 600,000*l.* The design of converting Wallasey Pool, on which Birkenhead is situated, into docks, was entertained several years ago, and originated with the late Mr. Laird, but it was not until 1844 that an act, as already mentioned, was obtained for effecting this object. The first stone of the proposed docks was laid on the 23rd of October, 1844. The area of the principal or floating dock will be 120 acres, a space exceeding that of all the docks in Liverpool, and it will have 19 feet depth of water. It will be surrounded with quays, warehouses, and other conveniences for shipping and discharging cargoes. There will also be a tidal harbour of about 40 acres, accessible at all times by the largest steamers employed in the coasting trade, and by all vessels whose draught does not exceed 15 feet; a harbour of refuge with an area of 10 acres; and beaching-ground of 4 or 5 acres, for the free use of the river-craft. In February, 1845, the commissioners purchased the Herculaneum dock at Liverpool, in order to accommodate vessels which might require to unload or take in part of their cargo at Liverpool, by which means they will be saved the necessity of paying full dock charges. Besides these advantages as a port, Birkenhead possesses a communication by railway with the populous midland counties, by means of a railway, 21 miles in length, which passes through Chester, and joins the Grand Junction Railway at Crewe, 54 miles from Birmingham. A line of railway from Manchester into Cheshire will also closely connect Birkenhead with that town on the east, and with Shropshire and Wales on the south-west. There are two railway termini at Birkenhead: one at Monk's Ferry, which is reached by means of a tunnel, of about 500 yards in length, which cost 20,000*l.*, and was opened October 17, 1844; and the other terminus is intended to be at the docks, which will also be reached by a tunnel. By these means the London and Birmingham and Grand Junction Railways may possess a water-side terminus for the Irish traffic.

The commissioners for the improvement of Birkenhead are invested with powers which enable them to carry into practice all those sanatory regulations which have hitherto been so much neglected in large towns. One of the local acts provides for the appointment of a Board of Health. The width of courts is regulated, and the streets already in progress are wider than in the best parts of most towns. In the north-west part of the township, on rising ground, a park containing 226 acres has been laid out, which will be drained, planted, and ornamented with two lakes. The whole will be enclosed with iron railings, and there will be access by six lodges. The elevation and design for villas and terraces in the park are to be subject to the approval of the commissioners. On the western side of the park there will be a cemetery of 71 acres, situated on elevated ground. Hamilton Square, about three minutes' walk from Monk's Ferry, is an area of 6½ acres, four of which are enclosed and planted as a shrubbery. The houses are handsomely built, and the townhall forms the centre of the southern side of the square. A market-hall is erecting, which will be 430 feet long by 131 feet broad, with six entrances; and it is intended that there shall be 42 shops and 80 stalls, which will be plentifully supplied with water from the roof. It is expected that the sale of surplus land in the immediate vicinity of the market will defray the cost of its erection. Slaughter-houses are also to be built in a suitable situation. The commissioners are also empowered to erect public baths. The number of churches is at present two; St. Mary's, built in 1817, and one recently completed. The church-yard of St. Mary's includes a part of the burial-ground of the ancient priory. Preparations are now (March, 1845) making for the erection of a third church with a parsonage-house. There are quarries of good building-stone in the township. There is a Scotch church, and one Independent and one Wesleyan chapel. Birkenhead has several good hotels, a news-room, a savings'-bank, and several other useful institutions. The communication with Liverpool is kept up by small steam-boats which ply from each side of the river every half-hour at the fare of twopence. In 1843 the number of passengers by the ferries exceeded two millions. It is intended that the boats shall soon commence running every quarter of an hour at one penny, and for one-half the year they are to ply both night and day. The profits of the ferry are a source of great emolument to the town commissioners. In November, 1844, the receipts were 1864*l.*, which was 418*l.* more than in the corresponding month of 1843. Another source of municipal income consists of ground-rents; and when the docks are opened, there will be dock and port charges, and after the market is completed, the rent of shops and stalls.

The population of the chapelry of Birkenhead was under 200 in 1821; in 1831, it exceeded 2000; and at the present time the township, with Tranmere, Holt Hill, Oxton, Bidstone, and some other places in the immediate neighbourhood, are together said to have a population of at least 16,000 inhabitants.

BIRMINGHAM. The statistics of BIRMINGHAM, P. C., having been given with less completeness and accuracy than those of other large towns in England, the present opportunity is taken for supplying omissions, and also of noticing some other matters relating to the present state of the town.

The parliamentary borough of Birmingham consists of the parishes of Birmingham and Edgbaston, and the two hamlets of Deritend and Bordesley and Duddleston-cum-Nechells. Their respective area and population are as under:—

	Area in acres.	Population in 1841.
Birmingham	2,660	138,215
Edgbaston	2,790	6,609
Deritend and Bordesley .	13,330	18,019
Duddleston-cum-Nechells .		20,079
	18,780	182,922

The following particulars, abstracted from the census returns of 1841, show the population, &c. of the parish of Birmingham and also of the borough:—

	Parish.	Borough.
Area in acres	2,660	18,780
Houses: Inhabited	27,272	36,121
Uninhabited . .	2,958	3,847
Building . . .	226	323
Males	67,317	88,572
Females	70,898	94,350
Total Persons	138,215	182,922
Ages: Males under 20 years .	31,087	41,211
Females under 20 years .	31,940	42,598
Males 20 years and upwards	36,230	47,361
Females 20 years and upwards	38,958	51,752
Persons born in the county	96,768	128,202
Persons born elsewhere .	41,447	54,720

Of the 128,202 persons born in the county of Warwick and residing in the borough of Birmingham on the 6th of June, 1841, there were 61,315 males and 66,887 females; born in other English counties, 22,950 males and 24,438 females; born in Scotland, 463 males and 257 females; born in Ireland, 2627 males and 2056 females; foreigners or British subjects born in foreign parts, 378 males and 179 females; and the place of birth of 839 males and 531 females was not ascertained.

The number of births in 1842 was 5094, which was 1516 more than the number of deaths. The number of illegitimate births was 207, or 4·1 per cent. In the same year the number of marriages was 1018, and 924 were solemnized according to the rites of the Established Church; 73 took place at registered places of worship used by Dissenters; and 21 couples were united at the superintendent-registrar's offices. The number of men married under age was 25, or only 2·4 per cent., and the number of women married under age was 69, or 6·9 per cent.: for England the proportions are respectively 4·5 and 13·5 per cent. of persons married under age. Out of 3578 deaths (1829 males and 1749 females) there were 914 of children under one year, and 1667 of children under the age of five. In the previous year above one-half the deaths (1658 out of 3305) were those of children aged under five. There are only three towns, Manchester, Leeds, and Liverpool, where the infant mortality is higher. The annual proportion of deaths to the population is 2·7 per cent., and in the whole of England 2·2 per cent.; but the mortality is higher in Liverpool, Manchester, Sheffield, and Bristol, than at Birmingham. The number of inquests held in the borough was 263 in 1844; and the average of the five years, from 1840 to 1844 inclusive, was 256. In 1844 the ratio of inquests to the total deaths was 1 in 16·63. The number of deaths by accident was 109; died by the visitation of God, 125; suicides, 9 (in 1842, 20; and in 1843, 25); burnt to death, 36 (in 1841 and 1842, 53 in each year); number drowned, 11; accidents by machinery, 2; killed by explosions and fire-arms, 1; verdicts of manslaughter, 4; of murder, 2. A coroner for the borough was first appointed in 1839. The cost of the coroner's court in 1844 was 926*l.*

The density of population is greater in Birmingham than in several of the largest towns in which the mortality is higher. In the parish of Birmingham there are 33,255 persons to a square mile; but the town is remarkably exempt from fever, and typhus is rare. There are no cellar-dwellings; but there are about 2030 courts, containing 12,254 houses, which, at four persons to each house, would give a population of 49,016; but nearly every family has a separate dwelling. There are about 40 miles of main sewers in the parish, and 3500*l.* a year is paid for cleansing the streets; but the drainage, paving, and cleansing of the courts and narrow streets are a good deal neglected, as in other large towns. The minimum width of streets under the last local act is 42 feet. In September, 1843, there were 1681 pigsties in the parish. On the other hand, the elevated situation of the town, and the dry and porous nature of the subsoil on which it is built, are favourable to health. The rise on the south side, from the river Rea, is 115 feet in 3000 yards; and from the Brook, on the north side, the rise is 70 feet in 2000 yards. The terminus of the London and Birmingham Railway, in the lower part of the town, is 376 feet above the level of low-water mark at London Bridge. The summit level of one of the canals is 460 feet above the level of the sea, and a considerable portion of the borough has a still higher elevation. The pavement of St. Philip's Church, which is nearly in the centre of the borough, is 475 feet above the level of the sea; and St. Paul's Churchyard is about fifty feet higher than the top of the cross of St. Paul's, London. Birmingham is well supplied with water, which is generally of good quality. There are about 80 miles of water-pipes, and about 8000 houses out of 40,281 are supplied by this means; and there is a pump in nearly every court. The charge for water service is 9*s.* a year for small tenements. The comfort of the population is increased by the cheapness of fuel: good coal is sold at 10*s.* per ton. The occupations of the working-classes are not, generally speaking, prejudicial to health, and with proper management and prudence the rate of wages which they receive is sufficient, when trade is prosperous, to procure them a sufficient supply of the necessaries of life. The minute division of labour, and the variety of operations which characterize the staple manufactures of Birmingham, are favourable to the well-being of the working-classes; for, as it seldom happens that all the members of a family are engaged in the same kind of manufacture, it follows that in seasons when trade is not good there is a better chance of some branch or other of industry, on which the livelihood of the family depends, escaping the general depression. The state of education and of pauperism will be subsequently noticed.

In nearly every house in England there is in use, at almost every hour of the day, some article or other of Birmingham manufacture. The subdivision of employments in Birmingham is very remarkable. 'There are very few large factories, properly so called, in which an article goes through the entire range of manufacturing processes; but there is a vast number of workshops, more or less extensive, in each of which portions of the work are done. One manufactured article, which is sold retail for a penny, may go through twenty workshops before it is finished; some having forty or fifty workmen, some four or five, while some are simply the garrets of workmen who ply their trade by their own fire-side. With the exception of the metropolis, there is perhaps no town in England where there are so many persons combining in themselves the characters of master and workman, as Birmingham, and none in which there is more observable a chain of links connecting one with another.' ('A Day at the Birmingham Factories,' by Mr. G. Dodd, in Supplement to 'Penny Magazine' for November, 1844.) The most recent account of the manufactures of Birmingham, including those in electro-metallurgy, will be found in the Supplements to the 'Penny Magazine' for October, November, and December, 1844.

The following abstract from the returns obtained at the last census includes nearly all the occupations which constitute the staple of the Birmingham trade:

Anvil-makers, 25; awl-blade makers, 43; bellows-makers, 113; brass-finishers and workers, 278; brass-founders and moulders, 3056; braziers and tinkers, 196; burnishers, 181; button-makers (all branches), 2898; candlestick-makers, 55; chain-makers, 132; clock and watch makers (all branches), 244; cock-founders, 154; comb-makers, 109; die sinkers and makers, 146; engine and machine makers, 245; engineers and engine-workers, 309; fender-makers, 96; file cutters and makers, 191; fire-iron makers, 91; founders, (branch not specified), 514; frying-pan makers, 35; German silver manufacturers, 63; gimlet-makers, 49; glass manufacturers (all branches), 964; gold-beaters, 131; gun and pistol makers (all branches), 1781; gun-barrel makers (all branches), ; hinge-makers, 132; iron manufacturers (all branches), 499; ironmongers, 87; ivory turners and workers, 70; japanners and lacquerers, 631; jewellers, goldsmiths, and silversmiths, 1398; lamp-makers, 244; lapidaries, 90; lock and key smiths, and bell-hangers, 314; mill-makers, 34; moulders (branch not specified), 83; nailors and nail-makers, 433; opticians, 47; ornament-makers, 37; patten and clog makers, 80; pattern-designers, 35; pen (steel) makers, 306; pin-makers (all branches), 120; plane-makers, 82; plated ware manufacturers, 34; platers, 730; platers, silver, 170; polishers, 227; pump-makers, 47; ring makers and turners, 40; rule-makers, 174; saddle-tree makers, 33; saw-makers, 36; screw-makers, 438; snuffer-makers, 146; spoon-makers, 348; spur-makers, 33; stampers and piercers, 312; steelyard-makers, 25; stirrup-makers, 33; sword cutlers and makers, 86; thimble-makers, 87; tin-plate workers and tinmen, 249; tool-makers, 350; tool (edge) makers, 54; toy-makers (in bone, gilt, glass, silver, steel, and tin), 924; tray-makers, 112; tube-makers, 27; umbrella and parasol makers, 129; urn-makers, 27; vice-makers, 23; whitesmiths, 193; wire-drawers, 277; wire-workers, 234.

In 1838 the average weekly wages of 791 persons engaged in about one hundred different branches of manufacture and handicraft in Birmingham were as follows:—

Ages.	Males.	Females.
7 to 13	3*s.* 1*d.*	2*s.* 4*d.*
14 to 20	5*s.* 9*d.*	5*s.* 2*d.*
Adults	24*s.* 3*d.*	8*s.* 0*d.*

Of the above 791 persons, 33 per cent. were workers in brass and copper; 11 per cent. in iron; 5 per cent. in guns and pistols; 4 per cent. in gold and silver; 1½ per cent. were glass-cutters; and the remainder were employed in a variety of other occupations. The average wages of adults are not high, but the income of families is often considerable when the wages of women and persons under 20 are added to the earnings of the head of the family. The occupation returns under the census show that out of a population of 182,000, the number engaged in some kind of occupation which was specified, was—males above 20, 43,688; males under 20, 8083; females above 20, 12,335; females under 20, 5245; and in 1024 cases the branch of employment was not specified. The number of persons of independent means was 3908; number of alms-people, pensioners, paupers, and beggars, 1075; number of 'other persons' (persons in barges, prisoners, &c.), 499; and the residue of the population consisted of 32,681 males under 20; 1621 above 20; 35,789 females above 20; and 36,974 females under 20.

Steam-power was first employed in manufactures at Birmingham in 1780. From 1780 to 1815 only 42 engines were set to work; from 1815 to 1830 there were 178; and from 1830 to 1838 there were 120 new ones. In January, 1839, the number of steam-engines at work was 240, of 3436 horses' power. The total quantity of coal consumed per day was estimated at 240 tons; and the number of persons employed in connection with steam-power was 5200 males and 1762 females. In the metal trades of the town 2155 horses' steam-power was employed, and the following is given as an estimate of the amount of power consumed in different branches:—

210	horses' power;	employed by iron-founders, engineers, and smiths; and steam first applied to these purposes in	1788
650	„	in rolling metals; and first applied	1790
170	„	in drawing wire; and first applied	1808
201	„	in iron forges and wrought-iron mills; and first applied	1810
78	„	in nail-cutting	1813
122	„	in wood-screw making	1819

The remainder of the steam-power was employed as follows:—grinding flour, 257 horses' power; glass-works, 95; wood-sawing, 152; paper-making, 60; colours and chemical preparations, 128; clay-grinding, 38; pumping, 444; sundries, 107; and engines of 159 horses' power were not at work.

An office for assaying and making silver was established at Birmingham in 1773; and in 1825 for gold. From 1773 to 1839 there had been assayed and marked 4,011,997 ozs. of silver. The quantity in the following years was:—

	Ounces.
1773-4	16,893
1800-1	87,473
1820-1	55,392
1838-9	114,500

The duty on gold and silver marked and assayed declined in each successive year from 4877*l.* in 1839, to 3348*l.* in 1842; and this falling off marks a period of general depression throughout the country. The quantity of gold assayed in 1838-9 was 2125 ozs.

The increase of wealth is indicated to some extent by the number of carriages which paid duty at different periods. In 1816 there were 404; in 1826, 697; and in 1839, 917; but in 1839 the duty was less than one-half of the amount charged in 1816.

In 1838 a very elaborate investigation was made, under the direction of the Birmingham Statistical Society, into the state of education in Birmingham; and the following are the results of this inquiry:—

Description of Schools.	Number of Schools.	Total Number of Scholars.
Sunday Schools:		
Church of England	15	4,565
Roman Catholic	2	338
Dissenters	39	11,854
Total	56	16,757
Returned also as day or evening scholars	..	4,141
Sunday-school scholars only	..	12,616
Infant-schools (private)	3	68
Dame schools	267	3,900
Common day-schools	177	4,280
Superior private and boarding schools	97	2,166
Supported solely by the scholars	544	10,414
Infant-schools supported partly by the public	7	735
Charity and endowed schools	26	3,331
Total	577	14,480
Evening schools supported by the scholars	36	563
Total number of schools and scholars	669	27,659
Evening schools attached to Sunday-schools	21	1,490

At the time the inquiry was made the population was estimated at 180,000, and the number of children in the borough at 45,000. Of the children 48·5 per cent. were receiving instruction in day and Sunday schools, and 51·5 per cent. were not receiving instruction in either. From similar inquiries it has been ascertained that the number of children between 5 and 15 years of age who were not receiving instruction in any school was 17·8 per cent. in the borough of Bury, Lancashire, in 1835; 30·7 per cent. in Manchester and Salford in 1834 and 1835; 34·7 per cent. at York in 1836; 52·7 per cent. at Liverpool in 1835 and 1836; and 65·9 per cent. in four parishes in the city of Westminster in 1837. The number of children attending schools was less in Birmingham than in any of the above-mentioned places, except in Liverpool and in the four Westminster parishes. So far as the ability to write may be taken as a proof of education, the borough of Birmingham is below Cumberland, Westmoreland, Northumberland, the North and East Ridings of Yorkshire, Durham, and Derbyshire, for out of 1018 marriages in 1842 there were 283 men (27 per cent.) and 448 women (44 per cent.) who signed the register with their marks. The proportion for England and Wales in the same year was respectively 32 and 47·9 per cent.

The want of public places of recreation and of innocent amusement is much felt at Birmingham. Many years ago, when the town was far less populous, the artisan had his small garden in the suburbs, which he cultivated in his spare time; but ground for such a purpose cannot now be had at a convenient distance. At the close of 1844 it was resolved that there should be public performances on the fine organ at the townhall once a-week, with the especial object of furnishing an agreeable and healthful enjoyment to the working-classes; and the plan is said to have succeeded. Quarterly tickets are issued at a small charge, and each performance is attended by a thousand or thirteen hundred persons. A subscription, amounting at present (March, 1845) to nearly 6000*l.*, has also been raised for erecting baths for the working classes. The number of public-houses, &c. in 1834 and 1839 was as under:

	Alehouses.	Spirit-shops.	Beer-shops.
1834	410	108	574
1839	511	129	549

In 1843 the police reported that there were 314 houses in the borough to which prostitutes resorted, in addition to 187 in which they lodge. There were 81 houses which were notorious as the receptacles of stolen goods, and 288 houses used as a resort by thieves, each of which was on an average frequented by 12 thieves. The number of persons charged before the borough magistrates is about 4000 a-year. In the week ending February 17, 1845, the number charged with felony was 23; misdemeanour 24; drunkenness 26; vagrancy 2. On an average of ten years ending Lady-day, 1842, the annual sum expended for the relief of the poor was 32,289*l.*; average weekly number of in-door paupers 693; out-door cases 3250, which, assuming each person to represent 2¼ persons, would make 8126, and the total of in and out door paupers would therefore average weekly 8819: in 1833 the number was 11,893. To this number must be added 360 persons employed in stone-breaking, and who may be supposed to represent 902 persons, and there were besides 4351 vagrants relieved weekly. The rates for the relief of the poor are collected and expended under a Board of Guardians originally constituted by 23 Geo. III., but which is now governed by an act of 1 & 2 Wm. IV. The number of guardians is one hundred and eight, who are elected triennially, and the overseers and churchwardens for the time being form part of the board. The rules and orders of the Guardians very closely resemble those adopted in Unions under the Poor Law Amendment Act. Gratuitous medical relief is extensively afforded at Birmingham; and in 1843 the number of patients at the following hospitals, infirmaries, and dispensaries was 31,662; and it appears that in about one-fifth of the births recourse was had to these public institutions:—

	In-Patients.	Out-Patients.
General Hospital . .	1627	10,055
Queen's Hospital . .	766	2,000
Town Infirmary . .	1170	5,818[*]
General Dispensary . .	2653	771 midwifery
Eye Infirmary . . .	12	2,459
Bodily Deformity Institution	..	153
Lying-in Institution . .	..	350

In 1844 the number of in-patients at the General Hospital was 1545; out-patients 9052; amount of subscriptions 2161*l.*; total income 6384*l.* Cost of each out-patient 1*s.* 10*d.*; of each in-patient 2*l.* 7*s.* 7*d.*, and without including the cost of bedding, furniture, and other establishment expenses the actual cost was 2*l.* 2*s.* 1*d.*

The parish of Birmingham is divided for ecclesiastical purposes into four district parishes: St. Martin's and St. Philip's, which contains a population of 94,316; St. George's, 24,499; St. Thomas's, 15,078; and All Saints, 4322. For all civil purposes Birmingham is considered as one parish.

Under a clause in the Municipal Reform Act, enabling towns to apply for a charter of incorporation, the borough of Birmingham was incorporated by royal charter dated October 21, 1838. The municipal boundary is co-extensive with the limits of the parliamentary borough. The number of parliamentary electors in 1839-40 was 4619, and in 1842-3, 6129. For municipal purposes the borough is divided into 13 wards. The corporate body consists of a mayor, 15 aldermen, and 48 councillors. There are 10 wards in the parish of Birmingham; and the hamlet of Deritend and Bordesley, the hamlet of Duddleston-cum-Nechells, and the parish of Edgbaston, each forms one ward. The wards of the parish of Birmingham are—Lady Wood, with a population of 8787; All Saints, 13,719; Hampton, 11,037; St. George's, 19,648; St. Mary, 14,685; St. Paul, 8973; Market Hall, 13,014; St. Peter, 16,773; St. Martin, 13,325; and St. Thomas, 18,254. The receipts of the borough fund in the year ending August, 1843, were 41,613*l.*, and the expenditure was 24,716*l.* The borough has its own court of quarter-sessions. Considerable discussion has recently taken place respecting a bill to provide for police regulations and good government of the borough, and for the transfer of the prison and public offices (now vested in the Guardians of the Poor) to the town council; but by a vote of the town council on February 24, it was determined not to proceed with the bill. There are at present three distinct bodies of commissioners for lighting, paving, and cleansing the borough; and four distinct boards of surveyors under the Highway Act. The Street Act Commissioners form an important local body, consisting of one hundred members. They discharge many of the duties which in other places ordinarily devolve on the town council. On the 27th of February, 1845, a bill was introduced into the House of Commons under their authority for effecting various improvements in their administration. The inhabitants of the hamlet of Duddleston-cum-Nechells are under separate commissioners, and on the same day a bill was also introduced for effecting improvements in the local administration, cleansing, paving, sewerage, &c. of those parts of the borough.

(*Returns under the Census Acts of Population and Occupations*; *Reports of Registrar-General*; *First Report of the Commissioners for Inquiry into the State of Large Towns*, &c., 1844; *Second Report*, 1845; *Report of the Sanatory Commissioners*, 1842; 'Economical Statistics of Birmingham,' in *Journal of London Statistical Society*, January, 1840, vol. ii. part vi.; 'Report on the State of Education in Birmingham,' in *Journ. of Stat. Soc.* vol. ii. part vii., April, 1840, &c.)

BIRTH. [INFANTICIDE, P. C.]

BISHOP, BISHOPRIC. Since the articles under these heads (P. C.) were written (in 1835) there have been several important changes in relation to the dioceses and revenues of the bishops in the United Church of England and Ireland. The inequality in the extent of dioceses has been in part remedied, first by the creation of the new sees of Ripon and Manchester, by 6 & 7 Wm. IV. c. 77, and next by remodelling the old dioceses. The newly created see of Manchester will not be filled up until a vacancy occurs either in the see of Bangor or St. Asaph; and whenever such vacancy occurs the above two Welsh bishoprics will be united, so that no addition will be made to the episcopal bench by the erection of Manchester into a bishop's see. A bishop was appointed to the new see of Ripon soon after the passing of 6 & 7 Wm. IV. c. 77; and as the same act made provision for the union of the sees of Gloucester and Bristol on a vacancy occurring in either of them, the number of bishoprics in England and Wales remains unaltered. Gloucester and Bristol no longer exist as separate sees, as their union has taken place. The bishop is styled Bishop of Gloucester and Bristol, and the congé d'eslire for his election will be addressed to the chapters of Gloucester and Bristol alternately. The diocese of Ripon is formed of detached parts of the dioceses of York and Chester. The diocese of Manchester will consist of the whole county of Lancaster, except the deanery of Furnes and Cartmel. The act 6 & 7 Wm. IV. made provision for uniting the see of Sodor and Man to that of Carlisle; but by 1 Vict. c. 30, its existence as a separate bishopric was preserved. The act 6 & 7 Wm. IV. c. 77, not only remodelled dioceses, but provided for a more equal distribution of episcopal revenues, according to the following scale:—

Archbishops.	
Canterbury . .	£15,000
York . . .	10,000
Bishops.	
London . . .	10,000
Durham . . .	8,000
Winchester . .	7,000
Ely . . .	5,500
St. Asaph and Bangor .	5,200
Worcester . .	5,000
Baths and Wells . .	5,000

The other bishoprics are augmented by fixed contributions out of the revenues of the richer sees, so as to increase their average annual incomes to not less than 4000*l.* nor more than 5000*l.* Thus under an Order in Council, dated 21st June, 1837, on the next vacation of the following sees, they will annually contribute to the Episcopal Fund as follows: See of Canterbury 7300*l.* a-year; York 1100*l.*; London 5000*l.*; Winchester 3600*l.*; Bath and Wells 1000*l.*; and Worcester 2300*l.* a-year. The surplus revenues are paid into the hands of the Ecclesiastical Commissioners, and constitute what is called the Episcopal Fund; and every seven years, from Jan. 1, 1837, a new return is to be made by them of the revenues of all the bishoprics, and thereupon the scale of episcopal payments is to be revised, so as to preserve the scale fixed upon by the act. Provision was also made in this act for a more equal distribution of patronage among the several bishops, proportioned to the relative magnitude and importance of their respective dioceses.

---

[*] In addition 3828 persons were visited at their own homes.

Under the act 3 & 4 Wm. IV. c. 37, and 4 & 5 Wm. IV. c. 90, which reduced prospectively the number of archbishoprics in Ireland from four to two, and the number of bishoprics from eighteen to ten, the alterations which it was intended to effect have already by lapse of time been nearly completed. The number of archbishops at present (March, 1845) is two and the number of bishops twelve. The future income of the episcopal establishment in Ireland will be 82,953*l.*, being a saving of 68,175*l.* a-year on the former establishment. This latter sum is under the management of the Ecclesiastical Commissioners of Ireland, and must be dispensed for ecclesiastical and educational purposes.

The bishoprics in the British colonies have lately been increased by the creation of several new sees. The oldest colonial bishopric was that of Nova Scotia, created in 1787, and when the articles Bishop and Bishopric, P. C., were written, there were also the bishoprics of Quebec, Jamaica, Barbadoes, and Calcutta. To these have been recently added the bishoprics of Toronto, Newfoundland, British Guiana, Antigua, Madras, Bombay, Australia, Tasmania, New Zealand, Gibraltar, and New Brunswick. Some of these bishoprics have been created by letters patent, and their revenues and jurisdiction are regulated by acts of parliament; but others, as those of New Zealand, Tasmania, Antigua, Gibraltar, &c., are not of royal or parliamentary creation, but have been established by the archbishops and bishops, in concert with or by consent of the ministers of the crown. In 1841 a meeting was held of the archbishops and bishops of England and Ireland at Lambeth Palace, when it was agreed to undertake the charge of funds then raising for the endowment of bishoprics in the colonies, and to become responsible for their application. In no case do they proceed without the concurrence of the government. In 1841, in pursuance of this resolution, the bishopric of New Zealand was created; in 1842, the four bishoprics of Guiana, Antigua, Gibraltar, and Tasmania; in 1844, Newfoundland and New Brunswick, and in 1845 Ceylon. As funds for endowments are raised, bishops will be consecrated for the Cape of Good Hope, and next for Sierra Leone, South Australia, Western Australia, Port Philip, and for Northern and Southern India. British colonies or dependencies which are not within any diocese are considered to be under the pastoral care of the Bishop of London.

There are thirty-two Roman Catholic archbishops, bishops, coadjutor bishops, and vicars-apostolic in the British colonies. At Sidney, Quebec, and in Bengal, the Roman Catholic prelates are of the rank of archbishops.

In 1840 a very important act (3 & 4 Vict. c. 86) was passed 'for better enforcing Church Discipline,' which repealed the old statute (1 Hen. VII. c. 4) under which bishops were enabled to proceed against their clergy, and sentence them to imprisonment. The new act provides 'that in every case of any clerk in holy orders of the United Church of England and Ireland who may be charged with any offence against the laws ecclesiastical, or concerning whom there may exist scandal or evil report as having offended against the said laws, it shall be lawful for the bishop of the diocese within which the offence is alleged or reported to have been committed, on the application of any party complaining thereof, or if he shall think fit, of his mere motion, to issue a commission under his hand or seal to five persons, of whom one shall be his vicar-general, or an archdeacon or rural dean within the diocese, for the purpose of making inquiry as to the grounds of such charge or report: provided always that notice of the intention to issue such commission under the hand of the bishop, containing an intimation of the nature of the offence, together with the names, addition, and residence of the party on whose application or motion such commission shall be about to issue, shall be sent by the bishop to the party accused fourteen days at least before such commission shall issue.' The bishop may at once pronounce sentence, by consent of the clerk; and such sentence is good and effectual in law. If he refuse or neglect to appear and make answer to the articles alleged against him, other than an unqualified admission of the truth thereof, 'the bishop shall proceed to hear the cause, with the assistance of three assessors, to be nominated by the bishop, one of whom shall be an advocate who shall have practised not less than five years in the court of the archbishop of the province, or a sergeant-at-law, or a barrister of not less than seven years' standing, and another shall be the dean of his cathedral church, or of one of his cathedral churches, or one of his archdeacons, or his chancellor; and upon the hearing of such cause. the bishop shall determine the same, and pronounce sentence thereupon according to the ecclesiastical law.' While the charge is under investigation the bishop may inhibit the party accused from performing any services of the church within his diocese until sentence has been passed; but if the person accused be the incumbent of a benefice, he may nominate any person or persons to perform such services during his inhibition, and such persons are to be licensed by the bishop if they are approved of by him. Appeals under the act are to the archbishop, and they are to be heard before the judge of the court of appeal in his province; but if the cause has been heard and determined in the first instance in the court of the archbishop, the appeal is then to the Queen in Council, and is to be heard before the Judicial Committee of Privy Council, and at least one archbishop or bishop must be present.

In matters of dispute between a diocesan and his clergy an appeal lies to the archbishop of the province in all cases excepting curates' stipends (1 & 2 Vict. c. 106).

Rolle, an old authority, contended that the archbishop might appoint a coadjutor to one of his suffragans who is infirm or incapable. This power is now established by 6 & 7 Vict. c. 62, entitled 'An act to provide for the performance of the episcopal functions in case of the incapacity of any bishop or archbishop.'

In 1841 a bishop of the United Church of England and Ireland was appointed for Jerusalem. The King of Prussia first suggested the appointment to Queen Victoria, and the right of appointing the bishop will be enjoyed alternately by the crowns of Prussia and England; but the Archbishop of Canterbury has a veto on the selection by Prussia. The Bishop of Jerusalem is a suffragan of the Archbishop of Canterbury; but he cannot exercise episcopal functions in the dominions of Great Britain, nor can the persons ordained by him. The Protestant Church of Jerusalem will comprehend persons using different liturgies and subscribing different articles of faith, who will be on terms of equality as members. The bishop may ordain Prussian clergymen, on their signing the Augsburg Confession and adopting the Prussian liturgy; and Englishmen, on their subscribing to our articles and liturgy. He is the legal protector of all Protestants of every denomination against the Turkish government. The act 5 Vict. c. 6, was passed to enable the archbishops of Canterbury and York, and such bishops as they might select, to consecrate a foreign bishop. The instructions given by the king of Prussia to his envoy with respect to the establishment of the bishopric of Jerusalem, are copied in the 'Ecclesiastical Gazette,' March 11, 1845.

At the present time there are twenty-four bishops of the Protestant Episcopal Church of the United States of America. In this church the superior powers of church government are vested in a General or National Convention which meets triennially. The Convention consists of two houses. The bishops sit as a body in their own right and form a separate House. The lower House is composed of lay and clerical delegates. Each diocese is represented by four laymen and four of the clergy, who are elected by local Diocesan Conventions. The lay members of the Diocesan Conventions are elected by their respective congregations or vestries. The general Convention, amongst other things, has the power of revising old or making new canons. It hears and determines charges against bishops; receives and examines testimonials from Diocesan Conventions recommending new bishops, and decides upon their appointment: without the certificate of the General Convention a bishop cannot be consecrated. At the General Convention which assembled at Philadelphia in October, 1844, 'sentence of suspension' was passed on a bishop by the House of Bishops. They adjudged him to be 'suspended from all public exercise of the office and functions of the sacred ministry, and in particular from all exercise whatsoever of the office and work of a bishop of the church of God.' The title assumed by a bishop in the United States is 'Right Reverend.'

The bishops of the Methodist Episcopal Church of the United States have no particular province or district. Their time is chiefly spent in attending the different annual conferences of the church.

The Roman Catholic hierarchy in the United States is composed of one archbishop, fifteen bishops, and five coadjutors. The first Roman Catholic bishop in the United States was consecrated in 1790.

England and Wales are divided by the Roman Catholic Church into 'Districts,' over each of which a bishop has been placed, who is a *bishop in partibus*. The London District is superintended by a bishop who is styled the Bishop of Olena; the Eastern District by the Bishop of Ariopolis; the Western District by the Bishop of Pella; the Central District by the Bishop of Cambysopolis; the Lancashire District by the Bishop of Tloa; the District of York by the Bishop of Trachis; the Northern District by the Bishop of Abydos; and the Welsh District is under a vicar-apostolic, the Bishop of Apollonia. Scotland is divided in a similar manner. Each District in Great Britain is subdivided into Rural Deaneries.

The Roman Catholic hierarchy in Ireland consists of four archbishops and twenty-two bishops. In the Charitable Donations (Ireland) Act (7 & 8 Vict. c. 97) the Roman Catholic prelates are designated for the first time since the Reformation by their episcopal titles. They had been referred to in the bill, when first brought in, as 'any person in the said church [of Rome] of any higher rank or order,' &c.; and, on the proposition of the government, this was altered to 'any archbishop or bishop, or other person in holy orders, of the Church of Rome.' In December, 1844, a royal commission was issued constituting the Board of Charitable Bequests in Ireland, and the two Roman Catholic archbishops and bishop who are appointed members of the Board are styled 'Most Reverend' and 'Right Reverend,' and are given precedency according to their episcopal rank.

It is stated in a recent authority, that the number of Roman Catholic archbishops in Europe is 108, and of bishops 469; and that there are 154 bishops in other parts of the world; making a total of 731 bishops. In France there are 14 archbishops and 66 bishops.

BISTORTA. [Polygonum Bistorta, P. C.]

BLACK ROD, USHER OF THE, is an officer of the House of Lords. He is styled the Gentleman Usher of the Black Rod, and is appointed by letters-patent from the crown. His deputy is styled the Yeoman Usher. They are the official messengers of the Lords; and either the Gentleman or the Yeoman Usher summons the Commons to the House of Lords, when the royal assent is given to bills. 'He executes orders for the commitment of parties guilty of breaches of privilege and contempt, and assists at the introduction of peers and other ceremonies.' (May's *Parliament*, p. 156.) One of the officers of the Legislative Council of Nova Scotia is styled Gentleman Usher of the Black Rod.

BLACKBERRY. [Rubus, P. C.]

BLAKE, WILLIAM. This extraordinary artist was the son of a London hosier, and was born in London in 1757. At the age of fourteen, his father was induced by his son's passion for drawing to apprentice him to an engraver of the name of Basire. He was a diligent and enthusiastic student; the day he devoted to the graver, and the night to poetry, for the graphic art absorbed but one-half of him, and he was utterly indifferent to the goods of this life: he used to say—'My business is not to gather gold, but to make glorious shapes, expressing god-like sentiments.' When he was twenty-six years of age, he married Catherine Boutcher, who survived him, and was a most devoted and attached wife, and fully appreciated the peculiarities of his mind. They lived at 28, Poland Street, and there Blake, with his wife always by his side, produced a series of designs and poems, which are quite unique in the peculiar spirit of their conception, but notwithstanding their peculiarity, are replete with beauties of the highest order. The spirit of universal benevolence and just appreciation of the greatness of life, animate and inanimate, breathed in his poems, and cannot easily be surpassed; but the mere versification is often very inharmonious. When Blake was only thirty years of age, Flaxman and another gentleman published a collection of his poems, and presented the printed sheets to the poet, under the hope that he might derive some profit from the sale of them.

The first of his own publications were the 'Songs of Innocence and of Experience, showing the two contrary states of the Human Soul,' which appeared with about sixty-five etched illustrations, in 1789. Several of these poems are remarkable for their true pathos.

These etchings and poems are executed in a very peculiar and original manner; the designs are drawn and the poems written upon the copper, with a secret composition (discovered to him by the spirit of his brother Robert, as he says); and when the uncovered parts of the plate were eaten away by aquafortis, the rest remained as if in stereotype. His wife worked off the plates in the press, and Blake tinted the impressions, designs, and letter-press, with a variety of pleasing colours.

His next work was 'The Gates of Paradise,' in sixteen small designs, of a very mystical character. This was followed by a series, dated Lambeth, 1794, of twenty-seven designs, four inches by six, under the title 'Urizen,' in which he seems to have attempted to represent hell and its mysteries; this extravagant work, says Allan Cunningham, 'is not a little fearful to look upon; a powerful, dark, terrible, though undefined and indescribable, impression is left on the mind, and it is in no haste to be gone.' After the completion of this work, Blake was employed by Mr. Edwards, a bookseller, to illustrate Young's 'Night Thoughts,' which he filled with marginal designs; so much to the satisfaction of Flaxman in many parts, that he introduced Blake to Hayley, the poet, who wished him to make some illustrations to the Life of Cowper, and persuaded him to remove, in 1800, to Felpham in Sussex. Flaxman was a constant friend to Blake, and the latter in his correspondence with him usually addressed him 'Dear Sculptor of Eternity,' and in the first letter he wrote to him from Felpham he called him 'Sublime Archangel.'

At this time Blake's mind was confirmed in that extraordinary state which many suppose to have been a species of chronic insanity. He was so exclusively occupied with his own ideas, that he at last persuaded himself that his imaginings were spiritual realities. He thought that he conversed with the spirits of the long departed great—of Homer, Moses, Pindar, Virgil, Dante, Milton, and many others: some of these spirits sat to him for their portraits. He remained at Felpham three years, and then returned to London. The first work after his return was his Jerusalem, comprising one hundred designs, of figures of men, spirits, gods, and angels; and for which, tinted, he charged twenty-five guineas. His next work were twelve designs to Blair's 'Grave,' for Cromek the engraver, who paid him twenty guineas for the twelve, but Blake was not allowed to engrave them himself; they were intrusted to Schiavonetti. These were followed by his 'Canterbury Pilgrimage,' a picture in water-colours or distemper, exhibited in his brother's house in 1809, with some other of his paintings in the same manner, of which he printed a 'descriptive catalogue,' containing many critical heresies, some sense, and much that is wild and absurd. The following extract from p. 27, though extreme, is founded in truth:—'As there is a class of men, whose whole delight is the destruction of men, so there is a class of artists whose whole art and science is fabricated for the purpose of destroying art: who these men are is soon known: "by their works ye shall know them." All who endeavour to raise up a style against Raphael, Michael Angelo, and the antique; those who separate Painting from Drawing; who look if a picture is well drawn; and if it is, immediately cry out, that it cannot be well coloured—those are the men.' Charles Lamb speaks of 'the Canterbury Pilgrims' in a letter to a friend as a work with 'wonderful power and spirit, but hard and dry, yet with grace.' In the same letter he says, 'I have heard of his poems, but never seen them. There is one to a tiger, which I have heard recited, beginning—

"Tiger, tiger, burning bright,
Through the deserts of the night"—

which is glorious. But, alas! I have not the book, and the man is flown, whither I know not—to Hades or a madhouse—but I must look on him as one of the most extraordinary persons of the age.'

In the descriptive catalogue of his exhibition, he makes some excellent remarks upon the character of Chaucer's writings; and some excessively severe remarks upon the 'Canterbury Pilgrimage' of Stothard. He seems to have injured himself very much in the opinion of the world by the extremities he went to in this catalogue; he was comparatively neglected after its publication, and the demand for his works very much declined. He became extremely poor, but he still continued to produce new works, as Twenty-one Illustrations to the Book of Job, which are among his best productions; two works of prophecies, one on America, in eighteen plates, the other on Europe, in seventeen; and a long series of illustrations to Dante, of which however he engraved only seven. His last performance was a likeness of his faithful wife, who, through his eccentricities reduced to the extreme of poverty, was never even inclined to complain. Blake himself never regretted his poverty: he considered himself a martyr in the cause of poetic art, and he pitied his fortunate contemporaries for their inordinate love of gain. He died on the 12th of August, 1828.

Blake lays a great stress upon drawing in his criticisms, yet there are few of his own designs which will bear even in this respect the test of criticism—his figures are heavy and ill proportioned, his outline is sharp and cutting, and the anatomica. markings of his figures are exaggerated and coarse—his happiest efforts are in his conceptions, and his designs are often tinted with great taste. As to his poetic fancies, there may be various opinions; his Songs of Innocence and of Experience are more poetical than his designs, the characteristic extravagancies of which are much more the symptoms of disease than the evidences of vigour—they are the offspring of an utterly uncontrolled and undisciplined imagination, which is the secret of their supposed originality; and this want of mental discipline is the extent of Blake's madness; his reason was unimpaired, but he devoted all the other faculties of his mind to the service of his fancy. He made many designs and wrote many poems which have not been published. 'He wrought much and slept little,' says his biographer, 'and has left volumes of verse, amounting, it is said, to nearly a hundred, prepared for the press. If they are as wild and mystical as the poetry of his Urizen, they are as well in manuscript—if they are as natural and as touching as many of his Songs of Innocence, a judicious selection might be safely published.' A very elegant edition of the 'Songs of Innocence,' &c. was published in London (W. Pickering, Chancery Lane) in 1839, exactly half a century after their first appearance, with a preface containing some excellent remarks upon Blake's character. There is a good portrait of Blake by T. Phillips, R.A., of which there is a print prefixed to the notice of Blake in 'The Lives of the most eminent British Painters,' &c. by Allan Cunningham.

BLANCHARD, JACQUES, whom D'Argenville dignifies with the title of the French Titian, was born at Paris in 1600. He was first instructed by N. Bolleri, and afterwards by H. le Blanc, at Lyon. He visited Italy, and arrived in Rome in 1624, and having studied there two years, he went to Venice, where he remained also two years. He found the works of the Venetian masters more suited to his taste, and models of imitation better adapted to his abilities, than the more serious compositions of the Romans. After spending some time at Turin and Lyon, Blanchard returned to Paris an accomplished painter, and by a series of easel pictures, which followed in rapid succession, he acquired a name as a colourist without a rival in France. He had however a short career; he died of consumption, aged only thirty-eight, in 1638. He left a son, Gabriel, who became a distinguished painter. Blanchard's principal works at Paris are a gallery in the Hôtel de Bouillon, containing thirteen pictures from antient mythology, painted in oil upon the wall; and the descent of the Holy Ghost in the church of Notre Dame. The majority of his works are of small dimensions, though the figures are of the size of life: they are chiefly religious. He painted also many portraits. The old French school owed as much to Blanchard for colour as it is indebted to Vouet for design. There are about seventy engravings after the works of Blanchard, by himself and by other engravers.

(D'Argenville, *Abrégé de la Vie des plus fameux Peintres.*)

BLAND, THE REV. ROBERT, B.A., was the son of Dr. Robert Bland, an eminent physician in London, and was born there in 1779. On leaving Pembroke College, Cambridge, he became an assistant master at Harrow, where he had previously been a pupil. After several other changes, including a short residence at Amsterdam as clergyman of the English church, he married in 1813, and became a curate in Essex. He left that county however in 1816, for the curacy of Kenilworth, which he retained during the remainder of his life. He died at Leamington, on the 12th of March, 1825. Mr. Bland enjoyed an excellent reputation, not only for his knowledge and taste in the learned languages, and in French and Italian, but also for his skill as a classical teacher. His character is described as amiable and exemplary. He published two volumes of original poems, 'Edwy and Elgiva,' 8vo. 1808; and 'The Four Slaves of Cythera,' a poetical romance, 8vo. 1809. He was also the author of 'Elements of Latin Hexameters and Pentameters,' a work which has gone through several editions. He contributed to periodical publications, and was one of the translators of the Memoirs of Grimm and Diderot, 2 vols. 8vo., 1813. He is best known however for his translations from the minor Greek poets. These first appeared in a volume entitled 'Translations, chiefly from the Greek Anthology, with Tales and Miscellaneous Poems,' 8vo., 1806 (chiefly by Mr. Bland and the late Mr. Merivale); again, in the form of 'A Collection of the most beautiful Poems of the Minor Poets of Greece, with Notes and Illustrations,' 8vo., 1813; and lastly, in an improved edition with new contributions, which was published in 1833 by Mr. Merivale. [Anthology, P. C.]

BLANKET. [Woollen and Worsted Manufactures, P. C., p. 555.]

BLASTEMA. [Cytoblast, P. C. S.]

BLASTING. Since the article Mining in P. C. was written, great improvements have been made in the means for removing vast masses of rock in such engineering operations as relate to excavations. The article referred to (p. 241) describes briefly the mode in operation up to that time, which consisted in the insertion of gunpowder into a small opening dug in the rock or stone, and firing this powder by means of a train and a slow-match, or by a safety fuse; but the bold achievements of Mr. Cubitt at the Dover cliffs have given a new character to this art.

The changes which have thus been wrought are not in the explosive material employed, but in the mode of igniting the material, and in the vast scale which this modification enables the engineer to adopt. Gunpowder is still the explosive agency; but a galvanic current effects the ignition. To those who have only a slight acquaintance with the nature of galvanism, this igniting power is a great mystery, but it may be readily explained thus:—So long as a galvanic current can travel along a wire uninterruptedly, its progress is silent and harmless; but if the continuity of the wire be broken, or if anything occurs to interrupt the course for a small interval, intense heat and disruptive action take place at that spot, quite sufficient to ignite gunpowder if placed there. The arrangements therefore are such as to enable the wires of a galvanic battery to come nearly in contact at the place where the gunpowder is deposited for blasting.

Although we have mentioned the name of Mr. Cubitt, on account of the extraordinary magnitude of his operations at Dover, yet the employment of galvanism in blasting was known rather earlier. Colonel (now General) Pasley, after many useless attempts had been made to remove the sunken hull of the 'Royal George' at Spithead, conceived that gunpowder might be carried down, by the aid of men descending in a diving-bell, and deposited in a water-tight vessel close to the ship, where it might be exploded by means of a galvanic current conducted by wires from an apparatus placed in a ship at some distance. The Admiralty gave the requisite permission in July, 1839; and Colonel Pasley proceeded to form cylinders for containing the powder, to provide electrical apparatus, boats of various kinds, a diving-bell, divers with water-tight dresses, and to make all the arrangements contingent on such a novel enterprise. The difficulties he met with were numerous; but he conquered them one by one; and at length, on September 23, he succeeded in exploding 2160 lbs. of powder, contained (under water) in a cylinder affixed to the outside of the hull of the sunken vessel. A second charge of 2300 lbs. was fired on October 15, and the effect of each explosion was to shatter considerable portions of the ship, which portions were afterwards attached to chains and cables by divers who went down in diving-dresses, and then hauled up by men working at capstans above. The brass guns recovered by these means have a value more than adequate to the whole cost of the operations; and the wood recovered has been chiefly placed in museums, or wrought up into articles of curiosity. Many different explosions, and a long series of auxiliary operations, were necessary to bring about this result.

The application of the same agency to the blasting of rocks for engineering purposes took place for the first time, so far as we are aware, in 1840, by Captain Paris, an engineer at Boston in the United States. Excavations were made in a rocky bed for the construction of quays and docks at that place; and the removal of the submarine rock was effected by galvanic blasting. The gunpowder was used in various quantities, from four to sixteen ounces, enclosed in air-tight tin canisters. The copper wires were inserted in the canisters; and these, as well as the powder, were secured by a water-proof composition. A hole was drilled in the rock for the reception of each canister, by a workman who descended in a diving-bell; and after securing the canister in the hole, and connecting them with a galvanic apparatus, a current exploded the gunpowder and blasted the rock. In the spring of 1842 the galvanic method was applied, under a modification introduced by Mr. Roberts, in blasting the rock of a quarry near the cathedral at Glasgow. In the same year some rocks were blasted under water, to aid in the reduction of a waterfall belonging to Lord Panmure, on the North Esk, with the view of rendering it accessible to salmon. In the autumn of the same year, the same agency was employed in making some excavations for the new harbour at Dunbar. But the experiment which tested the power of the method to the fullest extent was the one about to be noticed.

It was in January, 1843, that Mr. Cubitt made the first of his great galvanic blasts at Dover. The occasion for it thus arose:—The six or seven miles intervening between Folkstone and Dover exhibit a continued series of bold cliff-works connected with the South-Eastern Railway; and it was on part of this course that the necessity occurred for a process of blasting on an unexampled scale of magnitude. Proceeding from Folkstone, there is first a viaduct of great height and length; then the Martello tunnel, about a third of a mile in length; then the Warren cutting, a very deep excavation, two miles in length; then the Abbot's Cliff tunnel, more than a mile long; next a sea-wall, built up against the scarped face of the cliffs for a distance of two miles; then the double tunnel through the Shakspere Cliff; and, lastly, a timber viaduct along the face of the cliffs to the Dover terminus. Now in drawing a straight line from the Abbot's Cliff tunnel to the Shakspere tunnel for the sea-wall, it was found that a bulky promontory, called the Round Down Cliff, stood directly in the way. It was first attempted to tunnel through this cliff, but the soil being unfavourable, the idea of removing the cliff at one blast by gunpowder occurred to Mr. Cubitt the engineer; and there have been few examples in which a first attempt, on a vast scale, has so fully succeeded.

The arrangements for the explosion were thus made:—A horizontal gallery was excavated through the cliff, extending for about one hundred yards parallel with the intended line of railway, in a direction nearly east and west. Cross-galleries were driven from the centre and extremes of this main gallery. At the end of each cross-gallery a shaft was sunk, having at its bottom an excavated chamber, eleven feet long, five feet high, and four and a half wide. In the eastern chamber were deposited about 5000 lbs. of gunpowder, in the western 6000 lbs., and in the central 7000 lbs., making about 18,000 lbs. in all, or more than eight tons. The gunpowder was packed in bags; these bags were placed in boxes; loose powder was sprinkled over the open mouths of the bags; and the bursting charges were placed in the centre of the main charges. The distance of the charges from the face of the cliff varied from about fifty to seventy feet. These being the underground arrangements, those for firing the charge were as follow:—On the surface of the ground, behind the cliff, was a wooden shed for containing three galvanic batteries; each battery consisting of eighteen of Professor Daniell's cylinders, and two common batteries of twenty plates each. The wires from these batteries communicated at the other end by means of a very fine wire of platinum, the red-heating of which by the passage of the electric current would suffice to ignite the powder. The wires, covered with yarn, were extended on the grass to the top of the cliff, and then falling over the edge, were carried to the three excavated chambers, and placed in connexion with the charges. The wires were each about a thousand feet in length. All the passages and entrances to the powder-chambers were 'tamped,' or stopped up with dry mud, rammed down hard.

At two o'clock in the afternoon of the 26th of January, all the preparations being ready, three engineers worked the three batteries simultaneously; the three wires conducted the electric current to the three chambers, and the mighty explosion took place. Many had expected that noise, smoke, and fragments hurled to a vast distance, would have accompanied the explosion: but such did not occur. The rock seemed almost as if it had exchanged its solid for a fluid nature, for it glided downwards into the sea in one body. Sir John Herschel, in a communication to the 'Athenæum' immediately afterwards, says, 'Of the noise accompanying the immediate explosion, I can only describe it as a low murmur, lasting hardly more than half a second, and so faint, that had a companion at my elbow been speaking in an ordinary tone of voice, I doubt not it would have passed unheeded. Nor was the fall of the cliff (nearly 400 feet in height, and of which no less than 400,000 cubic yards were, within an interval of time hardly exceeding ten seconds, distributed over the beach on an area of eighteen acres, covered to an average depth of fourteen feet, and in many parts from thirty to fifty) accompanied with any considerable noise; certainly with none that attracted my own attention, or that of several others similarly stationed, with whom I afterwards compared notes.'

The complete success of such an experiment (by which it is said six months' time and 7000*l.* were saved to the company) naturally led to the adoption of similar means in other like cases. On March 2, in the same year, a second blast took place, a little beyond the Round Down Cliff, on a smaller scale than the former, as the mass requiring removal was not so bulky; there were 7000 lbs. of powder used, and 50,000 cubic yards of chalk dislodged. On April 18 a third blast took place, which consumed 10,000 lbs. of gunpowder. Later in the same year, in October, a fourth blast took place, in which the powder was distributed in twenty-eight distinct parts, deposited in as many separate excavations, and all were intended to be exploded simultaneously; but from some disarrangement of the wires, some of the charges did not explode, and these were fired separately on the following day.

The same agency has recently been employed by Mr. Brunel in the cliff-works connected with the South Devon Railway, between Exeter and Plymouth. Mr. Bidwell, too, has applied it to the quarrying of rocks for road-material, at the Wrekin in Shropshire. It has in like manner been applied by Messrs. Kemp of Edinburgh, in disintegrating a large mass of stone in the quarry of Rosyth Castle, about two miles from Queensferry. Indeed it now takes rank among the most powerful mechanical aids to the engineer.

BLECHNUM, a genus of plants belonging to the natural order of Ferns and the tribe Adiantariæ. It has its thecæ in a continuous line parallel to the midrib upon the transverse anastamosing veins, and covered by a continuous scarious indusium. There is but one British species of this genus, the *B. boreale*, Hard Fern. It has barren pectinate-pinnatifid fronds, with broadly linear rather obtuse pinnæ, fertile frond pinnate, pinnæ linear acute. This plant is exceedingly common in Great Britain, and is found almost everywhere in woods, on commons, heaths, and all uncultivated ground. It occurs in every European list of plants, and has been found in Northern Africa and North America. It is the *Lomaria Spicant* of Desveux, who is followed by Mr. Newman, in his 'History of British Ferns.' Linnæus described it as an *Osmunda.* The roots of this fern are black, tough, and wiry; the rhizoma tufted and hairy.

(Babington, *Manual;* Newman, *History of British Ferns.*)

BLETTING. All ripe fruits after they have been kept for some time begin to decompose, and the spots formed on the fruit during this process have been called by Professor Lindley *blets.* During the whole time of the growth of the fruits of plants various important chemical changes go on in their tissues, especially whilst ripening. These changes have been examined with great care by Berard. At first the flesh of most fruits consists of fibrous or cellular tissue, which is mostly composed of lignine. The liquid of fruits is sap, which exists between the cells in the intercellular passages. This liquid, besides a great quantity of water, contains sugar, gum, malic acid, malate of lime, colouring matter, a peculiar vegeto-animal substance, and an aromatic secretion proper to each fruit. In such fruits as the grape there is tartrate of potash and lime; in the lemon and the gooseberry, citric acid. As the process of ripening goes on, the quantity of water diminishes, and the sugar increases. This sugar is formed at the expense of the lignine, and is either in a concrete state, as in the grape, fig, and peach, or fluid, as in most fruits. It is after this period that bletting comes on, and changes take place in the fruit which render it unfit for the ordinary uses of man. Bletting is attended with the formation of carbonic acid, the nitrogenised substance enters into a state of putrefaction, and the sugar undergoes fermentation. These processes are undergone most rapidly when the fruit is exposed to the action of the oxygen of the atmosphere. The fruits in which these changes have been most accurately observed are the pear and the apple. A jargonelle pear was found to have sustained a loss of its constituents in the following proportion:—

		Ripe.		Bletted.
Lignine	...	2·19	...	1·85
Sugar	...	11·52	...	8·77
Water	...	83·88	...	62·73

It acquired rather more malic acid, gum, and nitrogenised matter.

The fact has been lately pointed out by Mr. Hassall that in all bletted fruits there exists a low form of *fungus*, which he considers the cause of the decay. He found, on inoculating sound fruits, even while growing on the tree, that he could produce immediately the process of decay, and wherever this was indicated by bletting, there he discovered the fibres of the fungus with the microscope. This appearance of the fungus however is only in accordance with what we know of the habits of fungi, whose sporules, being everywhere diffused through the air, immediately spring up where a fitting nidus is found for their growth. We find that as soon as a fruit becomes ripe its constituents commence union with the oxygen of the air, forming carbonic acid gas, and it is during this state of their elements that the fungus finds a soil ready for its development.

Whichever view be taken of the rotting of fruits, their preservation must be conducted on the same principle, for what will exclude oxygen will exclude the sporules of fungi. As a simple process it has been recommended to place at the bottom of a bottle a paste formed of lime, sulphate of iron, and water, and then to introduce the fruit, which has been pulled a few days before ripening. The fruits should be kept from the bottom of the bottle and as much as possible from each other, and the bottle should be closed by a cork and cement. In this way peaches, prunes, and apricots may be kept from twenty days to a month; pears and apples for three months. Mr. Hassall recommends that fruits should be washed over with a composition consisting of water one pound, shell-lac and borax two ounces.

(Lindley, *Introduction to Botany;* Hassall, *Transactions of Microscopical Society*, vol. i.)

BLI′GHIA, a genus of plants named after Captain William Bligh, R.N. [Bligh, William, P. C.], belonging to the natural order Sapindaceæ. It has a 5-parted calyx, five petals, a very short style, three stigmas, and a solitary seed with a very large arillus. Only one species of this genus has been described, the *B. sapida*, Akee-tree. It is a native of Guinea, from whence it has been introduced into the West Indies and South America. It is a tree attaining a height of thirty or forty feet. It has pubescent leaves, with three or four pairs of ovate-lanceolate veined leaflets. The fruit of this tree is a berry of a reddish or yellowish colour, about the size of a hen's egg. The aril of the seed is pulpy, and of a grateful subacid flavour, and is eaten in Africa and the West Indies. This tree does not produce flowers in this country. It may however be easily cultivated. It grows well in a mixture of loam and peat. Cuttings will strike in sand under a handglass. They should not be deprived of any of their leaves.

(Loudon, *Encyclopædia of Plants.*)

BLITUM (from βλίτον), a genus of plants belonging to the natural order Chenopodiaceæ. It has no corolla, a trifid calyx, a pistil with two styles, a single seed immersed in its berried calyx. Two species of this genus are known by the name of Strawberry Blite—*B. capitatum* and *B. virgatum*. The former has its flowers in terminal spikes; the latter has its heads lateral and scattered. Some writers have made the *B. virgatum* only a variety of the first, but its axillary flowers are constant. After flowering, the calyx of these two species swells out, and presents the size, appearance, and colour of the common wood strawberry. It is succulent, stains the hands, and was formerly used for colouring puddings. The taste is insipid. These plants are not natives of Great Britain, but are common on way-sides and in cultivated grounds in the south of Europe. The species of *Chenopodium* are closely allied to those of Blitum; and Meyer, Reichenbach, and Koch have referred the European species of Chenopodium with vertical seeds to the genus *Blitum*. These are the *C. rubrum*, *C. Bonus Henricus*, and *C. glaucum* of Babington's 'Manual of British Botany,' all three of which are Linnæan species.

(Koch, *Flora Germanica;* Loudon, *Encyclopædia of Plants;* Babington, *Manual.*)

BLIZARD, SIR WILLIAM, was born at Barnes Elms, in Surrey, in the year 1743, where his father was an auctioneer. His early education was neglected, but he was apprenticed to a surgeon and apothecary at Mortlake. During his apprenticeship he devoted himself to self-improvement, and paid much attention to botany. On leaving Mortlake, he became assistant to a surgeon in London, and attended during that time hospital practice at the London Hospital, and the lectures of William and John Hunter and Mr. Pott. His assiduity recommended him to his teachers, and he was soon elected surgeon to the Magdalen. On the decease of Mr. Thompson in 1780, he was elected surgeon to the London Hospital. About this time he connected himself with Dr. Maclaurin as a teacher of anatomy, and they lectured together, first at a small place in Thames Street, afterwards in Mark Lane, and in 1785 at the London Hospital. Imperfect as such an institution was for teaching medicine, it was the first that was established in London in connection with any of the large hospitals.

In 1787 Mr. Blizard was appointed Professor of Anatomy to the old Corporation of Surgeons, and in the year following was unanimously re-elected. He was afterwards appointed an examiner. He was also elected a Fellow of the Royal Society in 1787. He took an active interest in procuring for the old Corporation of Surgeons a new charter, which was at last obtained, the new institution being called the Royal College of Surgeons of London. By a charter granted in 1844, it is now called the Royal College of Surgeons of England. On the granting of the first charter, Mr. Blizard was appointed, in conjunction with Sir Everard Home, a professor of anatomy. He was president of the college twice during his life, and delivered the Hunterian Oration three times. On the occasion of the great collection of John Hunter being presented to the College by the government, Mr. Blizard presented also his preserved specimens in anatomy and pathology, amounting to about nine hundred preparations.

In 1796 he published a work entitled 'Suggestions for the Improvement of Hospitals and other Charitable Institutions,' 8vo. This work pointed out the evils that existed at that time in the various institutions intended for the relief of disease. Such was the want of cleanliness and attention to ventilation in many of these places, that it was questionable whether they did not do more harm than good. This work of Mr. Blizard drew particular attention to these facts, and was followed by a beneficial improvement in many of the metropolitan hospitals; but such is the imperfect construction of the buildings, and want of attention on the part of the managers, that many hospitals, even of the present day, are exposed to the charges brought against them in 1796.

In 1803 Mr. Blizard was appointed to present an address to the king, from the College of Surgeons, when he received the honour of knighthood. In 1819 he founded the Hunterian Society, which has for its object the bringing together medical men, and the discussion of medical topics at stated periods. He was the first president, and held the office three successive years. This society now possesses a good library, and its members meet once a fortnight at the rooms in Bloomfield Street, Finsbury. He also was the founder of the Samaritan Society, which was instituted with the view of explaining the circumstances of cases in hospitals, that have a claim upon benevolence, of obtaining a fund from which relief might be afforded, and providing a body of men that might properly execute and perpetuate the good design. This society has flourished, and now dispenses 500*l*. annually in the relief of objects of distress. Sir William took an active part in the formation of many of the metropolitan societies. He was one of the first fellows of the Horticultural Society. He was one of the founders, and for many years vice-president, of the London Institution.

Besides being Surgeon to the London Hospital and a member of the Council of the College of Surgeons, he held the offices of Consulting Surgeon to the Deaf and Dumb Asylum, the Marine Society, the Clergy Orphan Asylum, and the London Orphan Asylum. But with all his activity and industry, with the exception of an attack of fever, caught by working night and day in his dissecting-room, his health never failed him till the last. He belonged to a long-lived family; his father and mother died at the age of eighty-six, and his grandmother on his mother's side at ninety. In 1827 he was in his eighty-fifth year, but strong enough to make his first visit to Edinburgh. His eye-sight latterly failed him, and when this was discovered to be owing to cataract, he insisted, in spite of the entreaties of his friends, on having the operation of extraction performed. This was done by Mr. Lawrence in 1834, after which he regained the use of his eyes. He was however now in his ninety-third year, and during the following year his strength and health visibly failed him, although he attended a meeting of the court of examiners at the college the Friday before his death. He died on the 28th of August, 1835.

Sir William was tall in person, with features strongly marked. He was prone to jocularity, which exhibited itself on various occasions, and has obtained for him a place in the pages of 'Joe Miller.' He was most punctilious on points of etiquette, and retained the fashions of the last century to the day of his death. At one time it was customary for physicians and surgeons to attend at coffee-houses to be consulted. Sir William Blizard is said to have been the last medical man in the metropolis who pursued this practice. He regularly frequented, for this purpose, Batson's coffeehouse, Cornhill.

In early life, Sir William, in politics, was a great reformer. He regularly contributed to many of the periodicals of the day, under the signature of Curtius. Some of these contributions appeared in the 'Middlesex Journal, or Chronicle of Liberty,' and the 'Freeholders' Magazine, or Monthly Chronicle of Liberty.' As he grew older however, and his position in society improved, he became less democratic, was an admirer of Mr. Pitt, and a member of the Pitt Club. Subsequently, in his position of a member of the Council of the College of Surgeons, he was an opponent of all change in that body.

As a surgeon, Sir William Blizard never took the highest position in his day, but he was a good anatomist. His contributions to medical literature are few, and, considering the vast opportunities he must have had of witnessing all forms of disease in one of the largest hospitals in London, not so important or valuable as might have been anticipated. His principal papers are:—1, A new method of treating the Fistula Lachrymalis, *Phil. Trans.*, vol. lxx. 2, 'Experiments and Observations on the external use of Tartar Emetic,' 1787. 3, 'Observations on the uses of Electricity in Deafness,' 1790. 4, Lecture to the Scholars of the Maritime School at Chelsea, on the situation of the large blood-vessels of the extremities, explaining the use of the tourniquet,' 12mo., 1798. This was written with the view of affording sailors some knowledge of what could be done in cases of emergency from wounds of various kinds. 5, 'Observations on some epidemical effects,' 1792. 6, 'Hunterian Orations,' 1815, 1823, 1828. 7, Oration delivered before the Hunterian Society, 1819. 8, 'An Address to the Chairman and Members of the House Committee of the London Hospital, on the subject of Cholera,' 1831. 9, Desultory Reflections on Police, with an Essay on the means of preventing crimes and amending criminals,' 1785. This is an excellent essay, and contains some severe animadversions on the system of police at the time when it was published.

The materials for this notice have been chiefly selected from 'A Brief Memoir of Sir William Blizard, Knt.,' by W. Cooke, M.R.C.S.

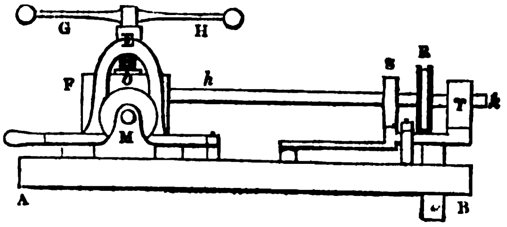
BLOCK MACHINERY. The assemblage of machines devised by the inventive genius of Mr. (now Sir Mark Isambard) Brunel for the formation of the blocks employed in raising burthens, and particularly in the important service of moving the rigging of ships, contains so many ingenious processes for gaining the proposed ends with the utmost accuracy, and, at the same time, with the least possible labour, as to justify the opinion that it constitutes one of the noblest triumphs of mechanical skill; and, in this article, it is intended to give a brief description of the principal parts of which it is composed.

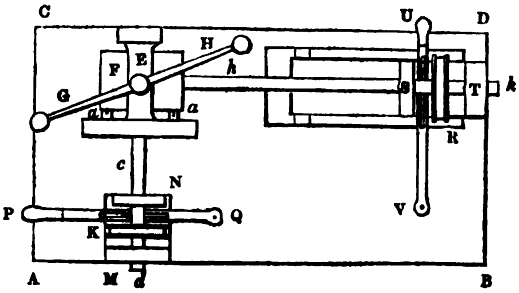
The machines may be said to consist of many saws and lathes; by these the work is performed, from the operation of cutting up a log of timber, to that of polishing the pins on which the pulleys turn; and motion is communicated to all of them by a single steam-engine.

A straight saw worked backwards and forwards, horizontally, by the engine, cuts off in succession different portions transversely from the log of timber (elm) which, for this purpose, is made to rest on a table or low bench; the portions cut off being of the proper lengths for the dimensions of the intended blocks. For the smaller logs a circular saw is used; it cuts the tree transversely, and consequently its plane is perpendicular to the axis of the latter: the saw is capable of being raised vertically, or moved horizontally, at pleasure, in order that it may be made to enter the wood above or below, or on either side.

After the log has been cut in slices, the latter are brought to what is called the ripping saw: this is circular; and its plane standing vertically, in part above the level of the table, it serves to cut the slices into rectangular parallelopipeds. In this state the wood is brought to the boring machine, which may be thus described (the lower figure representing the plan, and the upper a side elevation):—

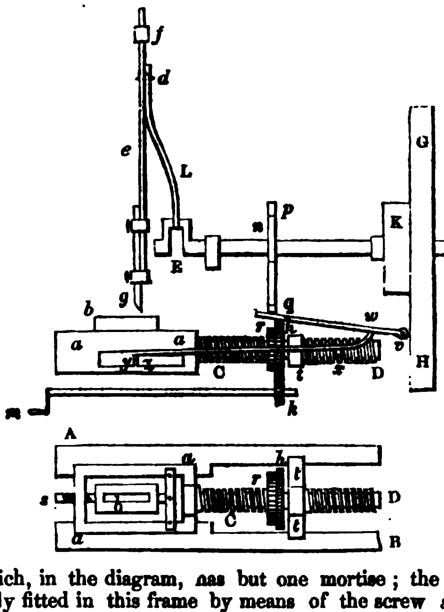
The rectangle A B C D represents the surface of a strong table, on which is fixed an iron frame E having three legs; within these the parallelopiped F is placed between three screw-heads, two of which appear at *a a*, and it is rendered immoveable during the operation by means of the screw *b*; this last being turned by the iron bar G H. *c d* is one of the borers, which turns on its axis by means of the pulley K, the latter receiving motion from the engine: this borer rests on the frame M N, which is capable of being moved towards the frame E by pressing on the end P of the lever P Q, so as to turn it about the pivot Q. *h k* is another borer, which turns on its axis by means of the pulley R, the latter also receiving motion from the engine: this borer rests on the frame S T, which is capable of being moved towards the frame E by pressing on the handle U V, so as to turn it about the pivot V.





The former borer makes the hole for the pin on which the sheaves of the block are to turn; the other merely makes a perforation at a spot which is to form one extremity of the mortise intended to contain a sheave. If the block is to contain two or three sheaves, the borer is to make as many perforations, the frame S T being capable of moving in a direction parallel to B D, in order that the point of the borer may be placed where the required perforations are to be made.

A remarkably ingenious machine is employed to cut the mortises in which the pulleys are to turn; and it is hoped that the following cut and description will suffice to render the process intelligible. A B is a representation of the horizontal surface of the table or stage on which the block is placed; and the diagram above it exhibits a side elevation of the acting part of the machine, the pillars and braces which support it being omitted, as they would have concealed, in part, the apparatus. *a a* is a frame made to contain the block *b* which, in the diagram, has but one mortise; the block is tightly fitted in this frame by means of the screw *s* at one extremity, and the frame is capable of being moved along the stage from *s* towards *t t*, as much as the whole length of the intended mortise. The great screw C D is fixed at one extremity to the frame which contains the block, and works in a concave screw which is cut in the transverse piece *t t*, the the latter being fixed to the table or stage.



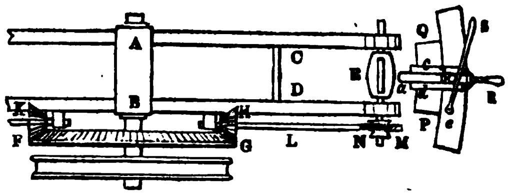
E F is an axle which terminates with a crank at E and carries at the opposite extremity the fly-wheel G H, the revolving motion being communicated from the engine by a strap passing over the cylinder K. The circular motion of the crank at E produces by means of the bent rod L, which turns on a joint at *d*, a reciprocating motion vertically in the rod *e* which passes through a collar at *f*: to the lower part of this rod is made fast the steel chisel *g* by which the mortise is to be cut; and it may be easily understood that, if two or three mortises are to be cut at the same time, as many chisels may be fixed, in line, parallel to one another, in a frame which is carried by the rod *e*. On the screw C D is a toothed wheel *h*, and below it is a small wheel *k* which can be turned round by means of the handle at *m*, and thus a small motion may be given to the frame *a a* in order to bring the hole previously bored in the block vertically under the chisel *g*. The axle E F carries an excentric wheel *n* (seen edgeways), on the circumference of which rides one extremity *p* of a bent lever *p q*, the lower branch of which lies tangentially on the top of a ratchet wheel *r*: the inferior surface of this branch has a notch, the sides of which, by the movement of the excentric wheel, are made to act on a tooth of the wheel *r*; and thus, the axle C D being turned, the frame *a a* is moved a little way towards the cross-piece *t t*. This movement always follows immediately after the chisel has made a descent, and thus there is presented a new part to be cut out from the block. Since the chisel goes quite through the block at each descent, and the movement is very rapid, the mortise is quickly made.

The extremity *q* of the bent lever *p q* rests upon a lever whose fulcrum is at *v*, and this rests at *w* on the bent lever *w x y* whose fulcrum is at *x*, and when by the motion of the frame *a a* the notch at *y* falls over the extremity *z* of a projection on the side of the frame, the notch in the branch *q* is lifted above the top of the wheel *r*, and the mortise being completed, the frame with the block moves no further. The cylinder K is hollow, and within it, upon the axle E F, is a cone which, while it turns with the axle, is capable of being moved backwards or forwards on the latter by means of a lever not shown in the cut: when this cone is thrust as far as it can go into K, the friction is great enough to allow the axle to be turned with the fly wheel and cylinder; but, on drawing the cone towards E, its surface is disengaged from the interior surface of K, so that the axle E F no longer moves with the fly wheel. It is while the axle ceases to revolve that the mortised block is removed, and one on which the operation is to be performed is put in its place.

The block is subsequently submitted to the action of a circular saw, by which the corners are cut off, and it is made to assume the form of an octangular prism: in this state it is removed to what is called the shaping machine, in order to be reduced to the requisite figure.

The shaping machine consists of two wheels connected together and turning on the same horizontal axle: they carry between the interior surfaces of their rims ten blocks at equal distances from one another on the circumference; and at first the blocks are disposed so that the mortises in each are perpendicular to a plane passing through the common axis of the two wheels, the axes of the blocks remaining always parallel to that axis. The wheels are made to revolve by a strap passing over a cylinder on the axle; the cylinder being in connection with the steam-engine: the cutting tool is applied, on a level with the axis of the wheels, to a horizontal frame which has the form of a circular arc, the centre being in the middle of that axle; and while the edge of the tool is pressed against the block it is slowly moved along the arc. Thus, the tool acting against the block during the revolution of the latter with the wheel, and being itself in motion horizontally, the face of the block is brought to the form of a segment of a sphere. Each block is then turned on its particular axis: first one quarter round, then another quarter, and finally a third quarter round: and in each of these positions an edge or side of the block is, by the tool, brought to a form similar to that which was given to the first face; the last of the four sides being completed after each block has been turned three quarters round on its own axis. The ten blocks are then removed and ten others put in their places, to be shaped in like manner.

The blocks are not turned on their several axes by hand, the machine containing an ingenious contrivance by which such revolutions are effected. In the following cut, A B is the axle of the double wheel, of which A C, B D represent two of the radii, and E one of the blocks at the circumference. A bevilled wheel F G is fitted on the axle of the double wheel, and, in the teeth of this, work as many pinions, H, K, &c., as there are blocks; each pinion has an axle L M in the direction of a radius of the great wheel, and extending as far as the circumference of the latter; near the extremity M is cut what is called a perpetual screw, whose threads work in the grooves of a pulley-shaped wheel N, on the axle of which is the block E.



During the process of shaping the blocks, the wheel F G revolves with the great wheel, carrying with it the pinions H, K, &c., and their axles L, M, &c., the pinions not changing their places on the circumference of F G, and consequently the blocks having no movements on their particular axles. But when the first faces of the ten blocks have been shaped, the whole machine is detached from the engine, and the wheel F G, which is capable of turning freely on the axle of the great wheel, being held fast, the latter is turned round by hand; this causes the pinions H, K, &c. to move on the circumference of F G, and, at the same time to revolve on their own axes; thus the axles L, M, &c. revolve, and, on account of their connection at N, &c. with the axles of the blocks, the latter revolve also on their axes. The numbers of the teeth are so proportioned that four revolutions of the great wheel, while F G is held fast, will cause each block to turn a quarter round on its own axle; this brings a new side of each block to the circumference of the wheel, and the whole machine being then re-connected with the steam-engine, the process with the tool is again carried on till the new side of the block is shaped; the machine is then released from the engine, the blocks turned as before another quarter round, and so on.

The part *a b* represents the shaping tool, which slides between the two plates *c* and *d* of a frame which is made to slide upon the circular arc PQ towards either of its extremities by moving the handle R; and while the tool is thus made to move slowly on the arc, it is kept close to the block by pressing on the handle S, which turns on a pivot at *e*, against a pin at *b*.

Lastly, the blocks are taken to what is called the scoring-machine, by which there are cut on each of the faces the two grooves intended to receive the rope by which the block is to be suspended when in use: this operation is performed by means of two cutting tools, with curved edges, fitted at the opposite extremities of a small brass wheel which revolves on an axle by the connection of the latter with the steam-engine: the block is fixed in a frame in an inclined position, so that the cutting tools form a groove which commences near the pin-hole of the block and deepens gradually towards either extremity.

The sheaves are made of lignum vitæ, and plates of the required thickness being cut from the tree, each of them has a circular form given to it by means of a trepanning, or crown saw, a cylinder of steel having teeth on one of its edges, and having on its axle a tool for boring the centre hole through which the pin is to pass; the plate of wood being fixed in its place, the workman by a lever presses the saw and centre-bit against it; and these by revolving rapidly, both give a circular form to the plate and bore the hole in its centre.

The sheave is then to be prepared to receive in its centre the metal *coak* or ring through which the pin is to pass; for this purpose it is laid horizontally on a plate, which may be kept at rest, or turned round on its axis, as may be required; a drill, or cutting tool, in a vertical position, is made to form in succession three semicircular excavations of small depth at equal distances from one another about the centre hole. During the cutting of each of these the plate carrying the sheave is fixed, but in each interval it is turned one-third part round, by which means the tool is enabled to enlarge the centre hole to a small depth, quite round the latter; thus the side of the sheave is countersunk about its centre in the form of a circle having three segments cut in its circumference: the like countersinking then takes place on the other side of the sheave. The coak, which is made of gun-metal and of a form to fit the countersink, is in two parts, one of them having a barrel which is to enter the centre hole; the parts are then introduced and riveted to the sheave. The middle part of the coak is then broached out so as to form a hole perfectly cylindrical; and, lastly, by a lathe also connected with the engine, the groove for the rope is formed round the circumference of the sheave.

The pins, which are of iron, are turned in a lathe of great strength; and are highly polished by being drawn with a revolving motion between two plates.

What has been said cannot be considered as a complete description of this very ingenious and complex machinery, but our limits prevent us from going more fully through the details.

A complete assemblage of the machines was, under the direction of Mr. (Sir M. I.) Brunel, executed, in 1804, by the late Mr. Henry Maudeslay, at Portsmouth; and a second was executed, in 1807, in the dockyard at Chatham.

BLOIS, PETER OF. [Peter of Blois, P. C.]

BLOND, or BLON, JACQUES CHRISTOPHE LE, a miniature painter, born at Frankfort in 1670, known as the inventor of printing in colours. He appears to have been studying in Rome as early as 1696, and he probably lived there many years. Before 1711 he was practising as a miniature painter with great success in Amsterdam, but he executed miniatures of so small a size that he injured his eyes, and he was forced to give up that style. He then took to oil painting, and executed several good pictures in that style also; but he appears to have soon afterwards turned his attention to printing in colours. He anticipated great results from his discovery, and removed to Paris as a larger field of operation, but not finding that encouragement which he expected, he came to London. Here he found ready subscribers to his novel plan of picture painting. Those however whom his representations had persuaded to venture money in the scheme were very much disappointed in the results. His prints were flat and dirty, and gave but very faint copies of their originals; they were however efforts of great merit and great novelty, and with more perseverance than Le Blond possessed, much good might have resulted. Le Blond however, disheartened by the coldness with which his prints were received, and a consequent bankruptcy, neglected the discovery, and turned his attention to a new scheme—the weaving in tapestry of the Cartoons of Raphael.

His plan of printing was very simple, too simple to produce tone. He used only the three primary colours, and passed the prints three times through the press, printing with one colour each time; the secondary and tertiary colours were obtained by printing one colour over one or both of the other two primary colours; and the impression was repeated for those parts where great depth was necessary: they were first engraved in mezzotint. He published an account of his plan in 1722, in French and English, in 4to., entitled 'Il Colorito, or the Harmony of Colouring in Painting, reduced to Mechanical Practice, under easy Precepts and infallible Rules,' with five examples, and a dedication to Sir Robert Walpole. A second edition was published in Paris, in 1756, after the death of Le Blond, by one of his pupils, under the title 'L'Art d'Imprimer les Tableaux.' Le Blond executed altogether in this style thirty-three plates, many after the great masters, and all very large—some of the portraits, which are a considerable proportion, are as large as life; they are extremely scarce.

Le Blond found also much assistance towards the commencement of his undertaking regarding the Cartoons of Raphael, but it was so inadequate to the full accomplishment of the tapestries, that after he had spent all that was advanced, he saw the hopelessness of persisting; and in about 1737 he absconded and went to Paris, leaving his friends the partly prepared apparatus as the indemnity for their outlay. In Paris he again had recourse to his printing in colours, for which he took out a patent in 1740, but he produced only two plates; the enterprise failed, and he himself is said to have died in an hospital in 1741. He instructed some pupils in the art, who carried it on after his death, but with little success. Cochin, fils, published an account of the process in an edition of Abraham Bosse's book 'De la Manière de Graver,' &c., Paris, 1758; and it is noticed in the 'Oeuvres Posthumes de Sylvain Bailly.' An artist of the name of Admiral, one of Le Blond's reputed pupils, was more successful than Le Blond, as he applied the process to anatomical plates, a style of work for which it is fully applicable. He published six anatomical plates at Amsterdam and Leyden, between 1734 and 1741, and a book of insects a few years later.

(Heineken, *Idée Générale d'une Collection d'Estampes*, and *Dictionnaire des Artistes*, &c.; Hüsgen, *Artistisches Magasin;* Huber, *Manuel des Amateurs*, &c.; Strutt, *Dictionary of Engravers;* Fiorillo, *Geschichte der Zeichnenden Künste*, &c.)

BLOW, JOHN, Mus. Doc., was born at North Collingham, Notts, in 1648, and educated in the Chapel-Royal, where he very early distinguished himself by his activity and enterprise, for it appears, from Clifford's 'Collection,' that while one of the 'children' of that royal establishment, he composed several anthems, which had the honour to be performed before the king. His advancement was rapid, and he became the greatest musical pluralist that the history of the art records; for he was successively appointed to the offices of Gentleman of the Chapels-Royal and Master of the Children; one of the King's Private Musicians; Composer to the same; Almoner and Master of the Choristers of St. Paul's Cathedral,—and Organist of Westminster Abbey. Part of these duties must have been executed by deputy, and, most likely, part neglected. He died in 1708, and was interred in the north aisle of Westminster Abbey, where a monument is erected to his memory, on which is engraved his famous '*Gloria Patri*,' a canon, together with a long inscription, wherein it is stated, and to his honour, that he was 'master to the famous Mr. H. Purcell.'

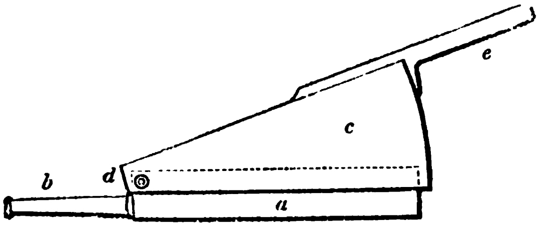
Dr. Blow was remarkable for the elegance of his person and address, to which may, in some measure, perhaps, be ascribed his lion's share in the musical offices of his day. His compositions are numerous, but more the offspring of study and patient labour than of genius. Two of his anthems however prove that he was sometimes inspired by the muse presiding over his art. And a few of the many secular compositions in his 'Amphion Anglicus,'—a volume of songs, &c.—were deservedly popular during his life, and are worth revival. One anecdote of him, given by Sir John Hawkins, shows with what intrepidity he could rebuke a favourite of the court to which he belonged, and whom he viewed as the enemy of his religion. In the chapel of James II., an anthem, by some Italian master, had been introduced, which the king, liking very much, asked Blow if he could make one as good. Blow answered in the affirmative, and the next Sunday produced the fine anthem, 'I beheld, and lo! a great multitude.' When service was over, the king sent Father Petre to tell the author that he was much pleased with it. 'But,' added the popish confessor, 'I myself think it too long.' 'That,' answered Blow, 'is the opinion of but one fool, and I heed it not.' The Jesuit was so displeased at this unceremonious assault, that he determined on revenge, and persuaded the king to put the composer under suspension; from which however he was soon released by the Revolution, which took place shortly after.

BLOWING-MACHINES, or machines for producing a current of air for the purpose of exciting the requisite intensity of combustion for metallurgical and other operations which require great heat, are a class of contrivances only slightly alluded to in the article Bellows (P. C., p. 198), but which, from their great importance and very general use, demand further explanation.

The kind of blowing-machine to which the name of *bellows* is usually applied consists of an air-tight chamber of variable dimensions, having one aperture closed by a valve which can open only inwards, and another, which is connected either directly or indirectly with the nozzle, or pipe for the exit of the current of air, closed by a valve which can only open outwards. When, by the application of mechanical force, this chamber is distended or enlarged, the pressure of the external air opens the valve which opens inwards, and consequently the chamber becomes filled with air; but when, by an altered application of power, the chamber is compressed so as to reduce its capacity, the condensation of the included air causes the valve by which it entered to close, and that which opens outwards to open, so that the air escapes by the nozzle, with a degree of force and rapidity proportionate to the pressure employed in compressing the chamber. The leathern bag of the musical instrument called a bagpipe is an example of such a variable, or expansible and compressible, chamber, and would therefore, if fitted with a nozzle, form a substitute for the common domestic bellows; but the same effect is produced, in a much more convenient way, by the use of a chamber formed of two boards, the edges of which are connected by pieces of leather laid in folds in such a manner that the upper board may be raised or depressed at pleasure, while the lower board remains stationary. Of the precise arrangement of the parts alluded to in hand-bellows for domestic use it is unnecessary to give any account: we proceed therefore to explain some of the principal modifications of form and arrangement in large bellows employed for forge-fires and furnaces.

The blast produced by such a machine as has been de scribed is intermittent, and also variable in intensity. The first of these defects may be remedied by the device mentioned in **Bellows**, P. C., of employing two separate bellows or pairs of bellows, worked alternately, so that the one may be expelling air while the other is drawing in a fresh supply. While, however, the blast thus produced is continuous, it is by no means equable in force, to remedy which defect the air expelled from the chamber already described should be forced into a second chamber also of variable dimensions, but compressed by a weight so as to produce a constant steady pressure, and the nozzle should be made to open into the second chamber. In forge-bellows of this construction there are three boards, connected by leather sides which are kept in regular folds by hoops of cane. The middle board is fixed in a horizontal position, and has the nozzle attached to it, while the upper and lower boards are moveable, and loaded with weights, the effect of which is that when the machine is at rest the chamber formed between the upper and the middle boards is collapsed, while that between the middle and the lower boards is distended and full of air. When in use the lower board is raised by means of a lever and chain, and the air inclosed between it and the middle board is forced through a valve into the upper chamber; and by the rapid repetition of this action the upper chamber is filled with air more rapidly than the nozzle can carry it off, so that the upper board rises. The working of the bellows may then be suspended for a time, as a continuous and equable blast will be maintained by the pressure of the loaded upper board until it has, by the complete expulsion of the air, descended to its original position. It should be remembered that this perfect equability of blast is only maintained while the working of the bellows is suspended, because during that time the blast is produced solely by the pressure of the loaded board; while, during the working of the bellows, the pressure alternates between that and the superior pressure produced by the influx of air from the lower chamber, thereby causing the upper board to rise and fall with each stroke. Many smiths' bellows are made of the pear-shaped form common to hand-bellows, and have the boards, or at least the lower and middle boards, united by a kind of hinge-joint; but the superior machines of this description have the boards circular, and the working apparatus so arranged as to make their action parallel; and in some cases, as for portable forges, helical springs are applied to the boards in lieu of weights.

Beckmann, in an article on the invention of bellows (*History of Inventions*, English edit. of 1814, vol. i. p. 105), observes that large bellows, such as were formerly used in smelting-houses, when made with leather, were attended with many inconveniences. They require careful management and expensive repairs, and wear out after a few years' use, and the leather needs to be frequently greased or oiled, in order, if it be thin, to prevent the enclosed air from passing through it, or, if thick, to keep the leather soft and pliable, and prevent it from cracking in the folds. These defects led to the invention, apparently in Germany, in the sixteenth or seventeenth century, of bellows formed entirely (excepting the nozzle and hinge-joint) of wood, which were long used in metallurgic operations on the Continent, and appear, from what Beckmann says as to their efficiency, to be well adapted for use where more perfect machines are unattainable. The annexed cut, representing a side elevation of such an apparatus, will sufficiently explain the structure of wooden bellows. In this figure *a* represents a wooden box of an oblong square form, the upper edge of which is indicated by dotted lines. It is open at the top, and from one end of it proceeds the nozzle *b*, which, as well as the bottom board of the box, is supplied with a flap-valve, like common bellows. This box is fixed in a horizontal position, and is covered by the box *c*, which is open at the bottom, and is so much larger than *a* as to allow its sides to slide up and down outside the sides of the lower box without actual contact. The two boxes are united at the nozzle end by a hinge-joint formed by the bolt *d*, and the upper box is capable of being worked up and down by the projecting handle *e*. Great friction would be occasioned if an attempt were made to obtain a close fit by the accurate adjustment of the boxes one to the other, and it would be impossible, in consequence of the shrinking and warping of the wood, to make the machine air-tight; but this difficulty is obviated by attaching thin slips of wood to the inner sides of the box *c* in such a manner as to fill up the space between the two boxes; such slips being rendered very flexible by cutting them nearly through with a saw at intervals of fifteen or eighteen inches, and being pressed into close contact with the sides of the box *a* by small metal springs. The same object might be readily effected by slips of leather. Wooden bellows of this construction are both cheap and exceedingly durable, the slips or laths which render them air-tight being the only part liable to wear, and these are easily replaced. Though we find no notice of such a modification of them, a very trifling exercise of ingenuity would be sufficient to form double bellows of this simple character. In the article **Organ, Construction of** (P. C., p. 494), is a representation of a similar apparatus applied as organ-bellows; and by turning to **Williams** (P. C., p. 405), the reader may find a case in which the application of wooden bellows to a smith's forge would have been peculiarly valuable. The machine invented by Mr. Williams, in the absence of information respecting such contrivances, consisted of two square boxes containing pistons that were alternately raised by levers, and suffered to fall by their weight, aided by a load of stones; the whole forming a rude imitation of the cylinder blowing-engines now used in iron-works, rather than what we should call bellows.



A very different kind of blowing-machine, which appears to be of French origin, and has been much used for blast-furnaces on the Continent, and also, we believe, in the United States of North America, though it does not appear to have been much adopted in this country, is the water blowing-engine, otherwise called *trombe* or *trompe*, in which water is allowed to fall in a minutely divided stream by passing through a cullender, or by some other contrivance, down a large tube, in the sides of which, near the upper end, are several apertures for the admission of air. In so falling the water draws with it a great quantity of air, which passes with it into a vessel at the bottom of the pipe, where the water dashes upon a pedestal which disperses it through the vessel. By this action the separation of the air and water appears to be facilitated, and consequently the air collects in the upper part of the vessel, whence it is conducted by a pipe to the furnace, while the water escapes by apertures provided for the purpose in the lower part of the vessel. The action of this kind of blowing-engine, which is represented in several different forms, has been variously explained by different writers, and the powerful current of air produced by it has been compared to the wind which accompanies violent showers of rain. It is worthy of remark, as probably indicative of the origin of its name, if not also of the invention of this apparatus, that its French name *trombe* is the same as that of the meteorological phenomenon which we call a water-spout. For fuller particulars the reader may consult Dr. Ure's *Dictionary of Arts*, art. 'Metallurgy,' pp. 824, 825; Brewster's *Edinburgh Encyclopædia*, art. 'Blowing-Engine,' and the *Encyclopædia Britannica*, art. 'Hydro-Dynamics,' vol. xii., p. 106, of the seventh edition.

The great improvements which have been effected in the iron manufacture within the last century are, in a great measure, due to the introduction of very powerful blowing machines, in which the air is alternately drawn into and expelled from large cylinders, resembling those of a steam-engine, by the action of pistons impelled by a connection with water-wheels or steam-engines. The first blowing-machines or force-pumps of this character on a large scale were those of the Carron foundry, constructed by Smeaton, and set to work in the year 1760. The arrangement of the piston and valves is so similar to that of a steam-engine cylinder as to need no detailed description. In some cases, where steam is the moving power, the piston-rod of a double-acting blowing-cylinder (in which a blast is produced by every stroke, whether upwards or downwards), is connected directly with the vibrating beam of a steam-engine; in others the motion is transmitted through a series of cranks, so that two, three, or four blowing-cylinders may be worked in succession. These generally force the air into an air-chest of large dimensions, which is usually formed of iron, but sometimes of masonry,* and form which it is conducted to the blast-pipes, which are called *tuyeres* or *tweers*. Barlow, in his 'Treatise on Machinery and Manufactures,' part of the *Encyclopædia Metropolitana*, describes a very powerful blowing-machine at Woolwich Dockyard, in which four cylinders supply air, at a pressure of a quarter of a pound to the square inch, to a large air-chest from which pipes extend to all the forges and fires in the smithy, the pipes being supplied with cocks by which the blast can be turned off or on at pleasure. To ensure equability of pressure, a regulating cylinder, with a piston loaded to the required pressure, is used, and whenever the pressure exceeds the proper amount, it raises the piston, and the air escapes like steam from a safety-valve. Owing to the using of sliding instead of clack or flap-valves in the blowing-cylinders, this machine works very quietly. Another mode of regulating the blast is to throw the air from the cylinders into a large iron box inverted in a cistern of water, and somewhat resembling a gasometer, but so fixed as to be incapable of motion. The effect therefore of the condensation of air in the box is to force some of the water out, and the difference between the level of the water within and without the box forms a measure of the degree of condensation or pressure. In using such an apparatus care must be taken to conduct the air-pipes at so high a level as to render the forcing of water into the furnace impossible. The blast thus produced is exceedingly cold, which is a great disadvantage in a smelting-furnace. For a notice of the advantages of a hot blast see Iron, P. C. (p. 33).

---

* In Brewster's *Edinburgh Encyclopædia*, art. 'Blowing-Machines,' such an air-vault, at one of the Devonshire iron-works, is described as excavated in

The *water-bellows* is a simple kind of blowing-machine the invention of which we have seen attributed to Hornblower, one of the early English improvers of the steam-engine. It consists of two iron boxes, or hollow vessels with their under sides open, suspended from the opposite ends of a vibrating beam, resembling that of a steam-engine. The lower edges of these vessels dip into two cisterns of water, within which, rising above the surface of the water, are pipes connected with the blast or air chamber. When, by the motion of the beam, one of the vessels is forced down into the cistern, it compresses the air enclosed between it and the surface of the water, and consequently forces it along the blast-pipe. The other vessel, meanwhile, as it rises, admits a fresh supply of air through a valve which opens inwards, and this air is forced into the blast-pipe in like way when the action of the beam is reversed. Another machine of similar character, but still more simple, consists of a cask or cask-like vessel suspended on an axle in a horizontal position, so as to be capable of an oscillating motion. This cask is divided longitudinally by a vertical partition, reaching from the top very nearly to the bottom, and is about half filled with water. When the cask is turned a little upon its axis, as the water retains its level, the air at one side of the partition is condensed, and escapes through a valve into a pipe which conducts to the air-chamber or reservoir, while, owing to the enlargement of the space on the opposite side of the partition, air enters it through a valve opening inwards. On reversing the inclination of the cask, the case is reversed, and the air which entered before is expelled, while a fresh supply is drawn in on the opposite side of the partition. This is the most simple form of the apparatus, but far more perfect and more complicated machines are constructed on the same principle.

Barlow, in the 'Treatise' above cited, describes a simple and powerful blowing-machine used at Sharp and Roberts's engine manufactory, at Manchester, which may be compared to the Screw of Archimedes (P. C., p. 110), excepting that, instead of raising water, its object is to impel air. It is partly immersed in a reservoir of water, and is turned by a steam-engine. To this treatise, sections 383—385, and to the *Encyclopædia Britannica*, arts. 'Blowing-Machines' and 'Pneumatics,' we may refer for further information on the subject of this article. The last-mentioned work contains a description of a well-contrived substitute for a cylinder and piston engine, called Vaughan's blowing-machine, in which the required effect is produced by the backwards and forwards motion of square pistons in two oblong boxes, placed side by side, each of which may be compared to a double-acting cylinder. This contrivance is based upon the rude bellows used by Chinese smiths. Blowing-machines in which the current is produced by means of fanners are noticed in Bellows, P. C., and their application to steam-carriage furnaces is alluded to in Steam-Carriage, P. C., p. 491.

BLUMENBACH, JOHANN FRIEDRICH, was born at Gotha, on the 11th of May, 1752. He studied medicine, successively in the universities of Jena and Göttingen, and took his degree at the latter place in 1775. He chose for the subject of his inaugural dissertation the varieties of the human race. It was published at Göttingen with the title 'De Generis Humani Varietate Nativa,' 4to. 1775. This essay appears to have laid the foundation of many of his important investigations on this subject in after-life, and led to the formation of his collection of the skulls of all nations, which is one of the most extensive in existence. New editions of this dissertation appeared in 1776, 1781, 1793, and 1795. In the last edition a letter was added, addressed to Sir Joseph Banks, on the subject of some mummies which had been opened in London. The last edition of this work was translated into German by Gruber, in 1798, and into French by Chardel, in 1804.

In 1776, the year after taking his degree, Blumenbach was appointed extraordinary professor of medicine in the University of Göttingen, and in 1778 he was made ordinary professor. At the same time he also received the appointment of superintendent of the library and museum of natural history in the university. From this time his contributions to the sciences connected with medicine, especially anatomy and physiology, became regular. In physiology he pursued the path of Haller, and directed his attention more especially to the structure and functions of the lower animals, as a means of determining the true laws of human physiology. After the publication of his inaugural dissertation, his next work was an anatomical essay on the frontal sinus, entitled 'Prolusio Anatomica de Sinibus Frontalibus,' 4to., 1779 In 1781 he published a work on embryology, entitled 'Ueber den Bildungstrieb und das Zeugungs-geschäft,' 8vo., Göttingen. In this work he threw much light on the obscure subject of generation, and opened up a path for future inquirers. New editions of this work appeared in Germany in 1789 and 1791. It was translated into Dutch in 1790, and an edition, translated by Sir Alexander Crichton, appeared in English in 1793. In 1786 appeared his work on the human bones, with the title 'Geschichte und Beschreibung der Knochen des Menschlichen Körpers,' 8vo., Göttingen. He also published, in Latin, in the same year, an introduction to medical literature, with the title 'Introductio in Historiam Medicinæ Litterariam,' 8vo. Göttingen.

In the year 1787 he published his 'Institutiones Physiologicæ,' 8vo., Göttingen. This work was written in Latin, and was one of the first attempts that had been made to give a condensed account of the functions of the human body, without entering into the minute anatomical structure of the body. It quickly became the text-book of schools where physiology was taught. German translations by Eyerel and Beck appeared in 1789 and 1795. New editions of the original work were published in 1798, 1810, and 1821. It was translated into Dutch by Wolff, in 1791, and again, by Vosmaer, in 1808. An English edition, translated by Dr. Caldwell, appeared at Philadelphia in 1798. A French translation, by Pugnet, appeared in 1797. A second English translation, by Dr. Elliotson, was published in London, in 1817. A second edition of this translation was published in 1818, and is remarkable as being the first work that was ever printed by steam-machinery. Several subsequent editions of this translation appeared with copious notes by the translator, and these at last were so numerous, and the progress of physiology required so much of the original to be modified, that the translator published the last edition of this work with the title 'Human Physiology, &c., with which is incorporated much of the elementary part of the Institutiones Physiologicæ of J. F. Blumanbech, by John Elliotson, M.D.'

Blumenbach, in all his contributions to physiology, had frequent recourse to the lower animals for the purpose of illustrating and developing the functions of those of the higher; and in 1805 he was induced to publish a manual of comparative anatomy. This work appeared at Göttingen, with the title 'Handbuch der vergleichende Anatomie.' Editions of it appeared, in German, in 1815 and 1824. It was translated into English in 1809, by Mr. William Lawrence, surgeon, who, after John Hunter, was one of the earliest cultivators of comparative anatomy in connection with the study of medicine in this country. It was again translated into English by Mr. Coulson, and published in 1827. Although this work is meagre compared with those which have ap-

---

the solid rock, 72 feet long, 14 feet wide, and 13 feet high, and containing about 13 000 cubic feet of air. In the article referred to, it is proposed that such a vault should contain about 100 cylinders' full of air, and that, of course in addition to the air which naturally fills it, about 25 cylinders' full should be forced in before the tuyeres are opened.

peared both in this country and on the Continent since its first publication, it yet exerted an important influence on the systematic study of comparative anatomy, embodying as it did the results of previous observers, and the author's own labours in this department of scientific inquiry.

One of the results of the author's inquiries with regard to the varieties of the human race was the collection of a large number of skulls of the inhabitants of the various parts of the world. In 1791 he commenced the publication of a work in parts, containing descriptions and illustrations of these skulls. It was entitled 'Decas Collectionis suæ Craniorum diversarum Gentium illustrata,' 4to., Göttingen. This work extended to several volumes, and was finished in 1808. Although through this work the most important forms of the casts and skulls in the collection of Blumenbach are thus preserved, yet it is to be regretted that so valuable a repository should be suffered to fall into decay through want of care, as is at present the case with this collection at Göttingen.

Besides his large works, Blumenbach was the author of many small ones on particular departments of medical and physiological inquiry. In 1790 he published a paper in Meyer's Magazine on the comparative anatomy of warm and cold blooded animals; in 1794, a paper on Egyptian mummies opened in London; in 1813, a memoir of Augustus Gottlob Richter. He wrote prefaces to several translations of works into German, amongst others to the Works of Cheselden; the 'History of Poisons,' by Gmelin; 'Medical Logic,' by Blane; the 'Nutritive Organs of Mammalia,' by Neergaard. His papers in various periodicals are numerous, and on almost every subject connected with medicine. The titles of some are as follows:—'On Dragon's-blood;' 'On Wintersbark;' 'On Nutrition;' 'On the Reproduction of Bones;' 'On the Vital Principle of the Blood,' &c.

In 1783 Blumenbach visited Switzerland. During this journey he made notes on the medical topography of the districts through which he travelled, and afterwards published them in his 'Medicinische Bibliothek,' a work which he edited at Göttingen from 1780 to 1794. He visited England in 1788, and again in 1792. In 1812 he was appointed secretary to the Royal Society of Sciences at Göttingen. In 1816 he was made physician to the king of Great Britain and Hanover, and in 1821 was made a knight commander of the Guelphic order. In 1831 he was chosen a member of the Academy of Sciences in Paris. The jubilee of his graduation was celebrated by the University in Göttingen in 1825, and the jubilee of his professorship in the following year. On the former occasion a medal was struck in honour of the event. He died on the 22nd of January, 1840. It will however be seen that for many years he had ceased to labour in the cause of science, and that for a long time previous to his death the University of Göttingen could only boast of his illustrious name. Schräder has named after him a genus of plants *Blumenbachia.*

(Kallisen, *Medicinisches Schriftsteller-Lexicon*; *Lancet*, 1840; Blumenbach, *Works.*)

BLUMENBA'CHIUM, a genus of fossil alcyonoid Polypiaria, proposed by Dr. König.

BLYSMUS, a genus of plants belonging to the natural order Cyperaceæ. The glumes are fertile, the outermost the largest, and empty; bristles three to six; style not thickened at the base, persistent, but plano-convex, tipped with the undilated base of the style; the spikelets bracteated, alternate, forming a close distichous compound terminal spike. Two species of this inconspicuous genus are found in Great Britain. *B. compressus* is found in boggy pastures in England and Scotland. *B. rufus* inhabits marshes near the sea on the northern and western coasts.

(Babington, *Manual.*)

BOBBIN NET AND LACE. [WEAVING, P. C., p. 179.]

BO'BBIO, *the Province of*, an administrative division of the Sardinian territories, situated on the northern side of the Ligurian Apennines, is bounded north by the province of Voghera, west by the provinces of Novi and Tortona, south by the province of Chiavari, and east by the territory of Piacenza in the duchy of Parma. The province is mostly covered by ramifications of the Apennines, the principal one of which runs in a north-east direction, dividing the valley of the river Staffora from that of the Trebbia, both affluents of the Po. The highest summit, Monte Penice, is a calcareous mountain of a pyramidal form, rising north-west of the town of Bobbio, and is crossed by the road leading to Voghera. From the summit of the Penice there is a splendid view of the plains of Lombardy, the hills of Monferrato, and the chain of the Ligurian Apennines.

The province of Bobbio is about 25 miles long, and about 10 miles wide. It is divided into four mandamenti or districts, Bobbio, Ottone, Varzi, and Zavatarello, containing in all 27 communes, and about 32,000 inhabitants. The valleys produce corn, Indian corn, wine, and fruit. The mountains are partly covered with forests. Farms are mostly small. Sheep and pigs are numerous; the horned cattle is scanty and poor. Until lately there was not a carriage-road in the whole province. Many of the inhabitants emigrate to the plains to earn their subsistence.

Bobbio, the head town, is situated in a valley near the left bank of the Trebbia; it is a bishop's see, and has about 1600 inhabitants. Besides the cathedral, the church and former convent of St. Columbanus are deserving of notice. The convent is a vast and handsome building. The church, which is now a parish church, is large; it has 21 altars, some good fresco paintings, and a subterraneous vault in which St. Columbanus and several of his disciples are buried. Gerbert, afterwards Sylvester II., was for a time an inmate of the convent of Bobbio. The church and convent were first built about the end of the sixth century, but they have been rebuilt or restored at various times The well-known library, rich in valuable and rare MSS., among which were several palimpsests, has been distributed among the libraries of Milan, of the Vatican, and of the Turin university. The other buildings deserving of notice are—the palace of the antient family of Malaspina, and the episcopal palace. There is another Bobbio in the Sardinian states, in the district of the Valdenses near Pignerol.

(Casalis, *Dizionario Geografico Statistico degli Stati Sardi.*)

BOERNE, LUDWIG, was born in 1784, of Jewish parents, at Frankfort on the Main, where his father, Jacob Baruch, was a banker. After having received his preparatory education in his native place, he went to the university of Berlin, and afterwards to that of Halle, where he studied medicine, though against his will, for as persons of the Jewish persuasion cannot hold any public office in Germany, the only scientific department that they can devote themselves to with any hope of advantage to themselves is medicine, which they are allowed to practise. In 1807 however he gave up his medical pursuits, and in the university of Heidelberg he began to study politics and political economy, which he continued in 1808 at Giessen. On his return to Frankfort, which was then in the hands of the French, he received an office in the department of the police, which he held for several years, although it little agreed with his peculiar views. In 1815, when Frankfort recovered its old constitution, Boerne, being a Jew, was of course dismissed from his office, but received a pension. Having thus got rid of all external ties, he now began to devote himself with energy and great success to what he conceived to be his calling: he became a political writer, and successively edited three periodicals, the 'Frankfort Staats-Ristretto,' 'Die Zeitschwingen,' and 'Die Wage,' which were published at Offenbach, and to which he himself contributed some of the best of the political essays and literary criticisms. But as these periodicals, especially the 'Zeitschwingen,' were of too liberal a nature, the government of Hesse-Darmstadt suppressed them, and Boerne himself was soon after arrested at Frankfort, and charged with having promulgated revolutionary ideas. He was tried as a criminal, but as no evidence was brought against him, he was acquitted, and declared perfectly innocent. In 1817 Boerne exchanged his Jewish religion for Protestantism, and altered his name Baruch into Boerne. After having given up 'Die Wage,' in 1821. he lived in complete retirement, partly at Frankfort, partly at Paris, and partly at Hamburg, until, about the time of the French revolution of 1830, he went to reside at Paris, where he hoped to find that freedom which he had in vain laboured to rouse in Germany. But his expectations were disappointed, and he now endeavoured to act upon Germany through the medium of a French journal, 'La Balance,' which he established, and which was at the same time to be a sort of mediator between the two countries. But he gradually sank into a state of despondency and bitterness, which greatly contributed to his death, which took place on the 13th of February, 1837.

Owing to his retirement he was nearly forgotten in Germany, when, shortly before the outbreak of the French revolution, he published a collection of all his political, critical, and philosophical writings, in 8 vols. 8vo. (Hamburg, 1829-31; a second edition appeared in 1835). The occurrences in France contributed to make his works at the time very popular with the liberal party. During his residence at Paris he published six more volumes of political letters, entitled 'Briefe aus Paris,' and 'Neue Briefe aus Paris,' in which he attacked the German governments most unsparingly, and with a bitterness which must be accounted for by the disappointment of his hopes. Boerne, with all his faults, is one of the most eminent political and critical German writers of the present century. He was a man of great humour and wit; his deep feeling is most manifest in a splendid eulogium on Jean Paul ('Denkrede auf Jean Paul,' Erlangen and Hamburg, 1826, 8vo.), and he was one of the few Germans at Paris who maintained his character as a German, and did not sink into that frivolity and licentiousness into which many able persons of his acquaintance fell. He remained what he had always been, a sincere warm-hearted man. All his writings are distinguished for power, clearness, and brilliancy of style, qualities rarely met with in German writers. Some years after his death, his former friend, H. Heine, a witty but most frivolous writer, published a work on Boerne, entitled 'Heine über Boerne' (Hamburg, 1840, 8vo.), which is of a most defamatory nature. A monument infinitely more worthy of the noble spirit of Boerne is his Life by Carl Gutzkow (*L. Boerne's Leben*, Hamburg, 1840). The Germans at Paris have erected a brass monument on the tomb of Boerne in the cemetery of Père-la-Chaise, which was executed gratis by the French sculptor David.

BOGUE, DAVID, one of the principal founders of the London Missionary Society, was born on the 18th of February (Old Style), 1750, at Dowlau, near Eyemouth, in Berwickshire, and was a younger son of John Bogue, a landed proprietor. He received his early education at the grammar-school at Dunse, and afterwards removed to the university of Edinburgh, where he continued his studies for nine years; and took the degree of A.M. in 1771. He was licensed as a preacher in the Church of Scotland; but, although he had a prospect of obtaining the living of Coldingham, his native parish, his views on the subject of church patronage led him to relinquish his prospects of promotion, and to come to London, where he arrived in 1771. He shortly engaged himself as usher in a school at Chelsea, kept by the Rev. Mr. Smith, of Silver-street Chapel, whom he assisted also in his ministerial duties; and in 1776 he visited Holland, having been invited to take the pastoral charge of a Scotch church at Amsterdam. From the unsatisfactory appearance of affairs there, Bogue declined this engagement, and returned to England, and in the next year he was chosen pastor of an Independent church at Gosport, where he remained until his death, a period of nearly fifty years. About the year 1789, at the request of an opulent friend who desired to promote the education of young ministers of the Independent denomination, Bogue began to superintend a kind of dissenting college, many of the students in which attained eminence; and shortly afterwards he commenced his efforts on behalf of Christian missions, which led to the establishment of the London Missionary Society. In 1792 he published a discourse on this subject, which had been preached before the Society for promoting Religious Knowledge in the Highlands and Islands of Scotland, which, while it tended to excite the zeal of those favourable to missions, drew upon the author much obloquy from those who looked with more jealousy than himself upon the political changes then commencing on the continent of Europe—changes which he, in common with many other friends of civil and religious liberty, contemplated with deep interest and lively hope. In consequence of his liberal opinions, Bogue was not only exposed to much vilification while he lived, but has been styled since his death 'a bitter and somewhat revolutionary political dissenter,' a character which is contradicted by the whole tenor of his useful life, and from which he is ably defended by Dr. Morison in the work referred to at the close of this article. A paper supplied by Bogue to the 'Evangelical Magazine' for September, 1794, was the more immediate precursor of the London Missionary Society, in the formation of which, in the following year, he took an active part. Shortly afterwards he made arrangements for going out with a new mission to Bengal, the expenses of which were to be borne by his friend Robert Haldane; but, after repeated efforts to obtain the necessary permission from the East India Company, who were opposed to the design, it was relinquished. He then undertook the charge of a missionary seminary which the directors of the London Missionary Society deemed it advisable to found in aid of their foreign labours. Immediately after the peace of Amiens, in 1802, Bogue, in company with Mr. Hardcastle, Dr. Waugh, and the Rev. Matthew Wilks, visited Paris for the purpose of promoting measures which had long been contemplated for the introduction of Bibles and religious works into France, and in furtherance of which object he had written his 'Essay on the Divine Authority of the New Testament,' a work which, in addition to being very widely circulated in the English and French languages, has been translated into Spanish, Italian, and German. A copy was sent to Bonaparte while at St. Helena by the dowager Lady Grey, and, after his death, was returned to the author with some marginal notes by the emperor. In 1816, in conjunction with Dr. Bennett, Bogue undertook another continental missionary tour, for the promotion of the cause of missions in the Netherlands; and during the remainder of his life he was continually engaged in efforts connected with the work which lay so near his heart. In the autumn of 1825, when upon one of his numerous preaching tours for the Missionary Society, he was taken ill at Brighton, where he died on the 25th of October, in his seventy-sixth year. His remains were removed to Alverstoke, near Gosport, and interred with extraordinary marks of respect.

In 1815 the diploma of Doctor of Divinity was conferred upon Bogue, by Yale College, North America; and it has been stated that the same was offered by the university of Edinburgh, but declined. Owing however to his characteristic humility, he did not always use the title, even in his published works. In addition to his intimate connection with the London Missionary Society, Bogue was one of the originators of the Religious Tract Society, and wrote the first tract issued by it. He was also one of the founders and first editors of the 'Evangelical Magazine,' and was more or less connected with most of the important religious movements of his age. 'He was,' indeed, to use the words of the 'Gentleman's Magazine,' 'one of those men who contribute greatly to influence the character of the public mind.' Besides various minor works, he published discourses on the Millennium, and, in conjunction with his pupil and friend, Dr. James Bennett, a 'History of Dissenters, from the Revolution in 1688 to the year 1808,' in four volumes, 8vo., 1808-1812. A second edition, somewhat condensed and re-arranged, was published in 1833, in two 8vo. volumes, by Dr. Bennett, who has written a continuation of the history as a separate work. Dr. Bennett has published a lengthened memoir of Bogue, and there is a very full account of him, containing some additional matter, in Dr. Morison's 'Fathers and Founders of the London Missionary Society.' A brief French memoir in the 'Archives du Christianisme' for 1826 was reprinted at Paris as an 8vo. pamphlet. Behnes, the sculptor, has executed a bust of Dr. Bogue, from a posthumous cast, which conveys a good idea of that remarkable depth and solidity of character which led the French police, on occasion of his visit to Paris, to describe his countenance as characterized by what they termed 'profondeur.'

BOHLEN, PETER VON, late professor of Oriental literature in the university of Königsberg, was born on the 13th of March, 1796, of poor parents, in the village of Wüppels, near Jever, not far from the mouth of the Weser. He lost his father at the age of nine years, when he and his mother with two young daughters were left without any support, but they were assisted by the villagers. Bohlen received his first education in the village school to which he was admitted gratis. The clergyman of the place took great interest in the industrious boy, and even instructed him with his own children. The knowledge he thus acquired, created in him a love of learning, but as he felt that he ought to earn something to contribute to the support of his poor mother, he undertook all kinds of work, such as ploughing, reaping, hay-making, and the like, for the neighbouring farmers. Sometimes he even joined the smugglers on the coast in order to obtain a livelihood for himself and his mother. At last, when he was twelve years old, and it was thought necessary that he should learn some trade, he was put apprentice with a village tailor, in whose house he was obliged to do the lowest and dirtiest work, and to witness the most frightful scenes between husband and wife; he was ill-used by his master and his quarrelsome wife in a manner which he afterwards related with shuddering, and he used to wonder that under such circumstances he had not become a thorough knave himself. In 1810 he, as an orphan boy, for his mother had died in the mean time, was called upon to appear at Jever to be examined as to his fitness for serving in the army of Napoleon. He was delighted at the prospect of getting away from his master and of seeing something of the world. But he was found to be too short, and was obliged to return to the tailor. Some time afterwards he was called upon again, and was admitted into the army. At the examination the French general Guiton took an interest in him, on account of the cheerfulness with which he appeared to enter upon his new life. The general gave him some money, and permission to go and take leave of his friends. Bohlen, on his return, remained with the general in the capacity of servant; and in 1812 he accompanied his new master, who was extremely kind to him, to Hanover, from which place frequent excursions were made to the neighbouring towns. Afterwards they travelled to Stuttgard, Switzerland, and Berlin. General Guiton gradually ceased to demand any services of Bohlen, and treated him more as a son than as a servant. In 1813, when the French army returned from Russia, Guiton and his corps retreated to Magdeburg. Bohlen afterwards accompanied the general to Hamburg. At this time however the relation between the general and Bohlen became greatly altered; the Frenchman became more harsh and severe, and the young German, forgetting the kindness he had received, lost no opportunity of showing his obstinacy and his aversion to the French. During the siege of Hamburg Bohlen opened and read a note of great importance, which he had to carry to Fromont, the general's adjutant; and had it not been for Fromont's attachment to Bohlen, he would have paid for his curiosity and indiscretion with his life. Fromont at length procured Bohlen another situation as servant to Admiral l'Hermite, but he did not remain with the admiral above two months. Early in 1814 the French quitted Hamburg; and Bohlen, although he had nothing to live upon, refused to accompany the admiral. He remained at Hamburg; and at first lived for some time with a poor ferryman, who wanted Bohlen to engage in his own trade; but a black cook of Admiral l'Hermite, who had likewise remained at Hamburg, prevailed upon him to seek a place as waiter in an hotel. This was soon found; but the incessant work and the want of rest was more than he could bear; he accordingly left his place, and engaged himself as servant to a rich India merchant. As he had not much to do in his new situation, he got his master's clerk to instruct him in letter-writing and the like, and employed his time in reading. In the mean time he acquired a passion for writing poetry. He had the satisfaction of seeing his poems printed; and as some persons went so far as to compare him to Klopstock, his head was almost turned by his success. He had learned to speak French in his intercourse with Frenchmen, and he now learned English in the same way; for in the house of his employer scarcely any other language than English was spoken. He then began translating Burns into German; and, with the assistance of a dictionary and grammar, he even ventured upon translating Virgil. He next made an attempt to get admission into the gymnasium of Hamburg, but was refused, on the ground of being too old. His employer now became bankrupt, and Bohlen was again as poor as before; for he had never claimed his full wages, but only taken as much as he wanted at the time. Another attempt was made to get into the gymnasium; and the support of several benevolent men at length succeeded in gaining for him what he wanted, and in 1817 Bohlen became a pupil of the Johanneum at Hamburg. His diligence was extraordinary, and his conduct secured the good will of all. The gifts of benevolent friends, and private lessons which he began to give, procured him the means of living. His intention was at first to study theology; but the preparation that he made for it, the study of Hebrew, Arabic, and Persian, led him in another direction. About this time he was induced by a fit of vanity to assume the prefix that indicates a nobleman, *von* Bohlen, as he remembered to have heard that his father was descended from a noble family.

In 1821 he went to the University of Halle, some distinguished and wealthy Hamburgers having provided him with the means of pursuing his studies there for three years. Gesenius was his principal teacher; but he also attended many other courses of lectures on Oriental and classical literature. At the suggestion of Gesenius, Bohlen copied, translated, and commented upon, an episode of Ferdusi, which was sent to the Prussian ministry for the purpose of obtaining assistance from the Prussian government to continue his studies, and of paving the way to a future appointment in Prussia. In 1822, before he left Halle, Von Bohlen published a little work, 'Symbolae ad Interpretationem S. Cod. ex Lingua Persica,' which was well received; and in the autumn of the same year he went to Bonn, to study Arabic under Freytag. Here he wrote a dissertation on the life and character of Motenabbi, which received the prize, and was printed at Bonn in 1824; it was very well received by those acquainted with the literature of the Arabs. In the mean time he continued his studies of the Persian language, and in 1824 he began that of Sanscrit, under A. W. von Schlegel, and also learned Italian and Spanish. Towards the end of this year the Prussian ministry summoned him to Berlin, that he might complete his studies there, and prepare himself for a professorship at Königsberg, where it was proposed to give him an appointment. At Berlin he attended the lectures of Bopp, and formed an intimate friendship with the late Dr. Rosen. In 1825 he went to Königsberg to begin his career of academical teacher, in the usual way, as a private lecturer. He received however, from the first, a considerable salary; and in 1826 he was appointed professor extraordinary. In 1827 he travelled to Bonn, and married a lady whose acquaintance he had made during his stay there: and the year after he was appointed ordinary professor of Oriental literature. The unhealthy climate of Königsberg began gradually to undermine his health; and its influence was increased by his incessant studies and neglect of exercise. He then visited England, for the purpose of acquiring Oriental MSS. and books, for which the Prussian ministry placed funds at his disposal. He was also provided by the government with Arabic and Devanagari types, and printed with his own hands the 'Carmen Amâli.' Soon after he published his great work on Indian antiquities, entitled 'Das Alte Indien,' which, with all its defects, is one of the most valuable books on antient India; and no attempt has yet been made to supplant it, though Lassen's great work on the antiquities of India, which is now in the course of publication, will probably supersede the work of Bohlen. In 1837 he undertook a second journey to England. He stayed some time with the son of the Marquis of Landsdowne, and pursued his Oriental studies with his friend Dr. Rosen. On his return to the Continent he travelled with his wife to the south of France and Italy for the benefit of her health. Bohlen's health also was in such a precarious state that his friends advised him not to return to the north. He therefore lingered at Heidelberg and Bonn for some time, and then went to Halle. His wife died on the 7th of March, 1839, and from this blow he never recovered. He was unable to return to Königsberg, and remained at Halle. In the beginning of 1840 his condition became worse, and he died on the 6th of February at Halle, where he was buried.

Bohlen appears to have been a most amiable man; and in his autobiography, from which this account is taken, he relates without any reserve all the vicissitudes of his life, in a manner which secures the affection and admiration of every reader. His character appears to have been very much like that of his friend Rosen. In 1826 he was elected a member of the Royal Asiatic Society of London. He possessed a most extensive knowledge of Eastern history and literature, and his works rank among the first of their class: their deficiencies arise mainly from two causes; first, the great haste with which he worked, and secondly, a want of sound philological knowledge, for which he had little taste; though in later years this defect greatly impeded his antiquarian researches, as he himself confesses. We pass over a great number of papers and reviews which Bohlen wrote for the leading journals of Germany, and shall merely subjoin a list of his separate works: 1, 'Symbolae ad Interpretationem Sacr. Cod. ex Lingua Persica,' Leipzig, 1822; 2, 'Commentatio de Motenabbio, celeberrimo Arabum Poeta,' Bonn, 1824; 3, 'Carmen Arabicum, Amâli dictum,' Königsberg, 1825; 4, 'Vermischte Gedichte und Uebersetzungen,' Königsberg, 1826; 5, 'De Buddhaismo Tentamen,' Königsberg, 1827; 6, 'Das alte Indien mit besonderer Rücksicht auf Aegypten,' 2 vols., Königsberg, 1830; 7, 'Bhartriharis Sententiae et Carmen Chauropanchâsica,' Berlin, 1833; 8, 'Die Genesis, historisch-kritisch erläutert,' Königsberg, 1835; 9, 'Die Sprüche des Bhartrihari, metrisch nachgebildet,' Hamburg, 1835; 10, 'Ritusanhâra, sive Tempestatum Cyclus, Carmen Kâlidâsi,' Lips. 1840. Bohlen was a contributor to the Penny Cyclopædia, for which he wrote the articles LOKMAN, MAHABHARATAM, MAHMUD OF GHISNI, MANU, MOHAMMED (including KORAN), MONGOLS AND TARTARS.

(*Autobiographie des Dr. Peter von Bohlen, herausgegeben von Joh. Voigt*, Königsberg, 1842, second edition.)

BOIELDIEU, ADRIEN-FRANÇOIS, a French composer of high and well-deserved reputation, was born at Rouen, in 1775. At a very early period of his life he manifested a most decided talent for music, and at eighteen wrote a one-act opera, which was produced at the theatre of his native city, and drew all the amateurs of Normandy to hear it. In 1795 he went to Paris, and brought out several compositions, of which many met with great success, and some are still admired. In 1797 he produced 'La Famille Suisse,' at the Opera Comique; and this was speedily followed by others. In 1800 he wrote three operas,—'Beniowski,' 'Le Calife de Bagdad,' and 'Ma Tante Aurore,' all of them abounding in beauties of every musical kind, and become stock pieces. On the establishment of the Conservatoire de Musique, by the National Convention, Boieldieu was appointed one of the professors. In 1803 he accepted of the Emperor Alexander the appointment of Maître-de-Chapelle at the imperial court of Russia, and composed, for the Hermitage theatre, some operas, and various smaller dramatic works. In 1811 he returned to Paris, and there, among other operas, produced 'Jean de Paris,' 'Le Petit Chaperon Rouge,' and his greatest, or, at least, his most popular work, 'La Dame Blanche.' He afterwards was called upon to compose music for the baptism of the Duc de Bordeaux, and the coronation of Charles X. After this, the state of his health indicating the want of some repose, he proceeded to a watering-place in the Pyrenees, and appeared to be much benefited by his retirement and relief from business and care; but soon after he was suddenly attacked by illness, and died, October 3rd, 1835, after a very short confinement.

Boieldieu was honoured by a splendid public funeral, which was, in some degree, a military one, for he was an officer of the National Guard, and held the order of the Legion of Honour. Mass was celebrated in the grandest manner in the Eglise des Invalides, and his remains were then deposited in the cemetery of Père-la-Chaise. The heart of this very clever composer was claimed by the city of Rouen, and received with great pomp in the cathedral, which was magnificently decorated for the occasion, the council of the town having voted 12,000 francs to defray the expense of the solemnity. They also erected a column to the memory of their distinguished countryman; and the government settled a pension on the son of the composer, M. Adrien Boieldieu.

BOILER is the general name applied to vessels, whether close or open, in which fluids are exposed to heat for the purpose of ebullition or evaporation; but the term is most commonly applied to the close vessels used for the generation of steam. Such boilers, to lessen the danger of explosion, are almost invariably made of wrought metal, which, if burst, will tear rather than fly to pieces, as cast metal would do; and the plates made for the purpose are formed of the best and toughest metal, and rolled or wrought with peculiar care. Engineers differ as to the comparative merits of iron and copper as a material for steam-engine boilers. Most however admit that iron, when of good quality, has the greatest cohesive strength, although the greater uniformity of texture in sheet-copper renders it safe to construct copper boilers of less thickness than those of iron, to withstand a given pressure. Further than this, supposing an explosion to occur with a copper boiler, it is likely only to produce a rent or tear in the metal, while an iron boiler, even though wholly of wrought plates, is frequently blown to pieces. The cost of copper is about four times that of iron, but as, owing to its far more rapid transmission of heat, a copper boiler may be made considerably smaller than an iron one to produce the same quantity of steam, and may therefore be still further reduced in thickness and weight without impairing its strength; the cost of a copper boiler is nearer twice than four times that of an iron boiler of equal evaporating power; and, as a set-off to this increased expenditure, the value of the old copper, when the boiler is worn out, is equal to three-fourths of its original cost, while an old iron boiler is worth little more than the cost of removal. Steam-engine boilers are treated of under Steam-Engine [P. C., pp. 482-484], Steam-Carriage [P. C., p. 490], and Steam-Vessel [P. C., p. 508], and those of railway locomotives under Railway [P. C., pp. 248, 259]; and such readers as may wish for further information respecting the various schemes which have been devised for remedying the real or supposed defects of ordinary boilers or steam generators, will find some curious details in the article 'Boiler' in Hebert's *Engineer's and Mechanic's Encyclopædia*. Boilers for the production of steam or the heating of water for the purpose of warming buildings are noticed under Warming and Ventilation [P. C., pp. 69, 70].

Of the various other kinds of boiler employed in manufacturing operations, one of the most important is that employed, under the name of Howard's Vacuum-Pan, for boiling sugar at a lower temperature than in the open air, by the formation of a partial vacuum. A representation of this apparatus is given under Sugar [P. C., p. 232].

BOL, FERDINAND, a very able portrait painter and etcher, born at Dort in the early part of the seventeenth century. He was the pupil of Rembrandt, and executed some portraits in his style, of equal merit. He painted also some historical pieces of great merit, which are at Amsterdam, but they are inferior to his portraits. He died rich, at Amsterdam, where he principally lived, in 1681, advanced in years. He etched also sixteen spirited plates.

(Houbracken, *Schouburg der Kunstschilders*, &c.; Bartsch, *Catalogue Raisonné de l'Œuvre de Rembrandt*, &c.; Heineken, *Dictionnaire des Artistes*, &c.)

BOLOGNA, JOHN OF, or GIOVANNI DA, a celebrated sculptor and architect, born at Douay in Flanders, about 1524. He went early to Rome, where he distinguished himself by his models of celebrated works. Though a Fleming, he is known only by the above name. Van Mander calls him Jean de Bologne, yet he lived the greater part of his life at Florence. Van Mander probably knew only that name by which he was called by Vasari, who speaks of him as Giovanni Bologna, or Giovan Bologna da Douai, a name which he seems to have acquired from his celebrated fountain at Bologna, of which the crowning colossal bronze figure of Neptune is one of the masterpieces of modern sculpture.

Several also of the noblest works in sculpture at Florence are by the hand of John of Bologna, two of which are unsurpassed in modern art—the marble group of the Rape of the Sabine Woman, in the Loggia de' Lanzi, in the Piazza Granduca; and the well known bronze of Mercury in the act of springing into the air, with one foot still upon a globe, in the imperial gallery.

John was one of the original forty members of the Academy of Florence, and was also sculptor to the grand-duke Francesco I. In 1580 he was invited to Genoa, where he executed several admirable works, chiefly in bronze. He died at Florence in 1608, aged eighty-four, or, according to a note in De Yongh's edition of Van Mander, only seventy-nine, for it is there stated that he was born in 1529. Baldinucci, the chief authority for the life of John of Bologna, mentions in the body of his article, that he died in August, in 1608, a few months before his bronze equestrian statue of the grand-duke of Florence, Ferdinand I., was fixed in its place; yet in the heading of the article it is said that he died in 1599, an inconsistency probably due to the editor. John of Bologna is the sculptor who, when he showed to Michelangelo, whilst at Rome, a carefully finished model, was told by the latter to learn to sketch before he attempted to finish—a precept which he did not forget. John of Bologna, with the exception of Michelangelo, surpassed all the sculptors of his age, or indeed of the sixteenth century, and he surpassed Michelangelo himself in proportion and execution. His Rape of the Sabine is a magnificent group; it is composed of three figures: the Roman is bearing the woman away in his arms, and is striding over a fallen Sabine. Andreani has cut three excellent views of it in chiaroscuro, in wood; Louis XIV. had it cast in bronze.

(Vasari, *Vite de' Pittori*, &c., ed. of Leghorn; Baldinucci, *Notizie dei Professori del Disegno*, &c.)

BOLSOVER STONE. The yellow limestone of Bolsover in Derbyshire is used in the construction of the new Houses of Parliament. It was selected for its durability, strength, fitness for ornamental work, and colour. It is a combination of carbonate of magnesia with carbonate of lime, in small granular crystals, without the slightest trace of organization, flinty nodules, or other blemishes. It has been subjected to various and severe mechanical pressures, chemical reagents, &c., and has sustained them with credit; but it is yet to be seen whether it can withstand the atmosphere of London, which has destroyed the Bath and Portland oolites.

BOLSWERT, SCHELTIUS, a designer and very celebrated engraver, born at Bolswert in Friesland, in 1586. He lived and worked chiefly at Antwerp, with his elder brother Boetius. His best works are after Rubens and Vandyck, after whom he has engraved several admirable works on a large scale. He was the personal friend of both painters, and Rubens is said to have examined and touched with the crayon all the proofs of Bolswert's engravings after his works. Bolswert's prints are distinguished as true works of art, not as mere excellent mechanical performances of the graver, a kind of excellence to which they make no pretensions. They are admirably drawn, various and true in their effects of colour, and effective in light and shade; he preserved also the characteristic style of the master after whom he engraved. He was equally excellent in portrait, history, and landscape. Ragot, a French engraver, copied several of his prints for Mariette: the copies are frequently sold as originals. The print of the celebrated picture of Christ crucified between the two Thieves, in which the soldier is piercing the side of Christ, is one of those copied by Ragot.

Bolswert engraved altogether 87 plates after Rubens, including 21 landscapes, and some of his best historical works; 23 after Vandyck, including Bolswert's own portrait; 22 after other masters; and 22 after his own designs. Some of his prints are marked S. A. Bolswert, where the A signifies Adamsen, or the son of Adam; Adam was the name of his father. Bolswert died at Antwerp, at an advanced age.

(Watelet et Levesque, *Dictionnaire des Arts*, &c.; Huber, *Manuel des Amateurs.*)

BOMBAX (from βόμβυξ), a genus of plants, the type of the natural order Bombaceæ. It has a naked, campanulate, unequally 2-5-lobed or truncately 5-toothed calyx; 5 petals joined together, and somewhat connected at the base with the column of the stamens; numerous stamens, monadelphous at the base, but free at the apex; the anthers inserted at the middle, kidney-shaped or oblong, opening above by a transverse chink; the capsules large, 5-celled, 5-valved, woody; cells many-seeded; albuminous seeds surrounded by silky cotton. The species of this genus are large trees with a soft spongy wood, which is frequently used for making canoes. They are natives of South America and the East Indies.

B. Ceiba, Common Silk-cotton Tree, has a prickly trunk, palmate leaves with 5 leaflets, turbinate fruit concave at the apex. This plant is a very large tree, and is a native of the West Indies and South America. Some of the older travellers gave extravagant accounts of its height; it is however frequently seen reaching above 100 feet. The down, which is contained in the seed-vessel, is very soft, but is too short to be used in the manufacture of cloth. It is made into hats and bonnets, and used for stuffing chairs and pillows, by the poor people in the districts in which it grows. It is not made into beds, as it is reputed unwholesome to lie upon. The trunks of the largest are made into canoes, and some of these will carry from 15 to 20 hogsheads of sugar. Columbus, in his first voyage to America, speaks of having seen a canoe made of this tree in Cuba, which contained 150 men. When the stem of this tree decays it becomes the prey of the larva of the Macaca beetle, which, when gutted and fried, is esteemed as a great delicacy by some persons.

B. pubescens has an unarmed trunk, the lower leaves quinate, the upper ones ternate; the leaflets obovate, elliptical, emarginate, coriaceous, smooth, or covered with black dots of stellate pili beneath; the pedicels inflated and hollow under the flower, and, as well as the calyxes, covered with black dots of stellate tomentum; the petals tomentose, three times longer than the calyx, with a smooth ovary. This plant reaches from twenty to thirty feet in height. It is a native of Brazil in the province of Minas Geraes, where the tree is called *Embirussu*. The bark is very tough and is used for making ropes. The other species of Bombax, of which from fourteen to twenty have been described, possess the same general qualities as the two species described. The wool of the pods of the *B. Malabaricum* is used in India to stuff pillows and beds. *B. insigne* is a native of the Burman empire, and is remarkable for its large, red, very showy flowers. All the species grow best in a rich loamy soil. Cuttings not too ripe, when taken off at a joint, will root freely in sand under a hand-glass in a moist heat. The best mode of propagating them is from seeds brought from the places of their natural growth. None of the species seem to have flowered in stoves, but this arises probably from the want of height.

(Burnett's *Outlines*; Loudon, *Encyclopædia of Plants*; G. Don, *Gardeners' Dictionary*.)

BONA FIDES and BONA FIDE is an expression often used in the conversation of common life. It is also often in the mouths of lawyers, and it occurs in acts of parliament, where (in some cases at least) it means that the acts referred to must not be done to evade the law, or in fraud of the law, as we sometimes express it, following the Roman phraseology (in fraudem legis). It appears to be used pursuant to the meaning of the words, in the room of good faith, which implies the absence of all fraud or deceit. Bona Fides is therefore opposed to fraud, and is a necessary ingredient in contracts, and in many acts which do not belong to contracts. How much fraud may be legally used, or what is the meaning of Bona Fides in any particular case, will depend on the facts. Many things are not legal frauds, and many things are legally done Bona Fide, which the common notions of fair dealing condemn.

The phrase Bona Fides originated with the Romans, and it is opposed to Mala Fides, or Dolus (fraud). The notion of equity (æquitas), equality, fair dealing, equal dealing, is another form of expressing Bona Fides. He who possessed the property of another bona fide, might, so far as the general rules of law permitted, acquire the ownership of such property by use (usucapio). In this case bona fides consisted in believing that his possession originated in a good title, or, as Gaius (ii. 43) expresses it, when the possessor believed that he who transferred the thing to him was the owner.

The Romans classed under the head of bonæ fidei obligations a great variety of contracts, and also of legal acts, as buying, selling, mandatum [Agent, P. C.], guardianship, &c. Actions founded on these obligations were called 'bonæ fidei actiones,' and the legal proceedings were called 'bonæ fidei judicia.' The name arose from the formula 'ex bona fide,' which was inserted in the Intentio, or that part of the Prætor's formula (instruction to the judex) which had reference to the plaintiff's claim, and empowered the judex to decide according to the equity of the case, ex fide bona. Sometimes the expression 'æquius melius' was used instead of ex fide bona. Thus actions founded on contract or on acts which bore an analogy to contract, were called by the general name Condictiones, and were distributed into stricti judicii actiones, or stricti juris actiones, and bonæ fidei actiones; or actions in which the inquiry was about the strict legal rights of the parties, and actions in which the general principles of fair dealing were to be taken into the account. The object which was attained by the bonæ fidei judicia bears an analogy to the relief which may be sometimes obtained in a court of equity in England when there is none in a court of law.

The Intentio in those personal actions called Condictiones might be in this form: quidquid (ob eam rem) Numerium Negidium Aulo Egerio dare facere oportet ex fide bona — whatever Numerius Negidius ought pursuant to good faith to give or do to Aulus Egerius. (Gaius, iv. 47.) All the actions in which this formula is used were actions arising out of contracts or quasi contracts; and not actions founded on delict, nor actions in which the ownership of a thing was in question. By leaving out the expression 'ex bona fide' in the Intentio just quoted, the action is reduced to an action stricti juris. But the bonæ fidei actio, by virtue of the formula (quidquid, &c.), referred to a thing not determined: the stricti juris actio might refer either to a thing determined, as a particular field or slave, which was the subject of a contract, or to a thing undetermined (quidquid). Therefore all indeterminate actions (incertæ actiones) were not bonæ fidei actiones, but all bonæ fidei actiones were incertæ actiones.

BONA NOTABILIA. [Administration, P. C.; Executor, P. C.]

BONAPARTE, LETIZIA RAMOLINO, born at Ajaccio in Corsica, in August, 1750, married in 1767 Charles Bonaparte, a landed proprietor and a lawyer. Charles fought under Paoli for the independence of the island against the French, and his young wife accompanied him through their mountain expeditions. The vicissitudes of the Bonaparte family are narrated under Bonaparte, Napoleon, P. C. After her son Napoleon became First Consul of France, Madame Letizia fixed her residence at Paris, where she lived rather retired, but after the empire was proclaimed she assumed the title of 'Madame Mère:' she had her own household, her chamberlains, ladies of honour, and all the accessories of a court. Des Cazes was appointed her secretary. Her half-brother Fesch had been made a cardinal. Madame Mère was not bewildered by her sudden rise; she was economical in her expenditure, and she is said to have once observed, that perhaps some day she would have to support out of her savings all these kings, meaning her sons. She was designated by Napoleon as especial patroness of the charitable institutions of France. After Napoleon's first abdication in 1814, she went to live at Rome, but repaired again to Paris when her son returned from Elba. After his second downfall she went back to Rome, where she spent her latter years in the company of her sons Lucien, Louis, Jerome, and of her brother Cardinal Fesch. She is said to have been very charitable to the poor. She died in February, 1836.

(Bausset, *Mémoires anecdotiques sur l'Intérieur du Palais*; *Biographie des Contemporains*.)

BONAPARTE, JOSEPH, Napoleon's elder brother, was born in Corsica in 1768. He received his education at the college of Autun in France. After the death of his father, he returned to Corsica in 1785. He applied himself to the study of the law, according to his father's wishes. In 1792 he was made a member of the new administration of Corsica, under Paoli, who was an old friend of the Bonaparte family. In the following year, when Paoli declared against the National Convention, and called the English to his assistance, Joseph emigrated to Marseille, where he married one of the daughters of a wealthy banker of the name of Clari, whose younger daughter married Bernadotte, afterwards King of Sweden. In 1796 Joseph was appointed commissary to the army of Italy, which was commanded by his brother Napoleon. In 1797 he was elected deputy to the Council of the Five Hundred for his own native department of the Liamone in Corsica, that island having been evacuated by the English. Joseph repaired to Paris, from whence he was shortly after sent by the Executive Directory as ambassador to the pope. There was then at Rome a knot of enthusiasts who were bent upon establishing a Roman republic, and they relied upon the countenance and support of the French. On the 28th of December (1797) they assembled to the number of about three hundred, under the guidance of a sculptor named Ceracchi, and proceeded to the palace Corsini, where Joseph Bonaparte resided, vociferating 'The Republic and the Roman people for ever!' and they applied to the ambassador, claiming French protection. Joseph desired them to leave the palace. In the mean time a detachment of the papal troops, who were in pursuit, arrived in front of the palace, and insisted that the insurgents should leave the premises. Those from within insulted and taunted the soldiers, who at last rushed into the court of the palace to clear it of the fugitives. Some say that the soldiers did not enter the palace, but that the affray took place in the street in front of the palace. Joseph, attended by Generals Duphot and Sherlock, came down the staircase to remonstrate with the papal officers, but could not make himself heard in the midst of the confusion, when Duphot, young and impetuous, drew his sword, and rushed forward, followed by the insurgents, in order to drive away the soldiers. The soldiers then fired, killing several of their opponents, and Duphot among the rest. The insurgents dispersed in the gardens of the palace, and the soldiers formed themselves in the street outside. These transactions were much misrepresented by the French and their partisans. Joseph wrote in a vehement strain to the Cardinal Doria, secretary of state, complaining of the violation of his residence, and requiring immediate satisfaction. The cardinal hesitated; Joseph demanded his passports, and, heedless of the explanations sent by the Roman government, he set off in the night of the same day to return to France. The Directory then ordered Berthier to take possession of Rome.

Joseph resumed his seat in the Council of the Five Hundred, and, during the absence of Napoleon in Egypt, he and his brother Lucien prepared the way for his return, and for the revolution which followed. Napoleon, having become First Consul, made Joseph councillor of state, and he employed him in September, 1800, to negotiate a treaty of peace and commerce with the United States of North America. Having exhibited some diplomatic skill in this transaction, he was sent in the following year to Luneville, where he concluded a treaty of peace with the Emperor of Germany in 1801, and the next year he was likewise employed at Amiens to negotiate the treaty with England. He was made a senator, and on his brother attaining the imperial crown, Joseph was recognised as an Imperial Prince and Grand Elector of the Empire. It is said that his brother offered him, in 1804, the crown of the kingdom of Italy, but that Joseph refused, unless it was made independent of the crown of France. When Napoleon sent an army to invade Naples, at the beginning of 1806, he appointed his brother, 'Prince Joseph,' to lead the expedition, Marshal Massena acting as military commander. A few months after, Napoleon appointed by a decree 'his brother Joseph Napoleon King of Naples and Sicily.' Joseph reigned in Naples, though not in Sicily, little more than two years. The character of his administration is given in the 'History of Naples,' by Colletta, a writer by no means prejudiced against the French rule. Acting as his brother's subordinate, he effected fundamental changes in the institutions of the country; he abolished feudality, suppressed the convents, and by the sale of their property and of that of the crown he restored order in the finances; he promulgated the French codes and judiciary system; he began a cadastro, or survey and estimation of the landed property, for the better assessment of the land-tax; and he established a new and regular system of provincial administration. He also embellished the capital, began new roads in the provinces, and organised an effective gendarmerie to repress the robber bands in the provinces. Most of these measures were beneficial to the country, but they were effected in a hasty overbearing manner, like all the reforms made under Napoleon, and many individual rights and interests were overlooked and sacrificed. The times were stormy, and the country was still teeming with insurrections and conspiracies, which were suppressed in a summary way, and many executions took place. Neither the nobility nor the body of the people became reconciled to the new system until years after, under the rule of Murat.

By a decree of June. 1808, Napoleon appointed 'Joseph Napoleon to be King of Spain and of the Indies,' and soon after Joachim Murat succeeded him as King of Naples. In Spain Joseph met with much greater difficulties than at Naples. He tried mildness and conciliation, but even these failed, owing to the stern unbending character of the people. During the five years of his Spanish reign, three times he was obliged by the successes of the allied armies to leave his capital; the last time (1813) to return no more. Joseph would have wished to be really and not nominally king of Spain, but this was prevented both by the people, who would not submit to him, and by his brother Napoleon, who appointed by degrees his own generals to be military governors in the various divisions of Spain, and they acted quite independent of King Joseph and his Spanish ministers. In March, 1812, Joseph wrote to his brother, requesting to be allowed to resign his crown, as he saw that he could do no good in Spain. Soon after he repaired to Paris for the same object, but Napoleon induced him to remain in his place by telling him that he expected to make peace with England, and then he should withdraw his armies from Spain. This was before the Russian expedition. General Foy, in his history of the war in the Peninsula, speaks of Joseph as follows:—'When he assumed the crown of Spain, Joseph was forty years of age. His figure was graceful, and his manners elegant. He was fond of women, of the fine arts, and of literature. His conversation was fluent and methodical, and abounded with judicious remarks.' After the battle of Vittoria (June, 1813), where he narrowly escaped being taken prisoner by the English, he withdrew to France. In January, 1814, when Napoleon set off for the army, he appointed Joseph lieutenant-general of the empire, and placed him at the head of the council of regency which was to assist the empress-regent. Napoleon wrote to him from Rheims on the 16th March, that in case the enemy should advance in irresistible force, he must send off towards the Loire the empress and her son, the great dignitaries, the ministers, and all the heads of the administration. 'Do not leave my son for a moment,' added he; 'I should prefer hearing that he was at the bottom of the Seine rather than in the hands of the enemies of France.' Accordingly when the great army under Schwarzenberg arrived before Paris on the 28th of the same month, Joseph sent off the empress and her son to Blois. After the battle of the 30th, in which the troops outside of Paris were driven in by the allies, Marmont told Joseph that he could no longer defend the capital, and Joseph authorised him to treat for a suspension of arms for a few hours in order to arrange the terms of a capitulation. (Thibaudeau, *Le Consulat et l'Empire*, ix. 638.) Joseph then rejoined the empress at Blois. After Napoleon's abdication, Joseph and his brother Jerome thought of removing the empress and the regency to the south of France, but the empress refused, and was supported in her refusal by the members of the household. Soon after, the empress rejoined her father Francis of Austria, the regency was dissolved, and Joseph set out for Switzerland, where he purchased the estate of Prangins, near Nyon, on the banks of the lake Leman. From thence he corresponded with his brother at Elba, and with Murat at Naples, who had become restless under his engagements with Austria; and he is said to have given Murat the advice of declaring against Austria in 1815, so as to make a diversion in favour of Napoleon, a diversion which proved of no use to Napoleon and was fatal to Murat. Napoleon having returned to Paris in March, 1815, Joseph rejoined him there, and took his seat in the House of Peers. It is reported that, seeing the threatening appearance of the times, he advised Napoleon, before he set off for the army, to abdicate in favour of his son, and to appeal to his father-in-law the Emperor of Austria for his guarantee. This however was not done. After the return of Napoleon from his defeat at Waterloo and his second abdication, Joseph embarked for the United States, after having a last interview with his brother at the Ile d'Aix. He was well received in the United States, and after a time he fixed his residence on the banks of the Delaware, near Philadelphia, where he purchased an estate. He assumed the title of Count de Survilliers, and lived in a style of affluence, affording employment to many of the labouring population, and hospitality to the French emigrants who resorted to America. His wife remained in Europe with her two daughters, and resided at Brussels and afterwards at Florence. When the Paris revolution of 1830 became known in America, Joseph wrote a long letter or address to the House of Deputies, in which he put forth the claims of his nephew the young Napoleon. The letter was not read to the Chamber. He came himself to England soon after, and resided some time in this country, and at last repaired to Italy, where he died at Florence, in July, 1844. He was buried in the vaults of the church of Santa Croce. He is said in the newspapers to have left a fortune of fifteen millions of francs.

(*Biographical Sketch of Joseph Napoleon Bonaparte*, London, 1833; Abel Hugo, *Précis Historique des Evènemens qui ont cunduit Joseph Napoleon sur le Trône d'Espagne*; Botta, *Storia d'Italia*; Coppi, *Annali d'Italia*; Colletta, *Storia del Reame di Napoli*; Thibaudeau, *Le Consulat et l'Empire.*)

BONAPARTE, LUCIEN, a younger brother of Napoleon, was born at Ajaccio in 1775. He emigrated to Marseille with the rest of the family in 1793. He entered warmly into the revolutionary notions of that period, and made flaming speeches at various clubs, and wrote turgid pamphlets on liberty and equality. Soon after, he obtained employment in the commissariat at St. Maximin, a small town of Provence, where he married the daughter of an innkeeper. Being one of the republican municipality of that place, he exerted himself laudably, and at his own imminent peril, to save several unfortunate individuals accused of royalism, whom an agent of Barras and Freron, the terrorist commissioners in the south of France, wanted to remove to the prisons of Orange, where the guillotine was in constant activity. By showing a bold front to the agent, whom Lucien charged with informality in his commission, he detained the intended victims under arrest at St. Maximin, until the fall of Robespierre put a stop to the reign of terror. In the reaction however which took place in the south of France against the so-called Jacobins, Lucien was arrested as such on account of his speeches, and one of those whom he had saved proved most hostile against him. He was however liberated after a time. In 1796 Lucien was appointed commissary at war, probably through the influence of his brother, General Bonaparte. In the following year he was elected deputy to the Council of the Five Hundred, and he went to reside at Paris, where he took a house, of which his sister, Elisa Bacciocchi, did the honours. His drawing-room was resorted to by several men of note and of literary acquirements. Lucien took the opposition side in the council, and allied himself to Sièyes and his party, who wished to try their hands at a new constitution. While Napoleon was in Egypt, Lucien wrote to him, complaining of the incapacity and misgovernment of the Executive Directory, and urging him to return to France, which letters are said to have been intercepted by the English cruisers. After Napoleon's return, in October, 1799, Lucien, who was the president of the council, became the active leader of those who wished to overturn the Directory. In the stormy sitting of the 19th Brumaire, he resisted the motion made by several members to outlaw General Bonaparte, and as the confusion and uproar increased in the hall, he left the chair, and addressing his brother's soldiers outside, told them to march in and drive away the factious men who were sold to the English, the usual phrase in those times, and who were no longer the representatives of France. After the accomplishment of that revolution, in which he rendered most material assistance to his brother, he was one of the members of the commission which framed the new or Consular constitution. Soon after he was appointed minister of the interior, but remained in office only a short time, having had some disagreement with his brother upon matters of administration; and in October, 1800, after the campaign of Marengo, Napoleon sent him ambassador to Spain. His mission proved successful: he managed to ingratiate himself with Charles IV. and the favourite Godoy, and to re-establish French influence in Spain. He induced the weak Spanish government to join France in an attack upon Portugal, which ended by the latter country being obliged to sue for peace, for which it paid dearly. He also completed the arrangements concerning the new kingdom of Etruria, to be given to the young infante, son of the Duke of Parma, who had married a Spanish princess, in exchange for which Spain ceded to France her rights upon Parma and Piacenza. The cession of Louisiana to France was likewise confirmed. Having concluded these negotiations, Lucien returned to Paris in 1802. He was made a member of the tribunate, and as such he supported with all his eloquence the concordat with the pope, and also the institution of the Legion of Honour. Lucien was made a senator, and his brother gave him the senatorship or living of Sopelsdorf, an estate of the former elector of Treves. His wife being dead, Lucien married, in 1803, Mme. Jouberthou, the widow of a stockbroker, who had died at St. Domingo. Napoleon disapproved of this marriage, as he had disapproved of the marriage of Jerome, because he looked forward to royal alliances for his brothers. Lucien however supported the project of making his brother consul for life; but he says in his memoirs that he wished to have stopped there, and that he opposed from the first the idea of establishing an hereditary dynasty. When he saw his brother determined on assuming the imperial crown, he left France in the spring of 1804, and went to Italy. Thibaudeau and others say that the two brothers quarrelled on other grounds; about Lucien's marriage in particular. Lucien accuses Fouché of having, by his insidious reports, contributed to alienate him from his brother. The Senatus Consultum, which fixed the hereditary succession in Napoleon's family, named his brothers Joseph and Louis as eventual heirs to the throne, but made no mention of either Lucien or Jerome. Lucien, after a time, fixed his residence at Rome, where he was very kindly received by Pope Pius VII. He took a large house, and lived in a style of affluence. Being fond of literature and the fine arts, his house was much frequented. After the peace of Tilsit, Napoleon repaired to North Italy at the end of 1807, and sent for his brother Lucien to meet him at Mantua. The two brothers had there a conference, in which it seems that Napoleon offered to give Lucien a kingdom in Italy, at the same time telling him plainly that in such case he must be prepared to obey all his orders concerning the internal as well as the external policy of his administration. Lucien declined accepting a crown on those terms, and said that he preferred to remain in a private station. 'Be it so,' Napoleon replied; 'you cannot have henceforth any ground of complaint against me.' But he added in parting, that as Lucien would not fall in with his system of politics, he must prepare to quit the Continent, where his silent opposition could no longer be tolerated. (*Réponse de Lucien Bonaparte aux Mémoires du Général Lamarque.*)

Lucien returned to Rome, where he purchased the estate of Canino, in the province of Viterbo, near the borders of Tuscany. Pope Pius VII. created him Prince of Canino and Musignano in 1808. Soon after Napoleon began a course of vexatious proceedings towards the court of Rome, which ended in the arrest of the pope, and the seizure of his dominions. When the French took possession of Rome in 1809, Lucien, who had expressed himself very freely against this part of his brother's policy, was advised to leave that city, and he retired to his country estate. In 1810 he resolved to go to the United States, and having obtained passports from his brother, some say without any passports, he sailed from Civitavecchia, but was seized by an English cruiser and carried to Malta where after a time he obtained permission from the British government to reside in England under surveillance. Ludlow castle was fixed upon as his residence. Some time after, he removed to a place in the neighbourhood, where he remained till the end of the war, and employed himself in writing his poem of Charlemagne. After the peace of 1814 he returned to Rome, where he dedicated to Pope Pius his poem of Charlemagne. When Napoleon returned to France from Elba, in 1815, Lucien repaired to Paris. His object in this does not appear very clear. It has been surmised by some that Lucien acted from a generous impulse, to tender to his brother his advice in the hour of danger, and to keep him also, if possible, within constitutional limits. However this may be, he went to live at the palace of the Orleans family, assumed the style of an imperial prince, and claimed a seat of honour as such in the new House of Peers. This was resisted by several peers, on the ground that he had never been acknowledged as a prince of the empire, and had no diploma as such. He then took his seat in the body of the house as a common peer. In the private councils that took place, he advised Napoleon to offer to the Emperor of Austria, in order to detach him from the allies, to abdicate in favour of his son. This manœuvre not having succeeded, Napoleon set off for the army, lost the battle of Waterloo, and returned to Paris without an army. Lucien being appointed extraordinary commissioner of the emperor, to communicate with the representatives of the people, strove to revive in the Chamber of Deputies a feeling of sympathy for his brother; he spoke eloquently, he appealed to the gratitude of the nation, but was answered sternly by La Fayette, 'The nation has followed your brother over fifty fields of battle, from the burning sands of Egypt to the frozen deserts of Russia, through disasters as well as triumphs, and it is for this that we mourn the loss of three millions of Frenchmen!' Lucien advised his brother to dissolve the Chambers, since he could not manage them, and to assume the dictatorship. Napoleon hesitated, and at last refused; he said that he would not kindle a civil war; he most likely perceived what Lucien did not see, that the attempt would only lead to a short protracted struggle, attended by additional calamities to France and to himself. Lucien says that he was opposed to Napoleon's abdication, but when he saw his brother determined upon it, he insisted upon its being made at least in favour of young Napoleon. Napoleon smiled and shook his head incredulously, but at length inserted the clause in favour of his son. Lucien then proceeded to address the House of Peers to induce them to proclaim at once Napoleon II., but in vain he cried out, according to the forms of the old monarchy, 'The emperor has abdicated, long live the emperor!' the House remained mute, and as he went on speaking vehemently, one of the peers, Pontécoulant, taunted him with being an alien, a foreign titulary, a Roman prince, and not even a citizen of France. Soon after the allied armies made their appearance, Napoleon went to Rochefort, and Lucien set out to return to Italy. He rejoined his family at Rome, where he afterwards spent many years in peaceful retirement. In 1828 he began digging at a place called La Cucumella on his estate of Canino, which is believed to have been the site of the antient Vetulonia, once an important Etruscan city, and he gathered an ample collection of Etruscan antiquities, of which he published a description: 'Museum Etrusque de Lucien Bonaparte, Prince de Canino.' During the insurrection in the Papal States, in 1831, Lucien kept himself and his family aloof from that disorderly attempt. Some time after he revisited England, where he published several of his works. He returned to Italy, where he died in 1840. His eldest son, Charles Lucien Bonaparte, well known as a naturalist, and author of the 'Ornithology of the United States,' and of the 'Iconografia della Fauna Italica,' succeeded to the title. Enthusiastic in the cause of science, he has been the chief promoter of the annual congresses of the scientific men of Italy. Of Lucien's other children, one, having had some serious disputes with the Papal authorities, was obliged to leave Italy. Lucien ranks as a French author in prose and in verse. His published works are:—1, 'Charlemagne, ou l'Eglise délivrée,' an epic poem in 24 cantos, which has been translated into English by S. Butler, D.D., and the Rev. F. Hodgson, 2 vols. 4to., London, 1315. 2, 'La Cyrnéide, ou la Corse sauvée,' a poem in 12 cantos. 3, 'Mémoires de Lucien Bonaparte, Prince de Canino, écrits par luimême,' 8vo. London, 1836. 4, 'Réponse de Lucien Bonaparte aux Mémoires du Général Lamarque,' London, 1835. This is a sort of political confession, and at the same time an apology for his own and Napoleon's political conduct during the hundred days; it contains some curious revelations and frank avowals, though it is rather incoherent in its reasoning, like all the attempted justifications of Napoleon's political morality. Several of Lucien's speeches while a tribune have also been published; among others his 'Rapport sur l'Organisation des Cultes,' and 'Discours sur la Légion d'Honneur.' A defamatory book, entitled 'Mémoires de Lucien Bonaparte,' was published in France during the Restoration, but is now understood to be of no authority.

(Thibaudeau, *Le Consulat et l'Empire*; *Biographie des Contemporains*; and the works of Lucien already quoted.)

BONAPARTE, HORTENSE EUGÉNIE BEAUHARNOIS, daughter of Alexandre Viscount de Beauharnois and of Josephine Tascher de la Pagerie, was born at Paris in 1783. She was a child when the Revolution broke out, in which her father lost his life, and her mother was imprisoned and was only saved by the timely death of Robespierre. After the end of the reign of terror, Hortense was intrusted to Madame Campan for her education. Her mother's second marriage with General Bonaparte brightened her prospects; and when her stepfather became First Consul, Hortense went to enliven by her youthful grace and sprightly humour the court circle of the Tuileries. Napoleon was much pleased with her, as well as with her brother Eugene, and he behaved as a real father to both. In 1802 he gave Hortense in marriage to his younger brother Louis. It seems that his other brothers were not favourable to this match. Hortense had a son who died some years after in Holland. Her second son was christened by Pope Pius VII. at the time of Napoleon's coronation in 1804. Hortense's sons were looked upon as the eventual heirs of Napoleon, as he had no children, and his brother Joseph had only daughters. In 1806, Stephanie de Beauharnois, Hortense's cousin, was married to the hereditary prince of Baden. In the same year Louis was appointed King of Holland, and his wife followed him thither, not without regretting Paris and its brilliant society. In Holland Louis was inclined to favour his new subjects, the Dutch and their interests, but his wife was all for France and for Napoleon, who expected that his brothers should act merely as his lieutenants in the countries over which he appointed them to rule. After the death of her eldest son in 1807, Hortense was advised to travel for her health, and she ultimately returned to Paris, where she was delivered of a third son. In 1809, when Louis and Napoleon were at variance about Dutch politics, Hortense repaired to Holland at Napoleon's request, to watch her husband and keep him within the bounds of his allegiance to his imperial brother. Louis however proved refractory, and at last quitted Holland, of which Napoleon took possession. He repaired to Austria, and his wife returned to Paris, where she had an hotel and a princely household, and went by the name of the Queen of Holland, though her husband was no longer king. The eldest of her two living sons bore the title of Grand Duke of Berg. The divorce of her mother blighted the prospects of Hortense and her children, but she bore this disappointment with equanimity, always professing the most unbounded devotion to Napoleon, and obedience to his will. She became separated though not divorced from her husband, whose temper and tastes did not agree with her own. In 1814 she remained at Paris and was zealous in urging the defence of the town against the allies. When Napoleon abdicated at Fontainebleau, she remained with her mother at Malmaison, and saw her breathe her last, a loss which she poignantly felt. The Emperor Alexander showed her a marked interest, and it was chiefly owing to his influence that she obtained a formal grant of the domains of St. Leu, with the title of duchess. As Louis XVIII. had signed the grant, she went to thank him, and by her sprightly conversation delighted the aged king. But her saloon was the resort of most of the disaffected generals and partisans of the Empire; and this gave rise to the report that she was privy to the intrigues which prepared the return from Elba, which however has been denied by her friends. Meantime her husband sued in the French Courts to have his two sons removed from her charge and restored to him, but the return of Napoleon put a stop to the proceedings. She now resumed her attendance at the Tuileries, and did the honours of Napoleon's court. But she used her interest, as she had done before, in favour of the fallen and the unfortunate, without distinction of parties, for she was kind-hearted like her mother. After the battle of Waterloo, she attended Napoleon in his retirement at Malmaison, until he left it to embark. She then set out for Switzerland, and after many vexations from the police of various countries on account of political suspicions concerning her movements, she retired to the town of Constance, and afterwards, in 1817, she purchased the estate of Arenenberg, in the canton of Thurgau, where she afterwards used to spend the summers, and to go and pass the winters at Rome, at the Villa Borghese, which belonged to her sister-in-law Pauline. Her eldest son, Napoleon, married his cousin, Joseph Bonaparte's second daughter. In 1831 both her sons, much to her annoyance, joined the insurrection in the Papal State. The eldest fell ill during that short campaign, and died at Pesaro, and the other was smuggled out of Italy by the anxious mother, and after some narrow escapes they returned together to Arenenberg. This remaining son, Charles Louis, was naturalized as a citizen of the canton of Thurgau. In 1836, having made a rash attempt to put himself at the head of a military insurrection at Strasburg, he was arrested, but Louis-Philippe interfered to save him from punishment on condition of his emigrating to America. Hortense was too ill to follow him, and she died at Arenenberg, in October, 1837. Her son had returned from America to attend her last moments. Her remains were taken to France, and buried in the church of Ruel near Paris, by the side of those of her mother Josephine. Her son being afterwards expelled from Switzerland, in consequence of the remonstrances of the French government, came to England, from whence he made another insurrectionary attempt at Boulogne in 1839, for which he was shut up in the castle of Ham, where he still remains. Hortense had been deprived of the duchy of St. Leu at the second restoration of the Bourbons. She published some reminiscences or fragments of her memoirs, relative especially to her adventures in 1831: 'La Reine Hortense en Italie, en France, et en Angleterre, pendant l'année 1831,' 8vo. Paris, 1834. Amiable, kind-hearted, and womanly in her feelings and tastes, she is out of her sphere when talking of grave political interests; her admiration of Napoleon and his reign was a matter of impulse rather than of reason. Hortense was fond of music, and she composed several airs which have been applauded, among others a favourite one, 'Partant pour la Syrie—le jeune et beau Dunois.'

(*La Reine Hortense en Italie* already quoted; *Supplement* to the *Biographie Universelle*, art. 'Hortense;' Thibaudeau, *Le Consulat et l'Empire; Romances mises en musique par Hortense Duchesse de St. Leu*, with a biographical notice, by Count Lagarde.) She has disclaimed, as entirely apocryphal, certain pretended memoirs of her life, published under the name of a Baron van Scheelten.

BONE, HENRY, R. A., the most distinguished enamel-painter of his time, carried this branch of painting to a degree of perfection and efficiency which had previously not even been approached. He was the son of a cabinet chair-maker at Truro, in Cornwall, where he was born in 1755. He showed at an early age some artistic ability, and was accordingly apprenticed to a china manufacturer of the name of Cockworthy, who, in 1778, at the expiration of Bone's term of apprenticeship, was settled in Bristol. He remained in the employ of Mr. Cockworthy another year, at the expiration of which the china business failed, and Bone ventured to try his fortune in London. For many years he was chiefly employed in London by jewellers and others in enamel-painting for watch-cases, brooches, lockets, and the like; and also in a species of art called device-painting. He had however attracted some notice by an enamel portrait of his wife, which he exhibited at the Royal Academy in 1780, and by an original picture of a Muse and Cupid, which, though only five inches and a quarter by four inches and a quarter, was at that time considered to be of extraordinary dimensions: it was engraved in 1790 by R. Dagley.

Towards the close of the last century his engagements increased to that extent, that he was enabled to decline the drudgery of his profession, and to confine himself to miniature and to enamel painting, and he executed on enamel many of his own miniatures. In 1800 his reputation was established by the appointment of enamel-painter to the Prince of Wales, a distinction which was succeeded in the following year by his election as an Associate of the Royal Academy; and he was successively appointed enamel-painter to George III., George IV., and William IV. He was elected a full Academician in 1811, and for twenty years from this time he was assiduously employed in producing a long succession of admirable works, most of them of unprecedented dimensions; but about 1831 his advanced years compelled him to cease his professional labours, and he left his house in Berners Street, where he had chiefly resided, and retired to Clarendon Square, Somers Town, where he died, in December, 1834. Though Bone was in full employment for many years, his family was too numerous to allow him to grow rich. He had a son in the army and another in the navy, both of whom he survived: the former, Lieutenant Bone, died in consequence of wounds received at the battle of Toulouse. H. P. Bone, the present enamel-painter to the queen, is also one of his sons. Mrs. Bone, whom he married in 1779, was a Miss Vandermeulen, and was directly descended from Peter, the brother of the celebrated battle-painter Charles Antony Vandermeulen, and himself battle-painter to William III.

The following are Bone's principal works:—The Death of Dido; Cymon and Iphigenia; Venus; and Hope nursing Love, after Sir Joshua Reynolds; a copy (in the article ENAMEL, P. C., erroneously ascribed to his son, H. P. Bone) of a picture of Bacchus and Ariadne, by Titian, eighteen inches by sixteen and a half, dimensions up to this time unapproached except by himself, which was purchased by George Bowles, Esq., of Cavendish Square, for 2200 guineas. The original picture, which is now in the National Gallery, was then the property of the late Lord Kinnaird, who lent it to Bone for the express purpose of copying it. A Venus recumbent, after Titian; Bathsheba, after N. Poussin; La Belle Vierge, after Raphael; and an Assumption of the Virgin, after Murillo. A series of portraits of the Russell family, from the reign of Henry VII. to the present time, executed for the late Duke of Bedford, and now at Woburn Abbey. A set of portraits of the principal Royalists distinguished during the civil war of Charles I., for J. P. Ord, Esq., of Edge Hill, near Derby, which Bone left unfinished at his death: its completion was undertaken by his son, H. P. Bone, who, in all the great works, was his father's assistant. And, finally, his greatest and most interesting work, a series of eighty-five portraits of distinguished persons in the reign of Queen Elizabeth, varying in size from five inches by four to thirteen inches by eight: it remained in the possession of the artist during his life, but it was his desire that after his decease it should be offered to the government for purchase, which was accordingly done; but although at the moderate price of 5000*l*., the British government declined the purchase. The sum was considered too much for a collection comprising eighty-five authentic portraits of the most distinguished characters of one of the most interesting periods of English history. The fact of their being copies does not render them less interesting or less instructive to the public. They were disposed of by public sale, and the greater part of them were purchased, either at the sale or since, by W. J. Bankes, Esq.

(*Annual Biography and Obituary*, 1836.)

BONINGTON, RICHARD PARKES, was born in the village of Arnold, near Nottingham, in 1801. Bonington's father was a landscape and portrait painter, and perceiving a strong tendency in his son towards his own pursuit, even at a very early age, he trained him from his childhood in such a manner as in his judgment was best calculated to fit him for his future profession, at the same time not neglecting his education, as frequently happens, in those branches of instruction requisite to fit him for the ordinary business of life. Bonington's professional education however was chiefly French: his father took him to Paris, where he afterwards chiefly resided, when he was only fifteen years old, and procured him permission to study in the Louvre, where he made several excellent copies of some of the best Italian and Flemish landscapes in the collection. He became also a student of the Institute, attended occasionally the studio of Le Baron Gros, and spent the greater part of his time in the society of French artists.

Having obtained a considerable reputation in Paris by his works, which were chiefly marine and coast views, he visited Italy, where Venice, 'throned on her hundred isles,' offered to Bonington particular attractions in her crumbling palaces and her many waters. He made oil pictures of the ducal palace and of the grand canal, which were exhibited in England, and attracted much notice. They are painted somewhat in the style of Canaletto's works. It was his intention to paint many other similar pictures, of which he had already prepared the sketches, but he was already the victim of a fatal disease; he was in a deep decline, and the nervous debility inherent in this complaint reduced him to such a low state, that his constitution sunk under the excitement of his very success when he returned to England. He died in London, shortly after his return from a second visit to Paris, in September 1828, having not quite finished his twenty-seventh year.

He painted chiefly in water-colours, and mostly marine or river views; his style is simple and picturesque, quite free from conventionalisms.

Sir Thomas Lawrence, who attended Bonington's funeral, speaks of him in the following terms, in a letter to a friend, shortly after his death—'Your sad presage has been too fatally verified; the last duties have just been paid to the lamented Mr. Bonington. Except in the case of Mr. Harlow, I have never known, in my own time, the early death of talent so promising, and so rapidly and obviously improving. If I may judge from the later direction of his studies, and from remembrance of a morning's conversation, his mind seemed expanding in every way, and ripening into full maturity of taste and elevated judgment, with that generous ambition which makes confinement to lesser departments in the art painfully irksome and annoying:—

But the fair guerdon when we hope to find,
Comes the blind Fury with the abhorred shears,
And slits the thin-spun life

A series of twenty-four engravings from the works of Bonington has been published by Mr. Carpenter.

(Cunningham, *Lives of British Painters*, &c.)

BONOMI, JOSEPH, an Italian architect who practised in England, was born at Rome in 1739, and studied architecture under the Marchese Teodoli. In 1767 he was invited to England by the brothers Adam, and was for many years employed by them as an assistant and architectural draftsman. The acquaintance which he formed in London with Angelica Kauffman, then in the zenith of her fame, led to his marrying her cousin and ward, Rosa Florini, in 1775. When Angelica returned to Italy, after her marriage with Zucchi the painter, she induced Bonomi to do the same, and he left England in 1783, taking with him his family of three young children; but he did not remain in Italy above a year. About five years after his return, in November, 1789, he was elected an Associate of the Royal Academy, but was never raised to the rank of R. A., although Reynolds interested himself very warmly in his behalf, and did all that he could to obtain for him the professorship, which was bestowed on Fuseli. Bonomi died March 9, 1808, leaving a widow and six children, the eldest of whom now practises as an architect at Durham; and another son, who has visited Egypt, has published a work on the Egyptian antiquities in the British Museum.

Bonomi's chief professional works are, additions and alterations at Langley Hall, Kent, 1790; the chapel of the Spanish embassy, near Manchester Square, London, 1792; Eastwell House, Kent, for G. F. Hatton, Esq., father of the present Earl of Winchester, 1793; the pyramidal mausoleum in Blickling Park, Norfolk, 1794; Longford Hall, Salop; mansion at Laverstock, Hants, for H. Portal, Esq., 1797; the splendid mansion at Roseneath, in Dumbartonshire, for the Duke of Argyle, 1803, which last (not yet completed) is his most celebrated work, and is given as an example of modern design in the treatise on Civil Architecture (by Telford) in Brewster's Encyclopædia, although chiefly remarkable for the heresy, if not the solecism, of an entrance portico with a column in the centre. The reason assigned for this caprice is, that as the portico was intended for carriages to drive through, it was thought a column in the centre of the front would express its purpose better; yet, besides having a most awkward effect in itself, a column in that situation is not a little objectionable, on account of its obstructing the view from the entrance door. Nevertheless the design is praised as 'displaying originality of genius.'

Bonomi also made designs for the new sacristy of St. Peter's at Rome, of which edifice he had been appointed honorary architect in 1804.

BONSIGNO'RE, or BUONSIGNO'RE, FERDINANDO, architect to the King of Sardinia, and professor of architecture at Turin, is entitled to honourable distinction in his profession. Although known to us only by one work, yet that alone sufficiently proclaims his talent and establishes his fame. We regret that, owing perhaps to his recent death (March, 1844), we have not been able to collect any particulars respecting him or his professional life; nor does Nagler even so much as give him a place in his 'Künstler-Lexicon.' The church 'Della Gran Madre di Iddio' at Turin, an *ex-voto* structure intended to commemorate the king's return to his dominions, is one of the most classical and tasteful specimens of recent Italian architecture: a happy application of the idea of the Pantheon at Rome on a moderate scale, but by no means a servile imitation of it—certainly is distinguished from it by being raised on a spreading-out basement about 16 feet high and 112 in diameter, which, following the plan of the rotunda and advanced portico, constitutes a parapeted terrace about 12 feet wide around the edifice. The ascent is by two successive flights of steps leading up to the portico, and of the same width. The portico itself is a Corinthian hexastyle, diprostyle, with two inner columns. The interior, 50 feet in diameter by 75 in height, to the eye of the cupola, is divided on its plan into eight compartments alternately closed and open, the latter forming four semicircular recesses or tribunes, with two Corinthian columns in antis; and corresponding with these recessed divisions are four large pannels with bas-reliefs in the attic above the order. The dome is richly coffered with octagonal caissons. Plans, &c. of this highly interesting structure may be found in the volume of Förster's 'Bauzeitung' for 1837.

BOOKBINDING. When books were merely groups of leaves, either of thin skin or of some kind of vegetable membrane, the art of the bookbinder was a very primitive one. He had simply to paste or glue the leaves together, so as to form an extended sheet, and to attach this sheet to a cylinder round which it might be rolled. Even to the present day it is customary in some Oriental countries to write on slips of vellum, to sew these slips together into one long sheet or page, and to attach this to rollers at each end, clasped with gold or silver. The square form of binding, now so well known, was of later date, and constituted a vast stride towards improvement; it was adopted largely for the written missals used in Catholic countries, long before the invention of printing, and has been retained as the most convenient mode of binding.

In the binding of a book at the present day, whether humble or costly, there are generally three classes or successive stages of operations, varying in detail according to circumstances, but following each other pretty much in regular order. These relate first to the grouping of the sheets together, in a uniform and symmetrical way; next to the fixing of the stiff covers or boards which give firmness to the book; and lastly to those processes which relate rather to the external beauty than to the strength or efficiency of the book. These we shall designate as—1. *Preparing;* 2. *Binding;* 3. *Finishing*; and shall notice the different kinds as we go on.

1. *Preparing.* A book is built up of several sheets, each one folded and re-folded so as to assume a more convenient size than as originally printed. The number of successive foldings depends on the size of the work; thus octavo or 8vo. implies that there are eight printed pages on one side of a sheet, and that the sheet must be so folded as to be brought to one-eighth of its original size. The number whereby the size of a book is designated expresses at the same time the number of printed pages obtained from one side of a printed sheet, such as folio, 4to., 8vo., 12mo., 16mo., 18mo., 24mo., 32mo., &c. Some of the sheets employed are larger than others: thus 'royal octavo,' though folded into the same number of pages as 'post octavo,' is larger in size, through the sheet of paper being larger.

The folding of the printed sheets is one of the first operations in preparing for the binder. Each sheet has a letter at the bottom, such as A, B, &c., for identification; and there are as many signatures as there are sheets to form the volume. When the alphabet is in this way exhausted, another in smaller type, or duplicate letters, or letters combined with numerals, are employed. There is a heap of signature A, another heap of signature B, and so on. The folder sits before a bench, on which each sheet is spread out in succession; and the folding is aided by the use of a bone or ivory folding-knife: it is done with great rapidity, and with an accuracy which can only result from constant practice. The folded sheets are 'gathered' into new groups, fitted to make up into books; that is, each new group is made to contain one copy of the sheet bearing signature A, another of signature B, and so on. The groups are next 'collated,' that is, examined throughout to see that no mistake in the order of arrangement occurs.

If the sheets thus folded, gathered, and collated, are to be put into 'boards,' they are sewn in the next process; but if they are to be bound, and therefore finished in a more careful manner, they are beaten or pressed before being sewn, as a means of bringing them to a more compact and smooth state Until recent periods this process used to be effected by means of the hammer; the volume being divided into parcels of a few sheets; and these parcels, held flat on a smooth stone, being beaten with a heavy hammer. But the 'rolling-press' has greatly improved the mode of proceeding. This press consists of two smooth steel rollers, rotating nearly in contact; the parcels of a volume are placed between tin plates and then passed between the rollers, which gives them a more effective and expeditious pressure than the hammer. Sometimes the ink becomes 'transferred' to the opposite page by this process, when not properly conducted, to the great disfigurement of the book.

In sewing together the sheets for a volume, they are not actually fastened one to another, but all are in common attached to a range of parallel strings or bands placed across the back of the volume. Sometimes marks are cut with a saw across the back edges of the sheets, to receive the strings; but in others cases this is dispensed with. The process of sewing is carried on by the aid of a sewing-press, which consists of a flat bed or board, two upright bars rising from the ends of this, and a cross-bar at the top. The strings are fastened to this cross-bar and are stretched vertically downwards to the bed of the press, where they are firmly secured. The number of these strings depends principally on the size of the book, and varies from two to eight or ten. The sewer (a female) sits in front of the press, lays a folded sheet down on it, with the back edge in contact with the strings, opens the sheet in the middle, and sews it to the strings, passing a needle and thread to and fro. The needle passes through the back edge of the sheet twice as many times as there are strings; the object being to twist the thread round every string, and thus connect them and the sheet together. This being done with respect to the first sheet, a second is laid on the first, and sewn in a similar manner; and so on with a third, a fourth, and as many as there are to form the volume—all the threads being fastened to all the strings, and, indirectly, to each other; for the the thread passes from one sheet to another by a peculiar kind of stitch called a 'ketch' stitch.

Binding.—The sheets are by the sewing-process brought together into a book-like form, and are then ready to pass through the operations connected with the boards and covers. The back-edges of the sheets are glued together, to increase the strength of the volume: this is done simply by holding the book in the left hand, and brushing on it a little warm melted glue. This being dried, the ends of the strings (which are allowed to hang loose for an inch or so beyond the volume) are scraped thin, for the sake either of being rendered invisible when the book comes to be bound, or else to aid in fastening on the boards. The volume is next rounded in a singular manner; that is, rendered convex on the back and concave or hollow on the fore-edge. The workman lays the volume down flat, and hammers it with his right hand, while the left draws the sheets in such a way as to produce the rounding of the edges: the manipulation is a curious one; and as the glue is not yet quite dry, the sheets are enabled to yield a little to the action of the hand and hammer.

A groove is now made to receive the boards or stiff covers. These boards would project beyond the width of the back edge, and would be both unsightly and inconvenient, if some means were not adopted for compressing or confining them. A thin bevel-edged board is placed on each side of the volume far enough from the back edge to allow of a kind of ledge to be formed; these 'backing-boards,' as they are called, are placed parallel with the back edge; and the volume, with these boards on either side, is lowered into a press, with the back edge uppermost. By hammering this edge in a particular way, it is made to expand or spread out, and thus to form two ledges against which the covers of the book are to be placed. Although in common language we call the covers of a book the stiff sides which keep it firm and compact, yet the terms applied by a bookbinder are rather different. With him, this stiff envelope is called the *board*, the leather or cloth applied outside the board is the *cover*, and the two together form the *case;* and it will be convenient to retain the same terms here.

If the book is to be *boarded*, to use a familiar term, the edges of the leaves are not often cut; but if it is to be bound, this cutting of the edges is an essential process, and is done before the boards are fitted to the volume. The cutting is thus effected. The volume, placed between two boards, is screwed in a press; one of the ends of the volume being left projecting a little above the press. A cutting instrument, called a 'plough,' partaking in some degree of the action of a carpenter's plane, is passed over the end of the volume so as to shave off the ragged edges of the sheets, and leave them perfectly smooth. The volume is reversed in position, and the same thing done with the other end. It is then taken out of the press, and struck forcibly against a bench, so as to bring the convexity of the back and the concavity of the front edge alike to a plane level, which admits of the front edges of the leaves being cut in the same manner as the top and bottom edges had been. The book springs back again immediately on being released from the press; and then presents the neat appearance which a concave front edge, convex back, and plane top and bottom edges, are calculated to give.

Matters are now ready for applying the stiff 'boards.' These are made of 'millboard,' a smooth brown or drab-coloured pasteboard made of several layers of paper glued together and strongly pressed. The sizes and thicknesses vary according to the size of the volume and the kind of binding for which they are to be used. The boards are cut very quickly from the large sheets by a cutting edge applied nearly in the same way as in tobacco-shredding or in chaff-cutting. In attaching these boards to the book, the strength of the fastening depends on the kind of binding. If the book is to be 'bound,' holes are made through the boards, opposite to the strings, and the loose ends of the strings, being passed through these holes, are glued down firmly to the inner surface of the boards, thereby forming a very firm fastening. If, on the other hand, the volume is to be in 'cloth boards,' the strings are not generally passed through and glued down in this way, but the boards are fastened to the book chiefly by being pasted to the blank leaves or 'end-papers' placed at the beginning and end of the book. These boards, in this latter case, are brought somewhat to a finished state before being attached to the volume; for the cloth is cut to the required size, and handed over to a workman who pastes it upon the two boards, placed sufficiently wide apart to allow for the thickness of the book. Some books, especially in the present day, are made 'hollow' in the back; which is thus produced:—A double layer of paper or of cloth is placed between the leather of the cover and the back of the sheets; the leather is glued to the outer layer, and the back edge of the sheets to the inner layer, and as the two layers are connected at their edges, but detached or loose from each other at their surfaces, they give a kind of hollowness to the back of the book.

Most well-bound books have a little appendage at the top of the back-edge, called the 'head-band.' This gives a neat finish to the book, and at the same time strengthens the leather covering of the back-edge at that part. For common books the head-band consists of a cord inserted in silk or cotton; but for better work it consists of a little strip of vellum or pasteboard, around which coloured silken threads are twisted by the same process which fastens it to the volume.

When the volume is done in 'cloth,' of one uniform colour, the cloth cover is applied to the boards before the latter are attached to the volume; but when it is 'whole bound,' having leather all over the outer surface, or 'half-bound,' having partly leather and partly paper at the surface, these coverings are put on after the boards are attached to the book. The leather is cut to a size rather larger than is required to allow for paring and turning in, and is laid face downwards on a smooth board. The back of the leather is well pasted, and the book placed down upon it, the hands of the workman drawing, and adjusting, and pressing the leather, until it adheres closely to the book in every part. If 'half-binding' be the style of work, then the leather is so cut as to cover the back and a small portion of each board or side; while four small pieces are applied to the corners. The paper is subsequently so pasted on as to hide the ragged edges of all these five pieces of leather.

Finishing.—By the processes above described, the book has received all which is really necessary for service; the sheets have been arranged in proper order, sewed to strings, fastened to boards, and covered with cloth, leather, or paper. But a large portion of the talent, the ingenuity, and the capital applied to this branch of manufacture depend on the subsequent processes to which the book is subjected. These must be rapidly glanced at.

First, with respect to the *edges.* Most persons who purchase books are aware that, if in 'boards' or 'cloth-boards,' the top edges of the sheets, although placed level, are uncut; while the fore and bottom edges are ragged, uneven, and uncut. In some cases, to make a nearer approach towards neatness, the fore-edge only is cut; in occasional instances, too, the whole of the edges are cut, but left white. But a white edge to a book would soon become discoloured and unsightly; and it is far more usual either to sprinkle the edge with colour or to gild it. In sprinkling, the edges of several books are laid even one with another, and a piece of sponge, dipped into liquid colour, is passed lightly over the edges, so as to impart the tint to them regularly: this is called *colouring.* A more general method is that of *sprinkling.* The books are in this case ranged side by side on a bench, and a brush dipped in the liquid colour (which is formed of some such pigments as Venetian red, umber, &c.) is held over the books, and lightly tapped against a stick, whereby a shower of spots fall on the edges of the books, producing an appearance depending on the colour employed, and the manner in which the shower of spots is brought about. *Marbled* edges are sometimes produced, by a peculiar admixture and management of different colours sprinkled on the edge of the book.

Gilt edges are more delicate in their preparation. The gold so applied is in the same state as for various ornamental purposes, viz., an extremely thin leaf. Before the case or cover of the book is quite finished, the volume is struck forcibly against the back, so as to make the fore-edge flat instead of concave. It is then placed in a press, with the exposed edge uppermost. The edge is scraped smooth with a piece of steel, and is coated with a mixture of red chalk and water. The gold is blown out from small books, and spread on a leather cushion, where it is cut to the proper size by a smooth-edged knife. A camel-hair pencil is dipped into white of egg mixed with water, and with this the partially dry edge of the book is moistened; the gold is then taken up on a flat kind of brush, and applied to the moistened edge, to which it instantly adheres. When all the three edges have been gilt in this way, and allowed to remain a very few minutes, the workman takes a burnisher formed of a very smooth piece of hard stone, and setting the end of the handle against his shoulder, rubs the gold very forcibly—not (as might be supposed) endangering its permanence, but giving it a high degree of polish, by rubbing down the minute asperities which may be occasioned by the paper beneath. The gold employed has a greater or less degree of solidity according to the costliness of the book.

From the edges we pass to the covers; and first, to *leather* covers. The leather so employed is 'roan' or sheep, 'calf,' 'Morocco,' and 'Russia;' at least, these are the principal kinds, to which alone we need make allusion here. These kinds of leather receive their colour at the dye-houses in Bermondsey, where they are prepared; but 'roan-bound' books, such as school-books, are often sprinkled with colour by the bookbinders after the leather has been attached to the boards. For which purpose, the books are opened, and hung over two bars in such a manner that the leaves may hang vertically downwards, while the boards lie horizontal. A brush is dipped into the liquid colour, and dashed or sprinkled on the cover so as to give a group of spots or wavy lines, at the taste of the workman. Calf and Russia leathers do not often receive any modification of surface from the bookbinder; but Morocco is sometimes treated in the following manner:—The Morocco leather employed for chair-covers and such purposes is made either of kid-skin or sheep-skin according to its quality, and has a wrinkled appearance, arising from the surface having been rubbed very hard with a minutely grooved piece of wood. Now for many purposes of bookbinding these wrinkles are changed to a granulated appearance. Two pieces of leather being well wetted, and laid face to face, the upper one is rubbed in different directions with a flat piece of cork, by which the wrinkles are removed, and a slightly granulated texture produced.

The decorations produced on a leather-bound book by heated stamps or dies are very diversified. The dies for producing any particular device are fixed to handles, and when about to be used are warmed in a gas-heated stove. Many such dies are often used for one book, and the process of producing a sunken ornamental device by using these tools by hand is called 'blind-tooling.' But for many purposes it is more convenient to fasten a great number of small dies as partial devices to a metallic plate, by means of glue and cloth, and to stamp the device from this fixed plate by means of a press: this is called 'blocking.'

All the devices so produced on a book are called 'blind,' if no gold be employed; but much of the beauty of the workmanship depends on the tasteful introduction of this metal in forming part or all of the pattern. The leather, as laid on the book, is not in a fit state for receiving the gold without some modification of surface. It first receives a coating of parchment-size; then two or three coatings of white of egg, whereby a slight glossiness is produced; and just before the gold is to be laid on, the surface is slightly moistened with oil. The gold, cut up into small pieces to suit the kind of ornament, is laid on the book with a flat camel-hair brush; and the stamp or die, previously heated in the fire, is impressed on the gold, whereby two effects are produced at once—the production of the device, and the fixing of the gold to the leather. A piece of soft rag, lightly passed over the book, removes the small superfluous fragments of gold, and leaves the gilt device clearly marked.

But the decoration of volumes bound in cloth, although occupying a far lower level in respect to manual dexterity than the more costly binding in leather, has occupied much attention within the last few years, and has been one of the means for diffusing neat and even elegant volumes at a marvellously low price. Cloth-binding, in fact, has been the germ of one great advance in the art—the application of machinery to much that had previously been effected by manual labour.

The cloth with which books are covered is generally cotton of a particular kind, woven for the purpose. When the system of cloth binding came up, about twenty years ago, the cloth was used in the unaltered state, with the warp and weft threads visibly crossing each other at right angles. But now the cloth is more generally so altered by an artificial embossment of surface, as to leave the threads barely visible, and to give to it a close resemblance to leather. We may instance a work published by the publishers of the present volume, viz., the 'Pictorial Museum of Animated Nature,' of which the red cloth covers have had imparted to them, by embossing, a remarkably close resemblance to the appearance of leather; a resemblance which, though now becoming very common, would have deceived many an eye a few years ago. This embossing is produced by drawing the cloth, while yet uncut for the purposes of binding, between two steel rollers, of which the surfaces are engraved with the required device, and which have a row of gas-jets through their hollow centre, so as to keep up a constant temperature. There must be as many pairs of rollers as there are different devices for embossing cloth; so that the number in large factories is very considerable. Some of the rollers are intended for the production of a uniform device over the whole surface of the cloth; while others have particular devices for each particular book, and are consequently planned with especial reference to the size of the volume. The rapidity with which books can be now bound in this way, is one great cause of the surprising cheapness at which they are often sold. Five or six years ago, Dr. Ure said that 'should Messrs. Westleys (one of the largest establishments in this line) receive five thousand volumes, on any given occasion, they can have them all ready for publication within the incredibly short period of two days;' and this has been more than borne out by what has since been done.

Other kinds of cloth-covers, especially those which are much decorated with gold, are stamped with the device *after* being pasted on the covers, instead of before; they are, in fact, *cases*, each one quite ready to affix to the book in a speedy manner after being stamped. Great pressure is required in this process, for the mill-board is required to yield to the force, as well as the cloth itself. The case is placed down flat on an iron bed heated with gas from beneath; above is a press, to the lower end of which is attached the stamping-die or device, face downwards. Great mechanical power is then brought to bear on it, and the press descends with force sufficient to impart the pattern to the cover, gilt or not, according to the circumstances of the case.

India-rubber Binding.—The last few years have witnessed the introduction of a singular mode of binding, arising out of the use of a cement or glue of caoutchouc, instead of sewing, for fastening the sheets of books together. In this process, the sheets are not allowed to retain the folded form customary in other kinds of binding; but the edges are cut on *all four* sides—on the back as well as the front, top, and bottom; the consequence of which is, that all the leaves are separated one from another. The group of leaves to form one volume is placed in a kind of gauge, by which convexity is given to the back-edge and concavity to the front; and a cement of caoutchouc is carefully applied to the back-edge, whereby all the leaves become cemented together. The subsequent operations are much the same as in other binding. There is a certain kind of flexibility resulting from this method, advantageous when the volume is thick. This method was introduced by Mr. Hancock, and in reference to it Dr. Ure remarks:—'For engravings, atlasses, and ledgers, this binding is admirably adapted, because it allows the pages to be displayed most freely, without the risk of dislocating the volume; but for security, three or four stitches should be made. The leaves of music-books bound with caoutchouc, when turned over lie flat at their whole extent, as if in loose sheets, and do not torment the musician like the leaves of the ordinary books, which are so ready to spring back again. Manuscripts and collections of letters which happen to have little or no margin left at the back for stitching them by, may be bound by Mr. Hancock's plan without the least encroachment upon the writing. The thickest ledgers thus bound open as easily as paper in quire, and may be written up to the innermost margin of the book without the least inconvenience.'

A method was patented six or seven years ago, of 'Cement-binding.' This consists in cementing the leaves or sheets together at the back, with a composition of isinglass, oil, sugar, and other ingredients; and in covering the cemented edges with a strip of calico similarly cemented. What advantages (if any) this possesses over the caoutchouc binding, does not appear: its principle is evidently the same.

BOOK TRADE. The substance of this notice is condensed, with slight alterations here and there, from a 'Postscript' to 'William Caxton: a Biography,' by Mr. Charles Knight, which gives a history of the 'Progress of the Press in England.' The subject may be divided into five periods:—

I. From the introduction of printing by Caxton to the accession of James I., 1603.
II. From 1603 to the Revolution, 1688.
III. From 1688 to the accession of George III., 1760.
IV. From 1760 to 1800.
V. From 1800 to 1843.

I. One of the earliest objects of the first printers was to preserve from further destruction the scattered manuscripts of the antient poets, orators, and historians. But after the first half-century of printing men of letters anxiously demanded copies of the antient classics. The Manutiuses and Stephenses and Plantins produced neat and compactly printed octavos and duodecimos, in addition to the larger books, instead of only producing the expensive folios of their predecessors. The instant that they did this, the foundations of literature were widened and deepened. They probably at first overrated the demand; indeed, we know they did so, and they suffered in consequence; but a new demand very soon followed upon the first demand for cheap copies of the antient classics. The first English Bible was bought up and burnt; those who bought the Bibles contributed capital for making new Bibles, and those who burnt the Bibles by so doing advertised them. The first printers of the Bible were however cautious—they did not see the number of readers upon which they were to rely for a sale. In 1540 Grafton printed only 500 copies of his complete edition of the Scriptures: and yet, so great was the rush to this new supply of the most important knowledge, that we have existing 326 editions of the English Bible, or parts of the Bible, printed between 1526 and 1600.

The early English printers did not attempt what the continental printers were doing for the antient classics. Down to 1540 no Greek book had appeared from an English press. Oxford had only printed a part of Cicero's Epistles; Cambridge, no antient writer whatever: only three or four old Roman writers had been reprinted, at that date, throughout England. The English nobility were, probably for more than the first half-century of English printing, the great encouragers of our press: they required translations and abridgements of the classics—versions of French and Italian romances, old chronicles, and helps to devout exercises. Caxton and his successors abundantly supplied these wants, and the impulse to most of their exertions was given by the growing demand for literary amusement on the part of the great. But the priests strove with the laity for the education of the people; and not only in Protestant but in Catholic countries, were school and universities everywhere founded. Here again was a new source of employment for the press—A, B, C's, or Absies, Primers, Catechisms, Grammars, Dictionaries, were multiplied in every direction. Books became also during this period the tools of professional men. There were not many works of medicine, but a great many of law. The people too required instruction in the laws which they were required to obey; and thus the Statutes, mostly written in French, were translated and abridged by Rastell, an eminent law-printer. Even as early as the time of Caxton the press was employed to promulgate new laws.

Taken altogether, the activity of the press of England, during the first period of our inquiry, was very remarkable. To William Caxton, our first printer, are assigned 64 works.

Wynkyn de Worde, the able assistant and friend of Caxton, produced the large number of 408 books from 1493 to 1535, that is, upon an average, he printed 10 books in each year. To Richard Pynson, supposed to have been an assistant of Caxton, 212 works are assigned, between 1493 and 1531.

From the time of Caxton's press to that of Thomas Hacket, with whose name Dr. Dibdin's work concludes, we have the enumeration of 2926 books. The 'Typographical Antiquities' of Ames and Herbert comes down to a later period. They recorded the names of three hundred and fifty printers in England and Scotland, or of foreign printers engaged in producing books for England, who were working between 1474 and 1600. The same authors have recorded the titles (we have counted with sufficient accuracy to make the assertion) of nearly 10,000 distinct works printed among us during the same period. Many of these works however were only single sheets; but, on the other hand, there are doubtless many not here registered. Dividing the total number of books printed during these 130 years, we find that the average number of distinct works produced each year was 75.

Long after the invention of printing and its introduction into England, books were dear In the 'Privy Purse Accounts of Elizabeth of York,' published by Sir H. Nicolas, we find that, in 1505, twenty pence were given for a 'Primer' and a 'Psalter.' In 1505 twenty pence would have bought half a load of barley, and were equal to six days' work of a labourer. In 1516 'Fitzherbert's Abridgement,' a large folio law-book, the first published, was sold for forty shillings. At that time forty shillings would have bought three fat oxen. Books gradually became cheaper as the printers ventured to rely upon a larger number of purchasers. The exclusive privileges that were given to individuals for printing all sorts of books, during the reigns of Henry VIII., Mary, and Elizabeth—although they were in accordance with the spirit of monopoly which characterized that age, and were often granted to prevent the spread of books—offer a proof that the market was not large enough to enable the producers to incur the risk of competition. One with another, 200 copies may be estimated to have been printed of each book during the period we have been noticing; we think that proportion would have been quite adequate to the supply of the limited number of readers—to many of whom the power of reading was a novelty unsanctioned by the practice of their forefathers.

II. The second period of the English press, from the accession of James I. to the Revolution, was distinguished by pedantry at one time, to which succeeded the violence of religious and political controversy; and then came the profligate literature of the Restoration. The press was exceedingly active during the politico-religious contest. There is, in the British Museum, a collection of 2000 volumes of Tracts issued between the year 1640 and 1660, the whole number of which several publications amounts to the enormous quantity of 30,000. The number of impressions of new books unconnected with controversial subjects must have been very small during this period.

After the Restoration an act of parliament was passed that only twenty printers should practise their art in the kingdom. We see by a petition to parliament in 1666, that there were only 140 'working printers' in London. They were quite enough to produce the kind of literature which the court required.

At the fire of London, in 1666, the booksellers dwelling about St. Paul's lost an immense stock of books in quires, amounting, according to Evelyn, to the value of 200,000*l.*, which they were accustomed to stow in the vaults of the metropolitan cathedral, and of other neighbouring churches. At that time the people were beginning to read again, and to think;—and as new capital rushed in to replace the consumed stock of books, there was once more considerable activity in printing. The laws that regulated the number of printers soon after fell into disuse, as they had long fallen into contempt. We have before us a catalogue (the first compiled in this country) of 'all the books printed in England since the dreadful fire, 1666, to the end of Trinity Term, 1680,' which catalogue is continued to 1685, year by year. A great many—we may fairly say one-half—of these books, are single sermons and tracts. The whole number of books printed during the fourteen years from 1666 to 1680, we ascertain, by counting, was 3550, of which 947 were divinity, 420 law, and 153 physic,—so that two-fifths of the whole were professional books; 397 were school-books, and 253 on subjects of geography and navigation, including maps. Taking the average of these fourteen years, the total number of works produced yearly was 253; but deducting the reprints, pamphlets, single sermons, and maps, we may fairly assume that the yearly average of new books was much under 100. Of the number of copies constituting an edition we have no record; probably it must have been small, for the price of a book, as far as we can ascertain it, was considerable. In a catalogue, with prices, printed twenty-two years after the one we have just noticed, we find that the ordinary cost of an octavo was *five shillings*.

III. We have arrived at the third stage of this rapid sketch: from the Revolution to the accession of George III.

This period will ever be memorable in our history for the creation, in great part, of periodical literature. Till newspapers, and magazines, and reviews, and cyclopædias, were established, the people, even the middle classes, could not fairly be said to have possessed themselves of the keys of knowledge.

The publication of *intelligence* began during the wars of Charles I. and his Parliament. But the 'Mercuries' of those days were little more than occasional pamphlets. Burton speaks of a 'Pamphlet of News.' Before the Revolution there were several London papers, regulated however by privileges and surveyors of the press. Soon after the beginning of the eighteenth century (1709) London had one daily paper, fifteen three times a week, and one twice a week: this was before a stamp-duty was imposed on papers. After the stamp-duty in 1724 there were three daily papers, six weekly, and ten three times a week. Provincial newspapers had already been established in several places. In 1731, Cave, at his own risk, produced the first Magazine printed in England—the 'Gentleman's.' Its success was so great, that in the following year the booksellers, who could not understand Cave's project till they knew its value by experiment, set up a rival magazine, 'The London.' In 1749 the first Review, 'The Monthly,' was started; and in a few years was followed by 'The Critical.'

The periodical literature of this period greatly reduced the number of merely temporary books; and it had thus the advantage of imparting to our literature a more solid character. Making a proportionate deduction for the pamphlets inserted in the catalogues already referred to, it still appears that the great influx of periodical literature, although constituting a most important branch of literary commerce, had in some degree the effect of narrowing the publication of new books; and perhaps wholesomely so. It appears from a 'Complete Catalogue of Modern Books published from the beginning of the century to 1756,' from which 'all pamphlets and other tracts' are excluded, that in these fifty-seven years 5280 new works appeared, which exhibits only an average of ninety-three new works each year. It seems probable that the numbers of an edition printed had been increased; for, however strange it may appear, the general prices of the works in this catalogue are as low, if not lower than in a priced catalogue which we also have of books printed in the years 1702 and 1703. A quarto published in the first half of the last century seems to have averaged from 10*s.* to 12*s.* per volume; an octavo, from 5*s.* to 6*s.*; and a duodecimo from 2*s.* 6*d.* to 3*s.* In the earlier catalogue we have mentioned, pretty much the same prices exist: and yet an excise had been laid upon paper; and the prices of authorship, even for the humblest labours, were raised. We can only account for this upon the principle, that the publishers of the first half of the eighteenth century knew their trade, and, printing larger numbers, adapted their prices to the extension of the market. They also in many cases lessened their risk by publishing by subscription—a practice now almost gone out of use from the change of fashion, but possessing great advantages for the production of costly books. This was in many respects the golden age for publishers, when large and certain fortunes were made. Perhaps much of this proceeded from the publishers aiming less to produce novelty than excellence—selling *large impressions of few books*, and not distracting the public with their noisy competition in the manufacture of new wares for the market of the hour. Publishers thus grew into higher influence in society. They had long ceased to carry their books to Bristol or Stourbridge fairs, or to hawk them about the country in auctions. The trade of books had gone into regular commercial channels.

IV. The period from the accession of George III. to the close of the eighteenth century is marked by the rapid increase of the demand for popular literature, rather than by any prominent features of originality in literary production. Periodical literature spread on every side; newspapers, magazines, reviews, were multiplied; and the old system of selling books by hawkers was extended to the rural districts and small provincial towns. Of the *number-books* thus produced, the quality was indifferent, with a few exceptions; and the cost of these works was considerable. The principle however was then first developed, of extending the market by coming into it at regular intervals with fractions of a book, so that the humblest customer might lay by each week in a savings-bank of knowledge. This was an important step, which has produced great effects, but which is even now capable of a much more universal application than it has ever yet received. Smollett's 'History of England' was one of the most successful number-books; it sold to the extent of 20,000 copies.

The rapid growth of the publication of *new* books is best shown by examining the catalogues of the latter part of the eighteenth century, passing over the earlier years of the reign of George III. In the 'Modern Catalogue of Books,' from 1792 to the end of 1802, eleven years, we find that 4096 *new* works were published, exclusive of reprints not altered in price, and also exclusive of pamphlets: deducting one-fifth for reprints, we have an average of 372 new books per year. This is a prodigious stride beyond the average of 93 per year of the previous period. From some cause or other, the selling-price of books had increased, in most cases 50 per cent., in others 100 per cent. The 2*s.* 6*d.* duodecimo had become 4*s.*; the 6*s.* octavo, 10*s.* 6*d.*; and the 12*s.* quarto, 1*l.* 1*s.* It would appear from this that the exclusive market was principally sought for new books; that the publishers of novelties did not rely upon the increasing number of readers; and that the periodical works constituted the principal supply of the many. The aggregate increase of the commerce in books must however have become enormous, when compared with the previous fifty years.

V. Of the last period—the most remarkable for the great extension of the commerce in books—we shall present the accounts of the first 27 years collectively, and of the last 16 years in detail.

The number of new publications issued from 1800 to 1827, including reprints altered in size and price, but excluding pamphlets, was, according to the London Catalogue, 19,860. Deducting one-fifth for the reprints, we have 15,888 new books in 27 years; showing an average of 588 new books per year, being an increase of 216 per year over the last 11 years of the previous century. Books however were still rising in price. The 4*s.* duodecimo of the former period became 6*s.*, or was converted into a small octavo at 10*s.* 6*d.*; the 10*s.* 6*d.* octavo became 12*s.* or 14*s.*, and the guinea quarto very commonly two guineas. The demand for new books, even at the very high cost of those days, was principally maintained by Reading Societies and Circulating Libraries. When these new modes of diffusing knowledge were first established, it was predicted that they would destroy the trade of publishing. But the Reading Societies and the Circulating Libraries, by enabling many to read new books at a small expense, created a much larger market than the desires of individual purchasers for ephemeral works could have formed; and a very large class of books was expressly produced for this market.

But a much larger class of book-buyers had sprung up, principally out of the middle ranks. For these a new species of literature had to be produced—that of books conveying sterling information in a popular form, and published at a very cheap rate. In the year 1827 'Constable's Miscellany' led the way in this novel attempt; in the same year the Society for the Diffusion of Useful Knowledge, which had been formed in November, 1826, commenced its operations; and several publishers of eminence soon directed their capital into the same channels. Subsequently editions of our great writers have been multiplied at very reasonable prices; and many a tradesman's and mechanic's house now contains a well-selected stock of books, which, through an annual expenditure of 2*l.* or 3*l.*, has brought the means of intellectual improvement, and all the tranquil enjoyment that attends the practice of family reading, home to a man's own fireside.

The increasing desire for knowledge among the masses of the people was however not yet supplied. In 1832 the 'Penny Magazine' of the Society for the Diffusion of Useful Knowledge and 'Chambers's Journal' commenced to be published; and subsequently the 'Saturday Magazine.' The 'Penny Sheet' of the reign of Queen Anne was revived in the reign of William IV., with a much wider range of usefulness. It was said by some that the trade in books would be destroyed. They asserted also that the rewards of authorship would be destroyed, necessarily, at the same time. The 'Penny Cyclopædia' of the Society for the Diffusion of Useful Knowledge was deemed the most daring attempt at this double destruction. That work has returned about 150,000*l.* to the commerce of literature, and 40,000*l.* have been distributed amongst the authors and artists engaged in its production, of which sum more than three-fourths have been laboriously earned by the diligence of the writers.

There is a mode however of testing whether cheap literature has destroyed the publication of *new books*, without including reprints and pamphlets. We take the four years from 1829 to 1832, as computed by ourselves, from the London Catalogues; and the four years from 1839 to 1842, as computed by Mr. M'Culloch in the last edition of his 'Commercial Dictionary:'—

NEW WORKS, 1829 to 1832.

Years.	Vols.	Value of a single Copy at Publication price.		
1829	1413	£879	1*s.*	0*d.*
1830	1592	873	5	3
1831	1619	939	9	3
1832	1525	807	19	6

NEW WORKS, 1839 to 1842.

1839	2302	£966 11*s.* 2*d.*
1840	2091	943 3 5
1841	2011	902 5 9
1842	2193	968 2 6

the four years ending 1832 were published, of new books, 6149 volumes; in the four years ending 1842 were published 8597 volumes. The cost of a single copy of the 6149 volumes was 3499*l.*; of the 8597 volumes, 3780*l.* The average price per volume in the first period was 11*s.* 5*d.*; in the second period, 8*s.* 9½*d.*

Mr. M'Culloch has also given the following table of reprints, from 1839 to 1842:—

REPRINTS AND NEW EDITIONS.

No. of Vols.	Value at Publication price.
773	£296 7*s.* 8*d.*
821	327 16 10
741	314 12 7
684	295 9 6

Mr. M'Culloch adds: 'From inquiries we have made with much care and labour, we find that, at an average of the four years ending with 1842, 2149 volumes of new works, and 755 volumes of new editions and reprints (exclusive of pamphlets and periodical publications), were annually published in Great Britain; and we have further ascertained that the publication price of the former was 8*s.* 9½*d.*, and of the latter 8*s.* 2*d.* a volume. Hence, if we suppose the average impression of each work to have been 750 copies, it will be seen that the total value of the new works annually produced, if they were sold at the publication price, would be 708,498*l.* 8*s.* 9*d.*, and that of the new editions and reprints, 231,218*l.* 15*s.* We believe however that if we estimate the price at which the entire impressions of both descriptions of works actually sell at 4*s.* a volume, we shall not be far from the mark; and if so, the real value of the books annually produced will be 435,600*l.* a-year.'

But the most remarkable characteristic of the press of this country is its *periodical* literature. It might be asserted, without exaggeration, that the periodical works issued in Great Britain during one year comprise more sheets than all the books printed in Europe from the period of Gutenberg to the year 1500.

The number of *weekly periodical works* (not newspapers) issued in London on Saturday, May 4, 1844, was about sixty. Of these the weekly sale of the more important amounts to little less than 300,000 copies, or about fifteen millions annually. The greater number of these are devoted to the supply of persons who have only a very small sum to expend weekly upon their home reading.

Of the weekly publications, independent of the sale of many of them in monthly parts, we may fairly estimate that the annual returns are little short of 100,000*l.*

The *monthly* issue of periodical literature from London is unequalled by any similar commercial operation in Europe. 227 monthly periodical works were sent out on the last day of May, 1844, to every corner of the United Kingdom, from Paternoster Row. There are also 38 periodical works published quarterly: making a total of 265.

A bookseller, who has been many years conversant with the industry of the great literary hive of London on Magazine-day, has favoured us with the following computations, which we have every reason to believe perfectly accurate:—

The periodical works sold on the last day of the month amount to 500,000 copies.

The amount of cash expended in the purchase of these 500,000 copies is 25,000*l.*

The parcels dispatched into the country, of which very few remain over the day, are 2000.

The annual returns of periodical works, according to our estimate, amount to 300,000*l.* Mr. M'Culloch estimates them at 264,000*l.*

The number of newspapers published in the United Kingdom, in the year 1843, the returns of which can be obtained with the greatest accuracy through the Stamp Office, was 447. The stamps consumed by them in that year were 60,592,001. Their proportions are as follows:—

1843.

79	London newspapers	31,692,092
212	English provincial	17,058,056
8	Welsh	339,500
69	Scotch	5,027,589
79	Irish	6,474,764
		60,592,001

The average price of these papers is, as near as may be, 5*d.*; so that the sum annually expended in newspapers is about 1,250,000*l.* The quantity of paper required for the annual supply of these newspapers is 121,184 reams, some of which paper is of an enormous size. In a petition to the pope in 1471, from Sweynheim and Pannartz, printers at Rome, they bitterly complain of the want of demand for their books, their stock amounting to 12,000 volumes; and they say, 'You will admire how and where we could procure a sufficient quantity of paper, or even rags, for such a number of volumes.' About 1200 reams of paper would have produced all the poor printers' stock. Such are the changes of four centuries.

We recapitulate these estimated annual returns of the commerce of the press:—

New books and reprints	£435,600
Weekly publications, not newspapers	100,000
Monthly publications	300,000
Newspapers	1,250,000
	£2,085,600

The literary returns of the United Kingdom, in 1743, were unquestionably little more than 100,000*l.* per annum. What has multiplied them twenty-fold? Is it the contraction or the widening of the market—the exclusion or the diffusion of knowledge? The whole course of our literature has been that of a gradual and certain spread from the few to the many—from a luxury to a necessary—as much so as the spread of the cotton or the silk trade. Henry VIII. paid 12*s.* a yard for a silk gown for Anne Boleyn—a sum equal to five guineas a yard of our day. Upon whom do the silk-mercers now rely—upon the few Anne Boleyns, or the thousands who can buy a silk gown at half-a-crown a yard? The printing-machine has done for the commerce of literature what the mule and the Jacquard-loom have done for the commerce of silk. It has made literature accessible to all.

(For an account of the 'Book Trade of Germany,' see *Journal of London Statistical Society*, vol. iii.; and the same work, vol. vi., for a notice of the 'Book Trade in England.' As to newspapers, see NEWSPAPERS, P. C.)

BORA'GO, a genus of plants, the type of the natural order Boragineæ, and placed in the tribe Anchuseæ. This tribe is distinguished by possessing four nuts affixed to an hypogynous disk, with an excavated space surrounded by a tumid ring at their base. The genus Borago has a calyx with five deep segments; a rotate corolla with the tube very short, the throat with short, erect, emarginate scales; exserted stamens, the filaments bifid, the inner fork bearing the anther, the anthers linear, lanceolate, connivent in the form of a cone. All the species are rough plants, with fusiform roots, oblong or lanceolate leaves, and blue, panicled, drooping flowers.

B. officinalis, Common Borage, has the lower leaves obovate, obtuse, attenuated below; the segments of the corolla ovate, acute, flat, spreading. The flowers are blue, and the whole plant is hispid with tubercled hairs. This plant appears to be originally a native of Aleppo, but is now naturalised in most countries of Europe. In Great Britain it is not uncommon on rubbish and in waste places. Borage had formerly a great reputation as a cordial. Its virtues in this respect must have been overrated, as, in common with the whole family to which it belongs, it possesses no very active properties. The tissues contain gum, and on this account it may be used as a demulcent. It also possesses nitrate of potash, as well as other plants of the order, which renders it slightly febrifuge. Withering says the young tender leaves may be used as salads or as a potherb. G. Don has described three other species: *B. crassifolia*, a native of Persia; *B longifolia*, from Numidia; and *B. laxiflora*, a native of Corsica. They are all plants of the easiest culture. They may be always propagated by seed, which should be sown in the open ground. They form pretty border-flowers.

(Babington, *Manual of British Botany*; G. Don, *Gardener's Dictionary*.)

BORDER WARRANT is a writ issued by the sheriffs of the Scottish border counties, to apprehend a person domiciled in England who has incurred debt in Scotland, if he should happen to be in the sheriffs' jurisdiction. It is given on oath being made to the debt, and to the party's domicile. The principle of arrest in mesne process was never sanctioned in Scotland, farther than to the extent of apprehending debtors about to escape from the country until they should pay their debt or find security for it, and the border warrants are apart of the system.

BORDO'NE, PARIS (Cavaliere), one of the most distinguished painters of the Venetian school, especially in portrait, was born of a noble family at Treviso in 1566. He was for a short time the pupil of Titian in Venice, but they disagreed and separated, and Bordone chose afterwards Giorgione as his model, in preference to Titian, but he eventually adopted a style of his own, which however did not differ in anything material from the styles of these two great Venetian masters. Bordone's works are eminently distinguished for all the beauties of the Venetian school, and are not at all deficient in drawing or invention. One of his best works is the Martyrdom of St. Andrew, in the church of San Giobbe at Venice. Vasari mentions the picture formerly in the Scuola di San Marco, now in the Academy, of the Fisherman presenting the Ring he had received from that Saint to the Doge, as his masterpiece; but though the colouring is rich and the general execution good, the composition is bad, the point of sight, or horizontal line, is placed so high that the spectator has a kind of bird's-eye view of the scene; the figures are small; the background is rich architecture, but the perspective is incorrect. It was taken to Paris by the French during the war, but was restored to Venice in 1815. His picture of Paradise, formerly in the church of Ogni Santi at Treviso, is now also in the Venetian Academy. There is in the Dresden gallery a beautiful Holy Family by Bordone, and a picture of Apollo with a Lyre, and Marsyas and Midas in the background. Bordone spent some time in the service of Francis I. in France: he died in Venice, in 1570, according to the best authorities, but various dates are given both for his birth and death.

(Zanetti, *Della Pittura Veneziana*; Ridolfi, *Le Maraviglie dell' Arte*, &c.)

BORING INSTRUMENTS. The boring instruments commonly used by the carpenter consist of awls, or brad-awls, gimlets, augers, and bits of various kinds. The first-mentioned, which are only used for very small holes, and generally in soft wood, are solid cylindrical tools ground to a straight chisel-shaped edge, and mounted in round handles, by which they are pressed into the wood with an alternating semi-rotatory motion, taking care, in commencing the hole, to apply the chisel-shaped end at right angles to the grain, so as to cut the fibres, instead of simply entering between them by pressure. *Gimlets* are cylindrical tools hollowed out on one side, and terminating in a short conical screw with a sharp worm tapering off to a point. These, to afford more power, are mounted in transverse handles. Being pressed into the wood with a rotatory motion from left to right, the conical screw, directed by its tapering point, cuts its way into the wood, while the sharp edge of the semi-cylindrical cavity or hollow in the side of the gimlet detaches and clears away all the cuttings produced by the action of the screw. The borings enter the cavity in the side of the gimlet, and either work their way out of the hole as it proceeds or are withdrawn with it. Gimlets are made of various sizes, but are seldom used for boring holes exceeding a quarter of an inch, or from that to three-eighths, in diameter. *Augers* bear a general resemblance to gimlets, but are so large that their transverse handles are worked by two hands, while gimlets are used with one hand only. Sometimes the cutting parts are made very similar to those of a gimlet, but in other cases there is no screw, the end of the instrument being formed more like a centre-bit. In other cases, again, the semi-cylindrical hollow or cavity which receives the borings, and by the sharp edge of which the sides of the hole are trimmed, is made to wind somewhat spirally round the axis of the instrument, which then gradually tapers into a conical screw. Both augers and gimlets are made smaller at the upper part, near the handle, than near the end, where the edge of the shell-like cavity acts as a cutter, by which arrangement they may be readily turned even in very deep holes. *Bits* are boring instruments made to fit into a large crank-shaped handle termed a brace, by which they may be applied with greater power and precision than gimlets or augers, and are therefore preferred for large holes, for all cases in which accuracy is necessary, and for boring hard woods. They are made in sets, and are readily fixed in or detached from the brace by means of a spring. The principal kinds, as enumerated in Nicholson's *Architectural Dictionary* (article 'Bit'), are *shell-bits*, which resemble such augers as have no screw at the end, but simply an interior cylindrical concavity, with a cutting edge. *Centre-bits*, which, as their name imports, turn upon a centre or projecting point in the middle of their breadth as upon an axis: they are of a flat or chisel-like shape, and have a vertical cutting edge projecting from the extremity at one side, so as to cut the wood across the grain round the circumference of the hole, while on the opposite side of the axis or centre is a radial cutter projecting obliquely, but almost horizontally, from the face of the bit, which, as the instrument is turned round, ploughs away, in the form of a spiral shaving, the cylindrical core left by the action of the vertical cutter. Such an instrument may be compared to a revolving plough, the vertical cutter representing the coulter, and the radial cutter the ploughshare; and, as it cuts clean away the whole of the wood, it is well adapted for boring large holes with but little risk of splitting. *Taper shell-bits* are used to enlarge holes in wood; and *rimers* are pyramidal bits, with a vertical angle of about 3½°, the cross section of which is either polygonal or semicircular, used in like way for enlarging holes in brass or iron: their action is that of scraping rather than boring; and those of a polygonal shape are intended especially for iron. Instruments of the same kind, mounted for use in the hand instead of a brace, are called *broaches*. *Countersinks* are pyramidal bits with a vertical angle of about 90°, used for widening the upper part of screw-holes, so as to allow the heads of screws to be countersunk into them. Those for iron have generally but two cutting or rather scraping edges; but those for wood and the softer metals have a greater number, ranging up to twelve, formed on the conical surface of the bit. A screw-driver is frequently added to a set of boring-bits, and used, like them, in the brace.

Small holes in metal are usually bored with *drills* or boring-bits formed with scraping rather than cutting edges. These frequently resemble the countersinks used for iron, but are sometimes made more in the shape of a centre-bit. They are occasionally used in a brace, and where the pressure required is greater than can be given by the common brace, which is placed against the chest of the workman, an apparatus termed a press-drill is used, in which the brace is pressed to its work by a weighted lever. Some drills are used in a kind of stock which receives an alternating rotatory motion from a bow worked by hand, the tight string of which is passed round a pulley fixed upon the stock, and rubbed with resin to prevent the slipping of the string. Another simple and effective mode of working a drill is by fixing it in the lower extremity of a vertical spindle or stock, which is loaded near its lower extremity with a heavy circular mass of metal to give it an impetus. A strong cord is passed through a hole in the upper extremity of the spindle, and is attached to the opposite ends of a transverse piece of wood which, by means of a hole in the centre, is slipped upon the spindle, and is capable of moving up and down freely upon it. Before using the drill the transverse piece of wood must be turned round two or three times, so as to wind the cord spirally round the upper part of the spindle. The drill being then applied to the required place, and the spindle placed in a vertical position, the transverse bar is pressed smartly downwards by the hand. By this action the cord is untwisted, and the spindle is made to revolve with such rapidity that it gains an impetus sufficient to wind the cord round it in the opposite direction, and thereby to lift up the transverse bar, the pressure on which is relaxed for the moment. A fresh application of pressure again unwinds the cord, and occasions the spindle to revolve in the opposite direction, and by a repetition of the like operation the spindle is kept in very rapid motion, though revolving alternately in opposite directions. This ingenious *torsion drill-stock* is derived from the native smiths of Ceylon.

Common drills are frequently used, especially for very delicate purposes, in a lathe, and all the larger operations of metal boring, such as the boring of musket-barrels, cannon, and the cylinders of pumps and steam-engines, are performed by boring machinery on the principle of the lathe. The boring of guns is briefly alluded to under CANNON, P.C., p. 242. Musket-barrels are bored with a cylindrical plug of tempered steel about an inch and a half long, with its surface cut like a perpetual screw, with a flat thread about a quarter of an inch wide, with a very slight obliquity. The edges of this thread are sharp, and render it a very efficient boring implement, which, it must be remembered, has not to make a hole, but simply to remove inequalities from the inner surface of a cylinder formed by welding. In the early manufacture of steam-engines and similar machinery the difficulty of procuring accurate cylinders formed a great obstacle to improvement. The old method of boring cylinders and pump-barrels resembled the plan adopted for boring wooden water-pipes, which was to place the pipe in a carriage made to move forward as nearly as possible in the direction of its axis, against a revolving borer consisting of several cutters fixed in a solid wheel; but, notwithstanding the improvements introduced at the Carron foundry, by which the process was greatly improved, the plan was found essentially defective, as unavoidable irregularities in the casting affected the subsequent boring and polishing. This defect was obviated by the invention, by Mr. John Wilkinson, of Bersham, of a plan by which the borer was made to advance into the cylinder along an inflexible rod, so that the accuracy of the boring was made dependent upon the truth of the guide-rod, and totally independent of the accuracy of the casting. This invention formed a most important auxiliary to the success of Watt's improvements on the steam-engine, and it has been followed up by the introduction of machinery capable of performing the most stupendous operations of boring and turning in metal with mathematical accuracy. In addition to the mode above alluded to of boring wooden pipes, such, as well as stone pipes, have been made by cutting out the core with a cylindrical saw; a plan introduced in 1810 by Mr. Murdock.

The boring of rocks for blasting is described in MINING, P. C., p. 241; and under ARTESIAN WELLS, P. C., p. 412, is a statement of the circumstances under which similar borings are made to a very great depth for the purpose of finding water. The operation of boring such wells is performed with a number of variously fashioned chisels or jumpers, augers, and similar instruments, attached to the lower end of an iron rod formed of many lengths which screw into one another. To the upper joint of this compound rod is attached a transverse handle worked by two men, by which the boring instrument may either be turned round where an auger is used, or raised and turned a little way between each stroke where, as in cutting through rock, the hole must be formed more by chipping than boring. In boring through soft strata a kind of cylindrical auger is used, which, when full of earth, must be drawn up and cleared; and a similar instrument is employed to remove the chippings produced by the action of the chisels employed to perforate rock. As the weight of the rods required in boring a hole of great depth would render them unmanageable by hand, a triangle of poles, supporting tackle for raising the boring-rod, is erected over the hole, and, to facilitate the cutting or chipping action required to penetrate rock, an elastic wooden pole fixed at one end only, by inserting it in a pile of heavy stones, is placed horizontally over the hole, and provided with a chain by which the boring-rod may be suspended from it. The vibration of this pole, when set in motion by manual force, gives the required up-and-down motion to the rod, while the turning of the transverse handle causes the chisel or jumper continually to vary its stroke. To facilitate the working of this apparatus, it is usual to commence the operation of boring by forming a circular excavation about six or eight feet deep, and five or six feet in diameter, at the bottom of which a floor of planks may be laid for the borers to walk round upon. They may thus pursue their labours without being inconvenienced by the spring pole and triangle or shears erected over the excavation. A minute account of the mode of operation, with cuts of the various implements employed for boring, and ingenious contrivances for extracting broken rods or borers, for raising sand and water which may be too fluid to come up in the auger, for putting down, raising up, or straightening the pipes used to line the boring, and for meeting all the contingencies liable to arise in the course of the work, is given in Dr. Ure's *Dictionary of Arts, Manufactures, and Mines*, under the title 'Artesian Wells.' An interesting illustration of the difficulties sometimes experienced in this operation is given in the 'Penny Magazine' for November 13, 1841, in an account of the Artesian well at Grenelle, a suburb of Paris, which is carried to the immense depth of 602 yards, or more than one-third of a mile. Though, under ordinary circumstances, the operation is carried on with facility, much time and labour are lost, owing to the necessity of withdrawing and unscrewing the rod every time that the boring tool becomes filled with earth; to obviate which inconvenience Hebert devised a kind of boring-instrument which might be readily slid up and down the rod, so that the charged auger alone would have to be raised, without disturbing a single joint of the rod. Of this, together with a few of the commoner boring-instruments, the inventor gives a description in his *Engineer's and Mechanic's Encyclopædia* (article 'Boring-machines'), vol. i. pp. 232-234. In the 'Transactions' of the Society of Arts, vol. xix. pp. 165-168, is a description of a hollow cylindrical auger for boring peat, for the purpose of draining boggy lands which, by cutting out and completely removing a column of peat about six inches in diameter, produces a sole which will maintain a free passage for water for a very considerable time.

BORNIA, a genus of fossil plants from the coal formation, including Bornia equisetiformis, which Lindley ranks in Asterophyllites (*Foss. Flora*, t. 124).

BOROUGH COURTS OF RECORD. [BOROUGHS OF ENGLAND AND WALES, P. C.]

BORRERA, a genus of plants belonging to the natural order of lichens, named by Acharius, in honour of William Borrer, F.L.S., who has very successfully cultivated Cryptogamic Botany, especially that of Great Britain. A genus of Cinchonaceous plants has also been named after Mr. Borrer. [BORRERIA, P. C. S.]

BORRERIA, a genus of plants named in honour of William Borrer, F.L.S., an eminent living botanist. It belongs to the natural order Cinchonaceæ, and has the following characters:—Calyx with an ovate tube, and a permanent limb which is parted into 2-4 teeth; corolla salver-shaped or funnel-shaped, 4-lobed; stamens 4, exserted or inclosed; stigma bifid or undivided; capsule crowned by the limb of the calyx, 2-celled, opening from the apex at the dissepiment when mature, but without any dissepiment; coccæ or nuts 1-seeded, opening by a longitudinal chink inside. The species, which are very numerous, are most of them herbs or undershrubs, and are nearly all natives of tropical America.

B. ferruginea, has an herbaceous, hard, erect, branched stem; tetragonal hairy branches; oblong, acute, obliquely 3-4-nerved leaves, scabrous above and pale beneath, and scabrous on the nerves from hairs; bristles of the stipules the length of the sheath; whorls of flowers globose, terminal, and axillary; capsule downy, crowned by the four subulate teeth of the calyx. This plant is a native of Brazil, in elevated pastures in the provinces of Minas Geraes and St. Paul. The plant is called *Poaya*, and *Poaya da Maya* at Cape Frio. This is one of the plants which yield a bastard ipecacuanha. The roots are of a brown colour, and when taken produce sickness and vomiting.

B. Poaya is glabrous, and has an herbaceous simple tetragonal stem; sessile oblong-elliptic acute leaves, obliquely 6-nerved on both sides of the midrib; the stipules cleft into many long bristles; whorls of flowers capitate, sessile, few, axillary, and a larger terminal one; lobes of calyx 4, lanceolate linear acute, longer than the ovarium; corolla smooth; anthers exserted. A native of Brazil in elevated pastures. It has blue flowers. The roots are white, and produce sickness when taken, and are consequently frequently substituted for ipecacuanha. The leaves when chewed have a sweet taste at first, and afterwards an acid one; a decoction of them is sometimes employed in the cure of colic. Upwards of eighty species of this genus have been described, of which only the above two appear to be used by man. They may be cultivated in this country in greenhouses. A light soil suits them best, and cuttings of the shrubby species readily strike root under a hand-glass in heat. The herbaceous species require the same treatment as other tender annuals.

(Don, *Gardeners' Dictionary*.)

BOS (Fossil). The numerous remains of Bovine quadrupeds dug up in the superficial deposits of Europe and America offer analogies to the urus and to the common ox. The skulls and bones of the gigantic urus priscus (fossil aurochs) have been found in freshwater deposits in Yorkshire, Worcestershire, Essex, &c. Bos primigenius has been found at Herne Bay, and at Clacton in Essex, in drift beds above the London clay, and in a fluviatile deposit at Melksham in Wilts, near Peterborough, and in many other localities. A smaller species, bos longifrons, occurs in Ireland, where it was first pointed out by Mr. R. Ball.

(Owen 'On Fossil Mammalia,' *Report of British Assoc.* for 1843.)

BOSTON, THOMAS, a Scottish divine, very popular with a large class of religious thinkers, was born in the village of Dunse, in Berwickshire, on the 7th of March, 1676. He received the rudiments of his education at his native place, and afterwards attended the University of Edinburgh. His relations were poor, and his education appears to have been conducted in the face of impediments from pecuniary difficulties. After acting for some time as a private teacher, he obtained a licence as a probationer on the 16th of June, 1697. His first efforts to obtain an ecclesiastical benefice, though thus subsequent to the establishment of the Presbyterian polity by the Revolution, appear to have been baffled by the objections entertained towards his anti-patronage and ultra-Presbyterian principles. He was ordained, on the 21st of September, 1699, minister of the parish of Simprin, near his native place. In 1707 he was 'translated,' as it is termed, to the extensive but thinly peopled pastoral parish of Ettrick. He was a member of the General Assembly of 1703. While this assembly was in the midst of discussions on matters not likely to be acceptable to the court, it was dissolved by the commissioner, and the moderator, who, according to the theoretical principles of that ecclesiastical body, is the conductor of its routine, sanctioned the act by concluding the proceedings. Boston and others strongly protested against this compromise of clerical independence. He was opposed to the oath of abjuration, and in general to all measures which created restrictions on the independent movements of the ecclesiastical body to which he belonged. He joined those who supported the doctrines of 'The Marrow of Modern Divinity,' in the controversy in the Scottish Church on that work. He died on the 20th of May, 1732. He was a very voluminous writer, and his works are eminently popular in Scotland, and among the Presbyterians of England. His well known 'Fourfold State,' which was first printed in 1720, had a curious literary fate. It had been so far reconstructed by a person whom he had engaged to correct the press, that the author, scarcely recognising his own work, repudiated the book till he issued a genuine edition. The title of this book in full is, 'Human Nature in its Fourfold State: of Primitive Integrity subsisting in the Parents of Mankind in Paradise; Entire Depravation subsisting in the Unregenerate; Begun Recovery subsisting in the Regenerate; and Consummate Happiness or Misery subsisting in all Mankind in the Future State.' In 1776 there was published 'Memoirs of the Life, Time, and Writings of Thomas Boston, divided into Twelve Periods, written by Himself and addressed to his Children;' a work containing quite as ample an account of this writer as the majority of readers will wish to possess.

BOTANY, FOSSIL. The progress now making in the examination of the structure of fossil plants by microscopists, is such as to induce a postponement of the results till a later period. [PLANTS, FOSSIL, P. C. S.]

BOTHRODE'NDRON. [ULODENDRON, P. C. S.]

BOTRY'CHIUM, a genus of ferns belonging to the suborder Osmundaceæ and the tribe Ophioglosseæ of that family. It has distinct thecæ disposed in a compound spike attached to a pinnate or bi-pinnate frond. There is only one species a native of Great Britain, the *B. Lunaria*, Common Moonwort. It has a solitary pinnate frond, with notched or crenate, lunate or fan-shaped pinnæ. This is not a very conspicuous fern, but has been observed in almost every part of Great Britain. It grows on dry open heaths, elevated pastures, and waste lands which are generally shunned by other species of ferns.

In former times the ferns had a great reputation in medicine, not so much on account of their obvious as their supposed virtues. The lunate-shape of the pinnæ of this fern gave it its name and was the origin of much of the superstitious veneration with which it was regarded. When used it was gathered by the light of the moon. Gerarde says 'It is singular to heal green and fresh wounds. It hath been used among the alchymists and witches to do wonders withall, who say that it will loose locks and make them to fall from the feet of horses that grase where it doth grow, and hath been called of them Martagon, whereas in truth they are all but drowsy dreams and illusions; but it is singular for wounds as aforesaid.' Its healing powers are now however as much disregarded as its magical ones.

B. Virginicum, the Rattlesnake Fern, is a native of North America, and is the largest of the species. It is called rattlesnake fern from the fact of its growing in places where this venomous reptile is usually found. The other species of Botrychium are mostly natives of North America.

(*Encyclopædia of Plants*; Newman, *History of British Ferns*.)

BOTTA, CARLO GIUSEPPE, born at S. Giorgio in Piedmont, in 1766, studied medicine in the University of Turin, and took a doctor's degree in 1786. He also manifested an early turn for literary and historical studies, in which he had for his master Carlo Tenivelli, a writer of some note in Piedmont. At the outbreak of the French revolution, Botta, like many more of his countrymen, trusted in the professions and promises of liberty and universal happiness which came from beyond the Alps. He committed himself so far in some revolutionary plot, that he was arrested and confined in the citadel of Turin for two years, after which, being liberated, he emigrated to France. After living some time at Grenoble he was appointed surgeon to the French army called 'of the Alps,' and stationed at Gap. In 1796, after the first success of Bonaparte, he followed the French through their campaigns in Lombardy, and in the following year was present in Venice at the fall of that antient republic, a catastrophe which he has related with lively grief and indignation in his history. From Venice he sailed with the expedition that went to take possession of Corfú and the other Venetian islands in the name of France. At Corfú he wrote a professional work on the military hospital of that garrison, with digressions on the climate and the natural history of the island. In 1798 Botta returned to Italy, and was employed in his professional capacity with a detachment of Cisalpine troops stationed in the Valtellina, where he wrote a disquisition, in the form of a letter, on the analytical nosography of Pinel. At the end of that year, when the French Directory resolved on driving away their subservient though forced ally the King of Sardinia from Piedmont, General Joubert, who executed the mandate, nominated Botta one of the members of the provisional government of Piedmont, a government which was driven away a few months after by the victorious Suvarow. Botta was then obliged to emigrate to France a second time, and he was appointed surgeon to the new army of the Alps. He returned to Italy after the battle of Marengo, June, 1800, and was appointed member of the Consulta, or council of administration for Piedmont. The country was in a deplorable state, after being drained by so many revolutions and invasions; the French acted as imperious taskmasters, and the council had few means of doing good. In the 20th book of his history Botta describes at length the calamities of the times. One benefit however he and his colleagues managed to confer upon their native country, and this was, to secure out of the public domain an annual permanent income of half a million of francs, for the support of the University, Colleges, and Academy of Sciences of Turin. The benefit remained and survived all subsequent political vicissitudes.

When Napoleon resolved, in 1803, to unite, definitively, Piedmont to France, Botta was one of the deputation sent to Paris on the occasion. He then published a 'Précis Historique de la Maison de Savoie et du Piémont.' In 1804 he was elected deputy to the French legislative body, for the department of the Dora, and in consequence removed to Paris. He retained his seat in the legislative body, having been re-elected for the department of the Loire, till the fall of Napoleon. The office of legislator, as is well known, was a complete sinecure in France under Napoleon's empire, and Botta availed himself of his ample leisure in preparing for the press his history of the North American revolution and war of independence, which he had begun during his first French emigration, and which he published at Paris in 1810: 'Storia della Guerra dell' Indipendenza d'America.' The author lost by the publication, but a few years after his translator gained about five thousand crowns by the French edition of the work.

In April, 1814, Botta, with the other members of the legislative body, swore allegiance to the Bourbon dynasty. At the end of March, 1815, Napoleon's restored government appointed him Rector of the University of Nancy, which seems to show that he had turned round again with the crowd. He resigned his rectorship at the second Bourbon restoration, but was appointed instead Rector of the University of Rouen, an office which he did not retain long, for in 1816 he was living at Paris as a foreigner without employment or pension. He then applied himself to write a contemporary history of Italy during the French occupation, an arduous task amidst the growling of angry passions which had not yet had time to subside. He determined to write 'the whole truth,' as far as his means of information went; to speak with honest sincerity, not only of princes and ministers, but also of the people; to flatter no party; to calumniate no enemy;—a novel course after emerging from the inquisitorial system of Napoleon, when subserviency alone was praised, and resistance and independence were vituperated and hunted down. Botta communicated his intention to some friends, who told him that 'he either dared not or could not abide by his determination, and that even supposing that he dared and could, he ought not to do it.' Luckily he persisted, and disregarding the prejudices of men of all parties, absolutists and liberals, patriots and Bonapartists, freethinkers and ultramontanists, he produced a book which went far to redeem Italian literature from the charge of almost Oriental servility which it had incurred during the period of Napoleon's reign. Alone perhaps among the nations of Europe, the Italians, or rather, a numerous and active class among them, had, or thought they had, reason to regret the fall of that reign, when they found themselves placed in a false position; their wishes and national aspirations being opposed to those of the other European nations who had risen against the despotism of the conqueror. Italy had enjoyed fifteen years of comparative tranquillity; it had trusted Napoleon's vague promises of an eventual national union of the whole peninsula, which however appears to have been far removed from his thoughts; and it had meantime obtained considerable internal improvements in its municipal and local institutions. No wonder that the bold, the strong, the aspiring, among the Italians, should regret Napoleon and confound his cause, as many of the French have done and are still doing, with that of social progress and freedom. Botta displeased many of these by his plain speaking, nor did he care to conciliate the advocates of old absolutism. He published his work at Paris in 1824: 'Storia d' Italia dal 1789 al 1814,' 4 vols. 8vo. The book was assailed by strictures and denunciations, some of them very abusive and personal; but it stood its ground, went through numerous editions, both in Italy and abroad, and it has long since taken its place in every Italian library. The work is one of lasting interest: the author excels in the description of stirring events, the bustle of the camp, the alarms of a siege, the din and tumult of popular insurrections, the calamities of the devoted inhabitants—the victims of famine, pestilence, or the sword. His account of the insidious arts used by the French directory towards the disarmed court of Turin, that of the fall of Venice, the terrible re-action of 1799, the march of Suvarow, the battle of Novi, the siege of Genoa, the dreadful massacres of Naples, the pass of the Splugen by Macdonald's army, Napoleon's coronation at Milan, the war on the coast of Albania between the French and Ali Pasha, the horrors of the war of extermination in Calabria, are all masterly sketches. His style however is upon the whole unequal, and his sentiments at times seem inconsistent with one another. He is not always successful in drawing individual characters, or in scanning the internal workings of men. Some of his battle descriptions are somewhat confused. There is also a disproportion between the various parts of the work; twenty books are bestowed upon the Italian wars and vicissitudes from 1792 to the peace of Luneville in 1801, and only seven upon the subsequent period down to 1814. But notwithstanding these faults, Botta's history is a noble work, and one that does honour to Italian literature.

Encouraged by the success of this work, a certain number of Italian and French lovers of literature urged Botta to attempt a continuation of Guicciardini's history of Italy, from 1530, down to 1789, so that the end should meet the beginning of his contemporary history. These friends made a subscription among themselves sufficient to allow the writer a decent annual income during the time that he should be engaged in his laborious undertaking. Botta accepted the task in 1826, and he completed it at the end of 1830: 'Storia d' Italia in Continuazione al Guicciardini, sino al 1789,' 10 vols. 8vo., Paris, 1832. This larger work was received with applause, owing in part to the author's already established reputation as an historian. The Academy of La Crusca bestowed on the author its decennial prize, and Charles Albert, king of Sardinia, created him a knight and gave him a pension. This was the first token of favour obtained by Botta from any government for his writings, and, it is well to observe, that it was for the old and not for the contemporary history that it was granted, and therefore could not affect Botta's character for independence. In fact Botta lived and died poor. In 1832 Botta revisited his native Piedmont, and was very favourably received there. He afterwards returned to France, where he made an Italian translation of the journal of a French maritime expedition of discovery round the globe, which one of his sons accompanied in a medical capacity, and also as a naturalist. The translation was published after the father's death: 'Viaggio intorno al Globo, principalmente alla California e alle isole Sandwich, negli anni 1826-29, di A. Duhaut Cilly; con Note del giovane Botta,' Turin, 1841. He was invited to write the Life of Fra Paolo Sarpi, but he refused, saying that he was too old. He died at Paris, in August, 1837. His native town S. Giorgio has raised him a monument.

Besides the works mentioned in this article, Botta wrote—1, 'Il Camillo, o Vejo conquistato,' a poem, Paris, 1815; 2, 'Storia dei Popoli Italiani da Costantino fino à Napoleone,' a compilation published first in French in 1825, and afterwards Italian in 1826. His history of American independence has been translated into English, by Otis, and has been greatly praised in the United States. As a literary work however it is much inferior in merit to the two histories of Italy.

(Tipaldo, *Biografia degli Italiani Illustri*; *Foreign Quarterly Review*, No. I., July, 1827, article on Botta's 'History of Italy;' and in No. xxxiii. of the same Journal, a Review of his 'Continuation of Guicciardini.'

BOTTOMRY BOND. [BOTTOMRY, P. C.]

BOUCHARDON, EDME, a distinguished French sculptor, was born at Chaumont in Bassigny, in 1698. He was instructed in his youth by his father, who was likewise a sculptor and architect; and, after he had made sufficient progress, he entered the school of the younger Couston at Paris, where he soon distinguished himself, and obtained the first prize of the Royal Academy in 1722. By this prize he was entitled to study for a limited period at Rome, at the expense of the French government, in the French academy established there by Louis XIV. Bouchardon remained at Rome for ten years, during which time he was much employed, especially in busts, and he was selected to execute the monument to Clement XI.; but, being recalled by the French government about the same time, he did not execute it. He returned to Paris in 1732: in the year following he was elected Agréé, in 1744 a member, and in 1746 a professor, of the Academy of Painting and Sculpture. He died at Paris in 1762.

Bouchardon's principal works were the Fontaine de Grenelle, and the equestrian statue of Louis XV. The Fontaine de Grenelle is one of the finest in Paris; it was commenced in 1739 and finished in 1745: the inscription is by Cardinal Fleury. The authorities of Paris, by whose order it was made, were so well satisfied with its execution, that they voted Bouchardon, in 1746, a pension for life of 1500 francs. The statue of Louis XV., which was of marble, was placed in the Place Louis XV. in 1763, and was destroyed by the populace in 1792. Bouchardon was occupied in its execution during twelve years, yet it was unfinished when he died: the pedestal was executed by Pigal, who was chosen by Bouchardon himself to complete the monument. It was engraved by Cathelin. There are also some statues by Bouchardon in the church of S. Sulpice, and in the gardens of Versailles, Choisy, and Gros-Bois. He was sculptor to the king. Many of his works and sketches have been engraved, and there are a few etchings by his own hand.

J. J. Preisler engraved fifty antient statues from drawings by him. Count Caylus engraved many others, besides several of Bouchardon's original works; he also wrote a Life of Bouchardon. Bouchardon had a younger brother, who was painter to the King of Sweden, in which country he died.

(L'Abbé de Fontenai, *Dictionnaire des Artistes*, &c.; Heineken, *Dictionnaire des Artistes*, &c.; Watelet and Levesque, *Dictionnaire des Arts*, &c.

BOUCHER, FRANÇOIS, succeeded Vanloo as principal painter to Louis XV. He was born at Paris in 1704, studied under Le Moine, and at the age of nineteen obtained the first prize of the French Academy of Painting, by which he was by precedent entitled to study in Rome at the expense of the government; a privilege however which he did not obtain. He went to Rome at his own expense for a short time, and returned to Paris in 1731, and in 1735 was elected a member of the academy. He died in 1768, or, according to others, 1770, director of the academy.

Boucher was a painter of very great ability, and had extraordinary facility of execution, but he disregarded every correct principle, and devoted himself entirely to a picturesque effect, which consisted in a mere variegated tissue of light and shade. His figures are utterly void of expression. His subjects were chiefly mythological, amorous, and pastoral, and he painted figures and landscapes with equal facility. The corruption of pure taste, partly effected by Watteau, was fully accomplished by the works of Boucher, for though in his time a great popular favourite, his style has been subsequently condemned in the very strongest terms, even by his own countrymen, especially by Watelet and Diderot. He has been called the Anacreon of painters, a compliment (if one) which, though it may apply to Boucher's subjects, cannot apply to his execution of them. His designs are extremely numerous, amounting to several thousands, and a great many of them have been engraved; a few by himself, and others by upwards of 140 different engravers, French and foreign.

(L'Abbé de Fontenai, *Dictionnaire dès Artistes*; Heineken, *Dictionnaire des Artistes*, &c.; Watelet and Levesque, *Dictionnaire des Arts*, &c.; Fiorillo, *Geschichte der Mahlerey*, vol. iii.)

BOUFFLERS. There were two remarkable females often mentioned in the literary history of the eighteenth century who bore this title, and who are frequently confounded with each other. The one was the Marquise de Boufflers-Rémencourt, a correspondent of Voltaire, and the principal female ornament of the court of Stanislaus Augustus of Poland. She was a great reader, and wrote some pleasing verses. The other was the Comptesse de Boufflers-Rouvrel, who is perhaps better known in this country than her namesake, from having been a friend and correspondent of David Hume. She was mistress of the Prince of Conti, and on the death of her husband, in 1764, was disappointed at not becoming the wife of that prince. She wrote a tragedy in French prose. The ease and accurate idiom of her English letters show that she was a very accomplished woman.

BOULDER FORMATION, in Geology, a title now introduced to supplant that of diluvial deposits. *Till* is an equivalent term employed in Scotland. By various writers these accumulations are ranked in the ill-defined class of Pleistocene deposits.

BOURNE, VINCENT, was probably born three or four years before 1700, but the date of his birth does not appear to have been recorded. He became a king's scholar in Westminster School in 1710, whence he was elected to be sent to Trinity College, Cambridge, in 1714; he took the degree of A.B. in 1717, and that of A.M. in 1721. He obtained a fellowship at Trinity College, and was afterwards an usher in Westminster School, in which situation he seems to have continued for the rest of his life. He never took orders. He died December 2, 1747.

Vincent Bourne is the author of a considerable number of short Latin poems, of several translations of short English poems into Latin, and of a few epitaphs in Latin and English. He is an exceedingly pleasing writer. He has great originality and variety of thought, and great vividness of imagination, often combined with a delicate humour quite peculiar to himself. His subjects are generally occasional and of little importance; but the treatment is very delightful, and entirely free from classical or any other commonplaces. His Latin is remarkably pure; the expressions are chosen with exquisite tact, and his versification has a facility and harmony not surpassed by any modern writer of Latin poetry.

Some of Bourne's Latin translations are of poems admired once, but little valued now, such as Mallet's 'William and Margaret,' Rowe's 'Colin's Complaint,' and Tickel's 'Lucy and Colin;' but the versions are of singular excellence, retaining every trace of thought and expression which is really poetical, and improving, without appearing to change, the feeble imagery and spiritless language of the originals: the trivial and monotonous versification has also disappeared, and the poems have assumed a propriety and grace to which they had previously little claim. In poems of a higher poetical character, such as Gay's beautiful ballad of 'Black-eyed Susan,' Bourne's mode of translation is very different, and is distinguished by a fidelity which, to those who know the difficulty of approximating two languages so dissimilar in structure, is as curious as it is admirable. But even here he gives an occasional heightening touch; for instance, in translating the exquisite simile

> 'So the sweet lark, high pois'd in air,
> Shuts close his pinions to his breast
> If chance his mate's shrill note he hear,
> And drops at once into her nest,'

Bourne not only poises the lark, as Gay has done, but he gives the vibrating motion of the wings, so characteristic of the lark when singing: he has also transposed the second and third lines, in which Gay has obviously inverted the natural order of thought for the sake of the rhymes:—

> 'Sic alto in caelo, tremulis se librat ut alis,
> Si sociae accipiat forsan alauda sonos,
> Devolat extemplo, clausisque ad pectora pennis,
> In carae nidum praecipitatur avis.'

Cowper has translated four of Bourne's Latin poems into English, 'The Jackdaw,' 'The Parrot,' 'The Cricket,' and 'The Glow-worm,' in none of which, skilful as he was, has he equalled his original. Cowper speaks of Bourne in one of his letters. As he was well acquainted with the man, and well qualified to appreciate the value of his poetry, it is worth while to give the passage entire:—'I love the memory of Vinny Bourne. I think him a better poet than Tibullus, Propertius, Ausonius, or any of the writers in his way except Ovid, and not at all inferior to him. I love him with a love of partiality because he was usher of the fifth form at Westminster when I passed through it. He was so goodnatured and so indolent, that I lost more than I gained by him, for he made me as idle as himself. He was such a sloven as if he had trusted to his genius as a cloak for everything that could disgust you in his person; and indeed in his writings he has almost made amends for all. His humour is entirely original: he can speak of a magpie or a cat in terms so exquisitely appropriated to the character he draws, that one would suppose him animated by the spirit of the creature he describes. And with all his drollery there is a mixture of rational and even religious reflection at times, and always an air of pleasantry, good-nature, and humanity, that makes him, in my mind, one of the most amiable writers in the world. It is not common to meet with an author who can make you smile, and yet at nobody's expense; who is always entertaining, and yet always harmless; and who, though always elegant and classical to a degree not always found in the classics themselves, charms more by the simplicity and playfulness of his ideas than by the neatness and purity of his verse. Yet such was poor Vinny. I remember seeing the duke of Richmond set fire to his greasy locks, and box his ears to put it out again.'

The first edition of Bourne's 'Poematia' was in 1734, 8vo. To the third edition, in 1743, an appendix was added of other translations and poems, forming nearly one-half of the whole collection, 'Poematia, Latine partim reddita, partim scripta, à V. Bourne,' 12mo. There was another edition in 1750, 12mo. In 1772 a handsome volume in 4to. was published by subscription, 'Miscellaneous Poems, consisting of Originals and Translations, by Vincent Bourne, formerly of Trinity College, Cambridge, and Usher of Westminster School.' It contains a few additional poems, and two letters, one to a young lady, and another to his wife, written a short time before his death. 'Poetical Works, with his Letters,' 2 vols. 12mo., was published in 1808. We have not seen this edition. There has since been another edition in one vol. 12mo.

(Bourne, *Poematia*, 1743, 1772; Chalmers, *Biographical Dictionary*; *Critical Review*, 1772.)

BOVISTA, a genus of plants belonging to the natural order Fungi. This name was given it by Dillenius, and is a Latinised version of *Bofist*, its German name. In many parts of England its common name is Bull-fice, and some writers call it Bull puff-ball. The genus Bovista was at one time included under Lycoperdon [LYCOPERDON, P. C.], and the type of the genus, *Bovista gigantea*, was called by Linnæus *Lycoperdon Bovista*. The present Lycoperdon Bovista is the common or wolf puff-ball. The difference between the genera is, that Lycoperdon has a single peridium, while Bovista has a double one.

The *Bovista gigantea*, Bull Puff-ball, Frog's Cheese, and Bull-fice, is interesting on account of the enormous size it attains. It has the form of a flattened ball, at first of a perfectly white colour. Specimens have been gathered measuring as much as nine feet in circumference. When they have attained their full size, they begin to change colour; the external peridium cracks and peels off, the inner one also bursts at the apex. The interior is composed of a mass of tissue, which when young is white and moist, but at length becomes coloured and dry, and on being pressed emits a large quantity of powdery matter, which on being examined, is found to consist entirely of sporules. On examining the mass inside, it is found to consist of filaments which are mixed with sporules. Burnett says, 'It is probably the smoke that arises from these fungi when burned, or some of their allies the Lycoperdons, which forms the secret method advantageously employed by some persons who keep bees, in order to stupify the insects without killing them, while their hives are being robbed of all their honey.' Gerarde says, 'The common people use this fungus to kill or smoulder their bees.' He also says, 'In some parts, where the neighbours dwell far asunder, it is used to carry fire from place to place, whereof one species took the name of *Lucernarum fungus*.' It is used at the present day, in this country and on the Continent, as tinder, by the name of German tinder. The dried inside of this fungus was also at one time in great repute among surgeons as a styptic. A small pledget of it was always employed to cover the wound made in bleeding. It is now seldom used for that purpose. When this plant is young it is eatable. An Italian species, the *B. furfuracea*, which grows in great abundance on the heaths near Florence, is collected and sold in the markets, and, according to Micheli, is an esteemed article of food. Comparatively few however of the species of fungi are used as diet in this country.

(Bischoff, *Medicinisch-Pharmaceutische Botanik*; Burnett, *Outlines of Botany*.)

BOWDITCH, NATHANIEL. The materials for the life of Dr. Bowditch are contained in a very full and interesting account, written by his son, and prefixed to the fourth and posthumous volume of his translation of the 'Mécanique Céleste.' There are also before us 'Eulogy on Nathaniel Bowditch,' by John Pickering, Boston, 1838; 'Discourse on the Life and Character of the Hon. Nath. Bowditch,' &c., by Alexander Young, Boston, 1838; and 'Eulogy on the Life and Character of Nath. Bowditch,' by Daniel Appleton White, Salem, 1838.

Nathaniel Bowditch was born at Salem, in Massachussets, March 26, 1773. His family is traced to one of three brothers who emigrated from near Exeter at the beginning of the seventeenth century. His father was a poor working cooper, and could not give his son more school education than he could take up to the age of ten years. Perhaps this was no bad thing: for we are told that at the school to which young Bowditch was sent, it was the daily exercise of all the boys to spell the word *honorificabilitudinity*. At the above age he was taken by his father into the shop, and afterwards apprenticed to a ship-chandler. But a taste for arithmetic and mathematics developed itself early, and was cultivated, under many difficulties, with all the energy of his character, from which his mother had very early prophesied of him that he would be 'something decided.' In 1788 he was able to calculate an almanac for the year 1790. He learnt the elements of geometry and algebra by himself, and was taught navigation by an old British sailor. He taught himself Latin that he might read the 'Principia' of Newton, which he had done by the age of twenty-one. At different times of his life he also taught himself, in some cases with a little assistance, most of the European languages: his plan was to take the New Testament and a dictionary, and begin to translate, writing down the original; and in this way he is said to have left specimens of his attention to twenty-five languages or dialects. He is said also to have read through Chambers's Dictionary at an early age, without missing an article, and to have transcribed very largely from the Philosophical Transactions and other works which his poverty prevented him from buying.

He took to a sea-faring life in 1795, and made four long voyages as clerk or supercargo, and one as master. He was an excellent navigator, and on one occasion found his way into Salem harbour in a dark and snowy night, with no other guide than his own reckoning and one instantaneous glimpse of the light on Baker's Island. He taught every man on board his ship how to find a ship's place, and on one occasion had twelve seamen, being all his crew, every one of whom could take a lunar observation. He edited three editions of the celebrated work on navigation by John Hamilton Moore; but at last he had corrected so many errors, and made so many changes, that he thought himself justified in publishing it under his own name, as 'The new American Practical Navigator.' In this form it went through eight editions, and became very well known. His maritime life ended in 1804; in 1798 he married, but his wife died before the end of the year. In 1800 he married again; his second wife died in 1834, leaving a grown-up family. To the memory of this lady his translation of the 'Mécanique Céleste,' of which we shall presently speak, is dedicated.

In 1804 he was appointed to the presidency of the Essex Fire and Marine Company at Salem, a situation of emolument, which he held until 1823, when he accepted another and a still more lucrative appointment, the actuaryship of the Massachussets Hospital Life Assurance Company, at Boston. He died March 16, 1838, leaving behind him such a character, that, after making all allowance for filial and friendly partiality in the accounts above named, we must say they ought to have been published even though their subject had not attained any reputation of another kind.

Dr. Bowditch is the author of a good many papers in the Transactions of the American Academy, all on astronomical subjects: one in particular is on an extension of Napier's rules (vol. iii. pp. 33-38), by which they are applied (it is said; we have not seen the paper) to oblique-angled triangles. But the work which will carry his name down in Europe, and which entitles him to be considered as the first great promoter of mathematical analysis in the United States, is his translation of the 'Mécanique Céleste' of Laplace, with a commentary. Four volumes of this, answering to the first four volumes of the original, are completed and published, the last posthumously, Boston, 1829, 1832, 1834, 1839. The publication was substantially ready in 1817, but was deferred, among other reasons, by the expectation that Laplace himself would publish another edition. To the third volume is added a volume of appendix (Boston, 1834), containing the translator's collection of methods for computing the orbits of comets from observations, with auxiliary tables. All this was done at Dr. Bowditch's sole expense, with the cheerful consent of his family: the dedication above mentioned expressly states that the publication would not have been undertaken without his wife's consent.

The commentary is very valuable, not only as giving the reader of Laplace more recent views and simplifications, and bringing the results of a very great quantity of reading to bear upon the text, but also as a real and effective running explanation of all the innumerable steps which Laplace has omitted. Bowditch said, 'I never come across one of Laplace's "*Thus it plainly appears*" without feeling sure that I have got hours of hard study before me to fill up the chasm, and find out and show *how* it plainly appears.' We remember ourselves asking a distinguished extender of Laplace's views, what were the existing helps to the reading of the 'Mécanique Céleste,' and getting for answer 'A ream of paper and several hundred of quills.' There was no facilitating comment in existence, except on detached portions; and Dr. Bowditch supplied this defect in a sound working manner. It is easy to see that his explanations are for the most part those by which he himself gained the point to which he is endeavouring to bring his reader. A mathematician, who thought more of his own fame than his reader's progress, would have disdained to publish the plain straight-forward explanation with which the notes are filled, the matter of which is precisely such as a student of the most successful class manages to supply for himself. But this is the beauty of Bowditch's comment, as a comment; and appears to us well worth the results of reading which appear in many of the notes, and which, though by no means out of place, rather amplify and extend than explain. As a whole, and independently of its author, this translation is a great undertaking; as the work of a self-taught man, closely engaged in professional business, it is a wonder.

Dr. Bowditch bequeathed his library to the state of Massachussets, and it forms the commencement of a public library, named after him, at Boston.

BRACCIO FORTEBRACCI, called also BRACCIO DA MONTO'NE, from the name of his patrimonial estate, was born at Perugia, A.D. 1368, of an old patrician family. Braccio, before he was twenty, served as a Condottiere, or leader of a mercenary troop, in the service of the Count of Montefeltro against the Malatesti, Lords of Rimini. In 1393, when a general insurrection of the popular party took place at Perugia, in which a number of the nobles were killed and the remainder driven away, the castle of Montone became a rallying-point for the exiles, and Braccio one of their stoutest champions. After a desultory warfare between the two factions for several years, the popular party applied for protection to Gian Galeazzo Visconti, the powerful Duke of Milan, and paid allegiance to him in January, 1400; and after the death of Visconti, the party transferred its allegiance to Pope Boniface IX., under the plea of 'the welfare of the Republic,' on condition that the emigrant nobles should remain in banishment. Braccio now resumed his life of a Condottiere, and served in Lombardy under the great leader Alberico da Barbiano. He afterwards carried on a partisan warfare on his own account, in the Marches of Ancona, against the Marquis Ludovico Migliorati, the nephew of Pope Innocent VII., when he levied contributions, plundered towns, and got ransoms from his prisoners. It was the custom at that time to strip the common soldiers of their arms, horses, and accoutrements, and then set them free, but to detain the officers or gentlemen, and make them pay ransom according to their respective means.

In 1406 the great Western schism began, which was only extinguished twelve years after by the council of Constance, during which period several popes or antipopes distracted the church by their conflicting claims. Ladislaus, King of Naples, thought of availing himself of this confusion to occupy the Papal States and all central Italy, and he sent messengers to Braccio in 1408, to induce him to enter his service, promising to forward his views towards the subjection of his native town, Perugia. Braccio accepted the proposal, received a sum of money for his condotta, and crossing the Apennines at the head of a considerable body of horse and foot, he scoured the valley of the Tiber and took several towns in the name of the king. The people of Perugia, in alarm, sent ambassadors to Ladislaus, who was then at Rome, and offered him the demission of their city, provided he would not let the emigrants return. 'Rather than make peace with the nobles,' said the leaders of the people in the council, 'we will submit to a foreign king.' Ladislaus accepted, in June, 1408, the dominion of Perugia, with the 'merum et mixtum imperium.' He agreed that the emigrant nobles should not be allowed to remain within thirty miles of the gates of Perugia. He also sent a large body of Neapolitan cavalry to attack Braccio, who, having received timely information, retired to the Marches, from whence in 1409 he marched again towards the south, and joined the other great Condottiere, Sforza Attendolo, in driving away the troops of Ladislaus from the Roman State in the name of the new Pope, John XXIII. Braccio again attacked Perugia, when Ladislaus, having made peace with Pope John, sent Sforza to check his movements, and Braccio moved towards Bologna in obedience to the orders of the Pope. In 1414 Ladislaus died, and was succeeded by his sister Joanna II., a weak princess. In the following year the council of Constance deposed John XXIII. Braccio, ever intent upon his object of re-entering his native town by force, having exacted a sum of eighty thousand ducats from the people of Bologna, marched with his bands in the spring of 1416, and encamped in front of Perugia, before the citizens had time to prepare for defence. After some resistance, the citizens in despair sent him a deputation, offering to make him Lord of Perugia, provided he granted a general amnesty for the past. On the 19th of July, 1416, Braccio at the head of his bands, and of all the emigrant nobles, after twenty-four years of exile, re-entered Perugia in triumph amidst acclamations, and received the oath of allegiance from the magistrates and the principal citizens. His conduct was temperate, but firm: he enjoined strict discipline on his soldiers; he divided, at first, the civil offices among the two parties, but by degrees he gave to his friends the larger share; he checked the importunities of the emigrants to recover possession of their confiscated property; he paid the debts of the republic with his own treasures, accumulated during his wars; and he encouraged the university of Perugia. The people began to like him, and the learned gave him their praises; but he was cruel towards those who offered him any resistance.

In 1417 Braccio marched towards Rome, which in the absence of a legitimate pope was occupied by the Neapolitans, and entered it by capitulation, but he was shortly after obliged to evacuate it at the approach of his rival, Sforza. The council of Constance had now elected Pope Martin V., a man of determination, who expressed his intention of recovering full possession of the Papal States, and ridding them of all lords and usurpers. A deputation was sent to him from the council and magistrates of Perugia, requesting him to confirm Braccio, Count of Montone, as Lord of Perugia. Martin gave an evasive answer, upon which Braccio prepared for the threatened danger by raising money from the neighbouring chieftains of the Marches and of Umbria, who paid his demands through fear. About this time Braccio issued a decree restoring to the emigrant nobility of Perugia their property, of which they had been deprived since 1393.

Pope Martin allied himself with Queen Joanna of Naples, who gave him her General, Sforza Attendolo, to reduce the Papal territories into subjection. Braccio made preparation to oppose him, but before the two rivals could meet in the field the pope quarrelled with Joanna, upon which both he and Sforza supported the claims of the Anjou dynasty to the crown of Naples. One consequence of this change was that Martin agreed to make terms with Braccio, whom he invited to meet him at Florence in February, 1420. Braccio went to the conference with the retinue of a great potentate, and accompanied by the Lords of Foligno, Camerino, Fabriano, and others, and by the principal nobles of Perugia, Assisi, Todi, Orvieto, Narni, and Rieti. On arriving at the gates of Florence, he took off his armour and put on a vest of purple and gold, and entered the city on foot, escorted by the magistrates and first citizens of the republic, who accompanied him to the palace of the pontiff. It was agreed that Perugia and its territory, and several towns in the Marches, should be administered by Braccio and his heirs. Braccio was to serve with his troops at the expense of the pope against Bologna, which had revolted under one of the Bentivogli.

On his return Braccio contributed to embellish Perugia, and he ordered the construction of the emissary to carry off the superabundant waters of the Thrasymene lake. Bologna in the course of two months was obliged to capitulate to the troops of Braccio, and submit to the pope in July, 1420. At the close of that year he married, with great pomp, the sister of Varani, lord of Camerino. Meantime a civil war broke out in the kingdom of Naples. Louis of Anjou, count of Provence, encouraged by Pope Martin, and supported by Sforza, who had quarrelled with Queen Joanna, invaded the kingdom, where he found numerous adherents among the nobles. Joanna sent Antonio Caraffa, nicknamed Malizia on account of his cunning, as her ambassador to Alfonso of Aragon and of Sicily, who was then in Sardinia. Alfonso went to Sicily to collect his fleet for the assistance of Joanna, who at the same time offered to Braccio the command of her land forces, with the rank of high-constable of the kingdom, and paid him down two hundred thousand ducats in advance. In the spring of 1421 Braccio entered the Abruzzo with a large force, surprising by the rapidity of his march the partisans of the Angevins, who submitted, except Count Caldora, who took refuge in the mountains. Sulmona capitulated. Braccio, issuing out of the defiles of Abruzzo, surprised Capua, and suddenly appeared before Naples, which was then besieged by Sforza and by the fleet of Louis of Anjou. King Alfonso meantime arrived with his fleet at the entrance of the bay; Sforza was obliged to raise the siege, the Angevins retired to Castellamare, and Braccio entered Naples in triumph with King Alfonso, who, together with Queen Joanna, solemnly bestowed upon Braccio the golden staff of high-constable of the kingdom, with supreme command over both the Neapolitan and Aragonese forces, and caused the troops to swear obedience to him. The queen at the same time created him Count of Foggia and Prince of Capua, the last of which towns she gave him in fief. A desultory predatory warfare was carried on for some time by the troops of Braccio against those of Sforza, in which however the poor inhabitants of the fine plains of Campania were the greatest sufferers. Pope Martin now interfered as mediator, and Louis of Anjou, giving up his attempt for the present, withdrew to Rome. Sforza remained under arms, but Braccio undertook to win him over to the queen's party; in which he succeeded at an interview near Monte Casino, when the two rival chiefs, who had both served in their youth under Alberico da Barbiano, renewed their former acquaintance. The war being now over, Braccio in the spring of 1422 returned to Perugia, after having taken on his way Città di Castello, which he added to his other territories.

In the following year, fresh disturbances having broken out at Naples, Alfonso sent again for Braccio, and Queen Joanna gave the messengers a crown to be placed on his head as Prince of Aquila and Capua, with full power to subdue and govern the important province of Abruzzo, which had again revolted. On the 13th of February, 1423, the Lord of Perugia, seated on a seat of ivory in the great hall of the townhouse, and attended by the lords of Foligno and Camerino, received the Neapolitan envoys, from whom Corrado Trinci, lord of Foligno, having received the crown, placed it on the brow of Braccio and a golden chain round his neck, amidst loud acclamations of 'Long live the Prince of Capua and Lord of Perugia.' As the dominion of Braccio extended over great part of Umbria and the Marches, and on the south over the principality of Capua, the acquisition of Aquila and the Abruzzo would have joined these two portions so as to form the whole into a compact principality. Braccio's ambition is said to have soared still higher, and to have aspired to the crown of Naples. In May, 1423, he gathered his bands near Todi, to the number of 3200 horsemen and some thousand foot, with which he entered the kingdom of Naples; he overran Campania and Apulia, defeated the partisans of the Angevins, took Bari, and advanced into Calabria; then retracing his steps towards the Abruzzo, he laid siege to the strong town of Aquila in the summer of 1423. He summoned the town in the name of Joanna and Alfonso, whose commission he bore. The authorities replied that they were lieges of their queen, and that as she was at that time in durance in consequence of the dissensions which had arisen between her and Alfonso, they would not open their gates to any armed party until harmony was restored in the capital and at the seat of government. Braccio then blockaded the town and devastated the surrounding country. Joanna, who had now revoked her adoption of Alfonso and made common cause with Louis of Anjou, ordered Sforza to march to the relief of Aquila. Braccio, being joined by other bands of the Aragonese party, was in possession of the whole Abruzzo. In December, 1423, Sforza began his march from Apulia along the coast of the Adriatic, took Ortona, and crossed the river Pescara near its mouth, his advanced guard making their horses swim through the stream.

As the body of Sforza's army remained on the opposite bank, Sforza plunged again into the river to encourage them to cross. One of his men, being carried away by the current, was in the act of drowning, when Sforza pushed his horse forwards to save him, seized him by the arm, and both sank into the water and disappeared. Thus died Sforza Attendolo, the great Condottiere, on the 4th of January, 1424. His army, disheartened, retired from the Abruzzo. Braccio, who was at Chieti, upon hearing the news, extolled the fame of his rival, remarking that this unexpected catastrophe boded no good to himself. He however pushed on the siege of Aquila with renewed vigour. The town began to suffer through famine. The archbishop encouraged the besieged by telling them that the queen and the pope would soon relieve them, and he excommunicated Braccio in the name of the pontiff. At last, in the spring of 1424, the Angevin army, led by Count Caldora and other chiefs, marched into the Abruzzo, and encamped on the hills above Aquila. Braccio drew out his troops in the plain below in order of battle. His officers entreated him to attack Caldora's soldiers as they came down the defiles of the mountain and before they could form, but he obstinately refused, saying that he wished to fight the whole force of the enemy and to decide the question at once. The battle was fought on the 2nd of June. Caldora's army was greatly superior in numbers, and in the midst of the fight a sortie from the people of Aquila, falling on the rear of Braccio's line, decided the victory. Braccio, while fighting desperately, received a blow on the head and fell senseless. He was taken prisoner to the camp of Caldora, and treated with humanity. He survived for three days, refusing to take food, though urged to do so, and would not utter a word. It was said that his wound was not mortal. He died on the 5th of June, 1424, in the fifty-sixth year of his age. Rome rejoiced at his fall; Ludovico Colonna took his body to Pope Martin, who ordered it to be buried in unconsecrated ground outside of the walls. Eight years after, Nicolò Fortebracci recovered from Pope Eugenius IV. the remains of his relative, and deposited them in the church of the Franciscan convent of Perugia. Oddo Fortebracci, son of Braccio, resigned the government of Perugia into the hands of the pope, in July, 1424, retaining the various fiefs of his father, with the title of Count of Montone. The history of Braccio's life forms an important part of the history of Italy during the fifteenth century, which was the last age of its tumultuous independence.

(Fabretti, *Biografie dei Capitani venturieri dell' Umbria;* Campanus, *De Vita et Gestis Brachii;* Lomonaco, *Vite dei famosi Capitani d'Italia;* Compagnoni, *Storia della Marca;* and the contemporary local chroniclers, among whom must be noticed Lorenzo Spirito, who wrote a poem of one hundred and one chapters in terza rima, entitled *L'Altro Marte*, in which he narrates in chronical order the deeds of Braccio and of his contemporary Piccinino. This curious poem was printed at Vicenza in 1489: it is now extremely rare.)

BRACHYPHY'LLUM, a genus of fossil plants, supposed to belong to the Coniferæ. One species, B. mammillare of Brongniart, occurs in the carbonaceous beds of the Bath oolite formation on the Yorkshire coast.

BRACHYPO'DIUM, a genus of grasses [Graminaceæ, P. C.] belonging to the tribe Festucineæ of that order. It has unequal many-flowered glumes; the outer palea rounded on the back, setigerous at the summit, lateral nerves slightly converging, not vanishing upwards; the inner palea fringed on the ribs with rigid setæ; the styles terminal. Two of the species, *B. sylvaticum* and *B. pinnatum*, are British. This genus is distinguished from Triticum (wheat) by the unequal glumes alone.

(Babington, *Manual of British Botany.*)

BRADFORD CLAY, a thin bed of pale lead-coloured clay which lies upon the Bath oolite, especially at Bradford in Wiltshire, and contains, amongst other interesting fossils, the Pear Encrinite (Apiocrinus rotundus of Miller).

BRAKE, or BREAK, in Machinery, a contrivance for retarding or arresting motion, by creating an amount of friction too great for the moving power, or for the momentum of the machine, in cases where the moving power is suspended, to overcome. Brakes generally consist of blocks of wood so connected with a system of levers or screws that they may be pressed firmly against the periphery of a wheel mounted upon the main axle of the machine; but in some cases, instead of a block of wood, a strap or belt of iron, of sufficient length to embrace one-half of the periphery of the brake-wheel, or a series of small blocks of wood attached to the concave surface of such a strap, is used. The cuts given under Saw-Mill, P. C., p. 479, *Fig.* 4, and Wind-Mill, P. C., p. 445, show cases in which brakes of this semicircular character are employed, although the brake-wheels only, and not the brakes themselves, are represented. The brakes of railroad waggons, if small, as in the case of contractor's earth-waggons, are generally worked by levers, and often consist of a block of wood so mounted that, when the lever is depressed, it presses equally upon the peripheries of two wheels, which, in such a case, are very near together. The brakes of carriages which run in the regular trains are usually worked by screws, by which greater power may be gained, and they should be capable of affording sufficient pressure to completely stop the revolution of the wheel, although it is desirable to avoid the application of so strong a pressure, as, by causing the wheel to be dragged along the rail, it impairs the rotundity of the tire. Brakes for locomotive engines have been contrived, to be worked by steam; but they are not generally used, it being deemed better to confine the brakes to the tender and a few carriages in each train. With a view to prevent accident by the continued motion of the hinder part of a train when the engine is stopped by an accident, self-acting brakes have been devised, which would begin to act as soon as the buffers of two adjacent carriages were pressed together, and would arrest the revolution of the wheels with a force directly proportionate to the force with which the carriages ran together; but of these and many other schemes for the prevention of accidents, it is doubtful whether the inconvenience under certain circumstances would not more than counterbalance the anticipated advantages.

BRAMAH, JOSEPH, was born on the 13th (New Style) or 2nd (Old Style) of April, 1749, at Stainborough, in Yorkshire, where his father followed the occupation of a farmer. He was the eldest of five children, and was intended for his father's avocation; but he very early exhibited proofs of mechanical talent, and being, at the age of sixteen, incapacitated for agricultural labour by lameness, he was apprenticed to a carpenter and joiner. He subsequently removed to London, where he worked for some time as a journeyman cabinet-maker, and afterwards set up in the same business for himself. His adoption of the profession of engineer or machinist appears to have arisen from his invention of some very important improvements in water-closets, in consequence of which he became a manufacturer of such articles. His next important mechanical invention was the ingenious lock still known by his name, and which, after a lapse of sixty years, during which time many new kinds of lock have been introduced, maintains its character as one of the most inviolable locks ever contrived. [Lock, P. C. S.] This invention was patented in 1784. Among the numerous other inventions of Bramah were improvements in water-cocks, pumps, and fire-engines, and the hydraulic press, a machine of immense power, acting on the principle of the philosophical toy called the hydrostatic paradox. This invaluable machine, of which a representation and description is given under Hydraulics, P. C., p. 384, was patented in 1796. The boundless power which it enables one man to exert renders it an important agent in many manufacturing processes, one of which is described under Bandanas, P. C. S., p. 169. In the following year he patented the elegant and convenient beer-machine which is now so universally adopted in taverns for drawing liquors in the bar from barrels deposited in the cellar, by means of a force-pump. He was also the author of improvements in steam-engines, especially in boilers; in machinery for producing smooth and accurate surfaces on wood or metal; in paper-making machinery; in making pens by a mechanical process, by which several nibs, resembling steel pens, were cut out of one quill, and fixed in a holder for use; and in the construction of carriages. In 1806 he contrived an exceedingly ingenious mode of printing, which was shortly afterwards applied to the numbering of bank-notes, and by the introduction of which, during the issue of one-pound notes by the Bank of England, the labour of 100 clerks out of 120 was dispensed with. This machine consists of a number of discs or wheels, with the numbers from 1 to 9, and 0, cut upon the periphery of each, the whole being mounted upon one axle, but capable of turning independently of each other. By the action of mechanism which is incapable of error, the position of one wheel of the series is moved between each operation of printing, so that, when the machine is properly adjusted, it will print a series of numbers in regular progression, without the possibility of twice producing the same number. In 1812 he patented a scheme for laying mains or large water-pipes through the principal streets of London, of sufficient strength to withstand great pressure, to be applied by force-pumps; his object being to provide the means of extinguishing fires by throwing water without the aid of a fire-engine, and also to supply a lifting power applicable to the raising of great weights, by forcing water or air into an apparatus consisting of a series of tubes, sliding into one another like the tubes of a telescope, and capable of being projected when necessary. He asserted his ability to make a series of five hundred such tubes, each five feet long, capable of sliding within each other, and of being extended in a few seconds, by the pressure of air, to the length of 2500 feet; and with such an apparatus he proposed to raise wrecks, and regulate the descent of weights. The last patent obtained by Bramah was for a mode of preventing dry-rot in timber, by covering it with a thin coat of Parker's Roman cement. He died, in consequence of cold contracted while superintending the uprooting of trees in Holt Forest by his hydraulic press, on the 9th of December, 1814, in his sixty-sixth year. In the construction of some water-works at Norwich, Bramah acted with success in the department of the civil engineer. He also appeared as an author in a 'Dissertation on the Construction of Locks,' and a 'Letter to the Right Honourable Sir James Eyre, Lord Chief Justice of the Common Pleas, on the subject of the cause Boulton and Watt versus Hornblower and Maberly,' which was published in 1797, and is referred to under WATT, P. C., p. 141. A memoir, which gives a very pleasing account of his amiable private character, and of his energy and probity in business, was published in the 'New Monthly Magazine' for April, 1814, from the pen of William Cullen Brown, M.D., and a biographical notice, chiefly derived from Dr. Brown's memoir, is given in Stuart's 'Anecdotes of Steam-engines,' pp. 400-404.

BRAMAH'S PRESS. [HYDRAULICS, P. C., p. 384.]

BRANCHIO'STOMA, the name given by Costa to the most anomalous of all living fishes, and indeed of all the Vertebrata.

This extraordinary animal was first discovered on the coasts of Britain, a single specimen having been sent to Pallas from the coast of Cornwall, during the latter part of the last century. The great naturalist of Russia described and figured it in his *Spicilegia Zoologica*, under the name of *Limax lanceolatus*, believing it to be a mollusk, though remarking, in his description of it, on the resemblance of some of its characters to those of a fish. It seems to have been lost sight of for more than half a century, and, with the exception of a brief reference in Stewart's 'Elements of Natural History,' we find no notice of it in any synopsis of animals. In 1834 it was rediscovered by Costa, on the Neapolitan shores, who described it in the 'Annuario Zoologico,' under the name of *Branchiostoma lubricum*; and some years after, in his Fauna of the Kingdom of Naples, gave a fuller account of it. Costa first perceived that it was a fish, and not an invertebrate animal, and remarked its affinity to the Cyclostomatous fishes. In 1836 Mr. Yarrell gave an account of it in his 'History of British Fishes,' under the name of the Lancelet, *Amphioxus lanceolatus*. He had not then met with Costa's account of it. He figured and described it from a specimen found by Mr. Couch at Polperro in Cornwall, the first taken in that locality since its original discovery there. Mr. Yarrell gave the first correct notice of the chorda dorsalis and vertebral column. About the same time, singularly enough, considering how long it had escaped notice since the days of Pallas, it was taken by several naturalists on the coasts of Sweden. Sundevall and Loven found it in Bohuslan in 1834, but did not give an account of it till 1841. Retzius had it from the same locality, and published a notice of it in the Berlin Proceedings for November, 1839, in which also is a communication on the same subject by Professor J. Müller. Rathke gave an account of its structure in 1841. In the same year Mr. J. Goodsir published an elaborate memoir on its anatomy in the 'Transactions of the Royal Society of Edinburgh' for 1841, being the result of his examination of two examples taken in the Irish Sea, by Professor E. Forbes, in 1837. In 1842 a most valuable memoir on this animal was read before the Royal Society of Berlin, by Professor J. Müller, and this paper, beautifully illustrated, appeared in the volume of Transactions of that Society published in 1844.

Besides the instances of its capture above mentioned, it has been recently taken by Mr. MacAndrew, on the west coast of Scotland, and by Professor Edward Forbes, in the Ægean Sea.

The great interest which attaches to this fish depends on the strangeness of its anatomical characters, the unexampled degradation of its organization among the Vertebrata, and the link which it forms between the highest of animals and some of the lowest. A vertebrated animal without a brain, a fish with the respiratory system of a mollusk, and the circulatory system almost of an Annelide, presents a combination of characters which must excite the wonder and interest equally of the physiologist and the systematic naturalist. Scarcely any animal yet discovered is so likely to change received views of classification and relative order of characters as the Lancelet. As yet however it has attracted but little attention among zoologists, though the physiologists and anatomists have fully perceived its value. For these reasons we shall give a full account of what is now known respecting its external character, structure, and habits.

Description.—The usual size of the Lancelet is about two inches in length. The height to the length being as 1 : 10, and the breadth to the length as ¾ : 10. It is of a lanceolate form, tapering to each extremity, and riband-like. Anteriorly it terminates in a head scarcely distinguishable from the body, apparently pointed, but when examined closely seems to end in a rounded and somewhat spathulate rostrum, beneath which is the mouth, a *longitudinal* opening, fringed on each side by a row of long filaments, which can close in and clasp alternately, so as to protect the oral opening. Along the back runs a continuous fin, which dilates near the sharp posterior extremity on each side, so as to form a sort of caudal fin. Near the tail opens the vent, in front of which is a median fin continued to another opening, situated a little behind the centre of the body (*porus abdominalis*) and serving as an outlet for the genital products. Continued from this forwards nearly to the mouth, are two strong lateral folds, mistaken by Pallas for the margins of a ventral disk, and hence leading him to consider the animal a Gasteropodous Mollusk. The entire animal is translucent and of a silvery whiteness, its sides being marked by the indications of the lateral ichthyic muscles, which give it the aspect of a small sand-eel.

Organization. Skeleton.—The osseous system consists of a *chorda dorsalis* tapering at both ends, and, strange to say, not presenting the slightest vestige of a cranium, and of the germs of superior and inferior inter-spinous bones and fin-rays in the most rudimentary state. The *chorda dorsalis* is composed of from sixty to seventy vertebræ, which are also in a rudimentary state and little more than indicated. The 'chorda dorsalis,' to quote Mr. Goodsir, 'is formed externally of a fibrous sheath, and internally of an immense number of laminæ, each of the size and shape of a section of the column at the place where it is situated. When any portion of the column is removed, these plates may be pushed out from the tubular sheath, like a pile of coins. They have no great adhesion to one another, are of the consistence of parchment, and appear like flattened bladders, as if formed of two tough fibrous membranes pressed together.' Besides the skeleton of the nervous system, there is a hyoid apparatus, forming the armature of the mouth, and consisting of two sets of 17 articulated pieces, from each of which, except 2, a ray proceeds. These rays form the oral cirrhi. Müller takes a different view of this structure, maintaining that it corresponds neither to the jaw-bone nor to the hyoid apparatus in other animals, but is analogous to the cartilaginous ring of the mouth of the lamprey and the Myxinoid fishes, a system peculiar to that family. There is also in the lancelet a series of fine, transparent, cartilaginous hair-like ribs, seventy to eighty on each side, forming a cage for the protection of the branchial cavity.

Nervous system.—The spinal cord extends the whole length of the spine, but is not quite so sharp at the fore-end as behind. It presents no trace of a brain. From 55 to 60 nerves pass off from each side of it, which do not arise by double roots. The details of this important part of the animal's anatomy are fully given by Mr. Goodsir. Müller and Rathke have observed the existence of rudimentary eyes, consisting of a small black spot of pigment, but not furnished with any optical apparatus. No traces of organs of smelling or hearing have been met with.

Vascular system.—The observations of Müller having been made on the living animal, he was enabled to pursue this part of its organization further than the other observers. According to him, the vascular system of this animal corresponds in general arrangement with that of fishes, differing however in regard to the heart from that of all other vertebrate animals, and displaying a striking accordance with that in worms, for the hearts in the Branchiostoma are not only more divided than in other animals of its class, but present entirely the form and distribution of blood-vessels, and extend over wide spaces. The blood is white!

The *Respiratory system* is constituted by the anterior extremity of the intestinal tube, the walls of which are clothed with vibratile cilia, and protected and adapted to their office by the peculiar cage-like skeleton already mentioned, which is further strengthened by transverse cartilaginous rods, between which are numerous clefts, their openings protected by vibratile cilia. This was first made known by Müller, who described also a curious apparatus of finger-shaped wheel-organs and fringed folds placed at the entrance of the branchial cavity, and marking the commencement of the ciliated portion of the intestinal canal, of which the branchial sac forms a part. At the end of the branchial sac is the *porus abdominalis*, an opening which serves equally respiratory and genital purposes.

Fig. 1.

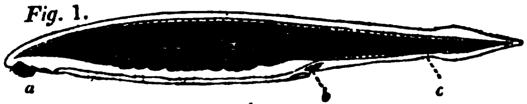


Fig. 2.

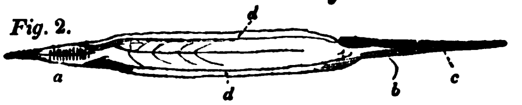


Fig. 3.

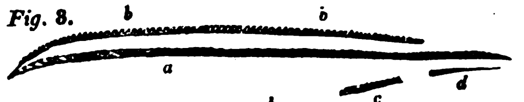


Fig. 4.

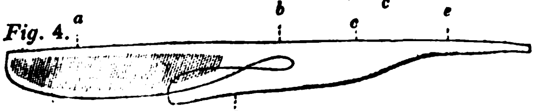


Fig. 5.

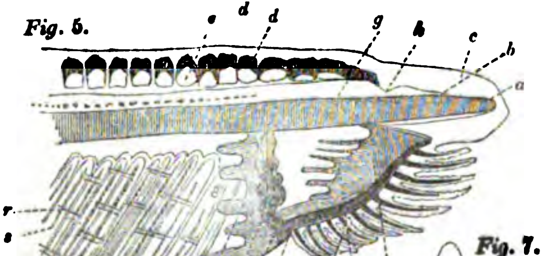


Fig. 7.

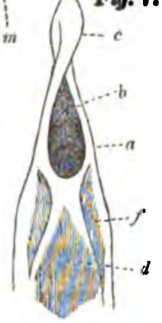


Fig. 6.

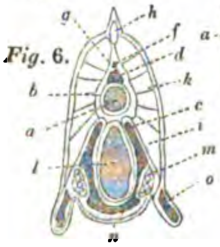
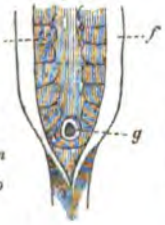


Fig. 8.



Explanation of the figures:—

Fig. 1, The Lancelet, a little larger than life. *a*, the mouth; *b*, *porus abdominalis*; *c*, the vent.

Fig. 2, View of the animal from beneath. *a*, the mouth; *b*, *porus abdominalis*; *e*, vent; *d*, *d*, ventral folds.

Fig. 3. The neuro-skeleton of the Lancelet, consisting of—*a*, the *chorda dorsalis*; *b*, *b*, the vesicular germs of the dorsal fin-rays; *c*, those of the anterior, and *d*, those of the posterior anal fins (from Goodsir).

Fig. 4. The intestinal system. *a*, the branchial sac: *b*, the œsophagus: *c*, greener and wider part of the intestinal canal; *d*, *cæcum*; *e*, narrower and posterior part of the intestinal canal.

Fig. 5. Anterior extremity of the body of a young animal (from Müller); the lateral muscles are omitted in order to show more clearly the other parts: *a*, *chorda dorsalis*; *b*, its sheath; *c*, rounded anterior extremity of the body, terminating in the dorsal fin; *d*, cellular dorsal fin-rays; and *e*, their contents: *g*, spinal marrow; *h*, eye; *i*, labial cartilages; *k*, cirrhi of the mouth; *l*, a muscle of the labial cartilages arising from the fringed fold between the cavity of the mouth and branchial cavity: *m*, wall of the mouth; *n*, finger-formed figures on the wall of the mouth (ciliated organs); *o*, fringed fold between the oral and branchial cavities; *p*, heart like arch of the aorta, connecting arch between the branchial heart and aorta; *q*, anterior and superior part of the branchial sac, in which the branchial slits are wanting; *r* and *s*, branchial ribs; *t*, branchial slits; *u*, walls of the belly.

Fig. 6, Transverse section of the body (from Müller): *a*, *chorda dorsalis*; *b*, its sheath; *c*, membranous layer: *d* spinal marrow, and *f*, canal above it; *g* and *h*, section of fin-rays: *i*, lateral muscles; *k*, intermuscular ligament; *l*, branchial sac; *m*, ovaria; *n*, wall of belly; *o*, lateral ventral folds, with their canal

Fig. 7, View of the anterior part of the body from beneath *a*, mouth; *b*, cirrhi; *c*, snout; *d*, ventral wall; *f*, lateral ventral fold.

Fig. 8, View of the underside of the body in the region of the *porus abdominalis*. *a*, ovary, *f*, lateral ventral folds; *g*, *porus abdominalis*.

The *Digestive system* consists of an intestinal canal, and a cœcum, both of which are ciliated. The latter is considered by Müller to be a liver, but the office of liver appears to be performed equally by the other parts of the intestines.

The *Reproductive system* is imperfectly known. As far as it has been observed, it appears in the form of certain bean-shaped bodies attached to the inner surface of the lining of the abdomen, on the outside of the branchial canals. Müller distinguishes the two sexes, but this part of the history of the Lancelet demands further investigation. It is not impossible that the two membraneous folds of the abdomen and their canals may be connected with this system and serve marsupial purposes. This we throw out as a suggestion.

The *Muscular system* is highly symmetrical, and consists of a series of lateral muscular bundles corresponding in number, size, and position to the vertebræ of the *chorda dorsalis*, and bearing a general resemblance to the lateral muscles of the higher fishes. Müller classes the muscles of the Lancelet under the heads of, 1st, lateral muscles: 2nd, abdominal muscles; 3rd, muscles of the oral ring and tentacula; 4th, muscles of the ring between the oral cavity and branchial sac; and, 5th, muscles of the branchial apparatus. The *skin* is thin, tough, and scaleless.

Habits.—The Lancelet lives in sandy ground at a depth of between ten and twenty fathoms water. It probably buries itself in the sand. When taken, it swims rapidly with a snake-like motion, but after a time settles down, unless disturbed, lying flat on its side. It is very tenacious of life. We have had it for three hours in a watch-glass under the microscope, at the end of which time, when disturbed, it seemed as lively as at first. It dislikes the light. It bears handling without injury. Its food was found by Müller in the intestinal canal of some of the specimens be examined; it consisted of infusorial animalculæ. The Lancelet does not swallow but simply imbibes its food.

General Remarks.—'*Branchiostoma*,' says Müller, 'is evidently a vertebrated animal and a fish. It is distinguished from all other Vertebrata by its peculiar circulatory system, and by the absence of a distinction between the brain and spinal marrow; from all other fishes by the extraordinary number of branchial ribs, by the union of the branchial and ventral cavities, and by the combination of the respiratory opening with the ventral opening.' Müller considers it connected with the Cyclostomatous fishes through the peculiar characters of its chorda dorsalis, and the absence of jaws, but as inferior to them in the absence of a distinct brain, and in the peculiarities of its respiratory system. 'The *Branchiostoma*,' he concludes, 'ranks next the Cyclostomatous fishes, but not among them, being removed from them by *distinctions which are greater than the differences between fishes and naked amphibia!*'

'Viewed as an entire animal,' writes Mr. Goodsir, 'the Lancelet is the most aberrant in the vertebrate sub-kingdom. It connects the Vertebrata not only to the Annulose animals, but also, through the medium of certain symmetrical Ascidiæ, (the genus *Pelonaia* of Forbes and Goodsir) to the Mollusks. We have only to suppose the Lancelet to have been developed from the dorsal aspect, the seat of its respiration to be transferred from its intestinal tube to a corresponding portion of its skin, and ganglia to be developed at the points of junction of one or more of its anterior spinal nerves, and inferior branch of its second pair, to have a true Annulose animal, with its peculiar circulation, respiration, generative organs, and nervous system, with supra-œsophageal ganglia and dorsal ganglionic recurrent nerve.'

Taking all we know of the structure of this truly wonderful animal into consideration, we are inclined to regard it as the relic of some great order of fishes, which in their organization brought down the vertebrated series to a parallel with the *lower* forms of Mollusca, and which became extinct in some former epoch of the world's geological history, and, from the unpreservable character of their bodies, and the absence of hard parts, left 'not a wreck behind.' The more we know of nature, the more are we convinced that there are no isolated organisms; that beings apparently anomalous are members of orders either partially known or for the most part extinct. Of all anomalous creatures the *Branchiostoma* is the most so, and it is much more consistent with the principles of scientific zoology to admit it as the type of a distinct order among fishes than to attempt to place it among defined groups. The strange combination of characters which it presents—a vertebrated animal without a brain, having the respiratory apparatus of an Ascidian Mollusk, and a ciliated intestinal cavity—if it does almost warrant its erection into the type of a class by itself, certainly is sufficient and more than sufficient to constitute it the type of an order in the lowest of the vertebrate classes.

BRASSES, MONUMENTAL. By 'a brass,' as the term is commonly used, is meant a plate of brass, which has been imbedded in a stone slab, and fastened down by being laid in melted pitch and riveted through the stone. The effigy of a person deceased is usually engraved on the brass plate; there is frequently a canopy over the head, and there are often armorial bearings, angels, saints, and other ornaments, together with inscriptions, sometimes on labels, sometimes round the border of the slab, but mostly below the feet of the effigy. These separate parts have been, in almost all cases, engraved on detached plates, each of which is inlaid in its own cavity of the stone. The engraved plates were not originally in the plain state in which they now appear, but were generally burnished and sometimes gilt, and the incised parts were filled with black or coloured resinous substances. The plates were sunk level with the surface of the stone, which was generally of a dark colour, and thus became an appropriate background, giving distinctness and relief to the engraved brasses, and adding to the beauty of the figures and ornaments. Slabs with brasses are commonly laid in the pavement of churches or cloisters, but are sometimes on table-tombs. As the art of making brass was not introduced into England till 1639, the plates are all of foreign manufacture, of the hard kind of brass formerly called latten.

The art of engraving the plates was probably brought to England from Flanders and France, as well as the plates themselves; early brasses still exist in this country which are known to have been engraved by Flemish artists, and there are many fine brasses still remaining in the churches of Flanders; those of France were nearly all destroyed during the Revolution, when they were converted into coin or cannon.

It is impossible to determine when monumental brasses were first introduced into England, most of the oldest specimens having doubtless been destroyed, but it was probably in the early part of the reign of Henry III. Brasses with dates as early as about 1240 are known to have been destroyed. Probably one of the earliest now remaining in England is that of Sir Roger de Trumpington, at Trumpington, in the county of Cambridge, who died in 1289. During the fourteenth century monumental brasses became more and more numerous: in the fifteenth century they were in still greater abundance; but towards the close of the sixteenth the number began to diminish, and in the reign of James I. the use of them had almost ceased. One of the latest specimens is a very fine brass of Harsnett, archbishop of York, who died in 1631: it is at Chigwell, in Essex. The number of brasses which now remain in England, though still considerable, is very small compared with what it has been. Many were destroyed when the monasteries were suppressed in the reign of Henry VIII.; many have been torn up, and sold as old metal; but the greatest destruction of them took place during the predominance of the Puritans, who regarded them as superstitious.

The effigy on a monumental brass is generally represented recumbent on the back, with the hands on the breast placed palm to palm, in the attitude of prayer; and this form applies equally to men and women; but occasionally the figure is represented standing or kneeling. The head usually rests on a cushion, which is sometimes supported by an angel on each side. Military noblemen are generally in full armour; ecclesiastics in the vestments peculiar to their orders; ladies have frequently a small dog lying at the feet. The canopies and other engraved architectural embellishments are frequently extremely elegant. The canopy is sometimes a pediment with pinnacles and finial; sometimes a foliated arch; and sometimes a foliated arch below a pediment; the canopy is sometimes isolated, and sometimes rests on slender pillars. Occasionally armorial bearings are placed on the pillars and spandrils, of which a specimen is shown in the article TOMB, P. C., in the beautiful brass of Eleanor de Bohun, in Westminster Abbey, wife of Thomas of Woodstock, duke of Gloucester, son of Edward III. The shields of arms, devices, and peculiarities of costume, appropriate each brass to its period in a remarkable manner. Each period has also a form of alphabetic character almost peculiar to itself, which, in the early brasses, is adhered to with singular uniformity. Some inscriptions in the Gothic letters are very handsome. Roman letters are rarely used before the reign of Henry VIII., and are generally inelegant enough. The Gothic forms continued to be used occasionally till a late period. Most of the early inscriptions are in Latin. French inscriptions occur generally from 1350 to 1400. English inscriptions afterwards became more common, but Latin still continued to be frequently used.

Monumental brasses in England have been most abundant in the eastern counties, partly perhaps in consequence of the contiguity of those counties to the Continent, whence the use of brasses seems to have been introduced, and partly of the want of stone suitable for the effigy in relief, for which the brasses appear to have been substituted. In Wales and the north of England brasses are comparatively rare. None have been found in Scotland; and only two in Ireland, which are of late date, in Dublin cathedral.

Specimens of monumental brasses are easily obtained by the process called *rubbing*. Paper of moderate thickness, tenacity, and softness, is laid upon the brass, and rubbed with a black or coloured material, which adheres to the paper where the brass is solid, leaving it in its original state where there are incisions, which of course offer no resistance to the rubber. With a little care a perfect fac-simile may be obtained. Shoemakers' heel-ball, which is a composition of tallow, wax, and lamp-black, has hitherto been found most convenient as a rubber; the operation is clean and easy. Paper of suitable quality and of the full size of a whole slab is manufactured on purpose, as well as suitable heel-balls.

Another material for making rubbings has recently been invented, which is composed of a yellow metallic powder mixed with the adhesive substance of which the rubber is composed, as the lamp-black is mixed with the tallow and wax. When the rubbing is made on a dark-coloured paper, a fac-simile is obtained not easily distinguishable from the original: the figure appears to be the brass itself, and the paper which remains unacted on by the rubber seems to be the stone slab in which the brass is imbedded.

The first collection of copies of brasses was made by Sir John Cullum, Craven Ord, and the Rev. Thomas Cole, not by rubbing in the manner just described, but by a rude process resembling copper-plate printing, which was afterwards worked over by the pen, and cost much time and labour. The collection was sold for 43*l*. to the late Francis Douce, and was bequeathed by him to the British Museum, where it is now in the print-room. In 1840 the first number was published of 'A Series of Monumental Brasses, extending from the reign of Edward I. to that of Elizabeth; by J. G. and L. A. B. Walker.' Parts I. to XV. have been published. The selection of specimens is very judicious, the plates are exceedingly accurate, and the work is accompanied by explanatory letter-press.

(This article has been abridged, with a few alterations and additions, from the *Penny Magazine*, Nos. 812 and 813.)

BRAY, SIR REGINALD, the reputed architect of Henry the Seventh's Chapel at Westminster, was the second son of Sir Richard Bray, one of the privy council to Henry VI. All that has been ascertained of his personal history is that he was greatly attached to the study of architecture, and stood in high favour with Henry VII.: therefore that he should be employed by that king to design the sumptuous structure intended for his own mausoleum was almost matter of course. Nevertheless, Bray's claim to the honour of so fine a work has been disputed, on no better grounds than that he did not live to see the building greatly advanced, the first stone being laid on the 18th of January, 1502 ('by the hands of John Islip, abbot of Westminster, Sir Reginald Braie, Kt. of the Garter, and others'), and he dying on the 5th of August in the following year. While his death within a year and a half afterwards proves nothing more than that he did not live to see his designs for the edifice fully realised, the fact of his assisting with the abbot in the ceremony of laying the first stone amounts to conclusive proof that he was the architect or designer of the fabric, it being the most unlikely thing imaginable that he would have taken an active share in such a ceremony had the building been the work of a rival artist. Besides, that Bray possessed talents equal to the occasion is beyond all doubt, it being admitted even by those who would reduce his fame, that he erected the nave of that other singularly beautiful structure, St. George's Chapel at Windsor, commenced by Edward IV. Sir Reginald's arms, crest, and device, R. B., and a hemp-break, occur in many places on the ceiling of that building, and in the south aisle there is a chapel still called after him, in which he was buried.

BREAD, BEER, AND ALE, ASSIZE OF. [Assize, P. C.]

BREAKWATER. [Plymouth, P. C.]

BREAST WHEEL. [Hydraulics, P. C., p. 384.]

BRECCIA. [Ossiferous Breccia and Caverns, P. C. S.]

BREVIA'RIUM ALARICIA'NUM is now the usual name of the code which was compiled at the command of Alaric II., king of the Visigoths, from the Roman law and the Roman jurists. It was completed A.D. 506, in the twenty-second year of his reign. The code was confirmed by the nobles and bishops, and signed by Anianus, the referendarius of Alaric, a circumstance from which the erroneous inference has sometimes been made that he was the compiler of it. The title Breviarium Alaricianum was only introduced in the sixteenth century: it was sometimes called Lex Romana, and sometimes Lex Theodosii, in respect of the most important part of its contents.

The contents of the Breviarium are formed of abbreviations or compilations from the following sources:—1, Codex Theodosianus, 16 books; 2, Novellae of Theodosius II., Valentinianus III., Marcian, Majorian, Severus; 3, The Institutions of Gaius; 4, The Receptae Sententiae of Paulus; 5, Codex Gregorianus; 6, Codex Hermogenianus; 7, Papinianus, lib. 1. Responsorum. Accordingly the code was composed of Imperial Constitutions, or Leges, as they are properly termed in the Breviarium, and of the writings of Roman jurists, which in the Breviarium are termed Jus.

This Code is of some value for the history of the Roman law, as it contains extracts from portions of the Roman law which are wholly or partially lost, as the work of Paulus, and from the first five books of the Theodosian Code, which however, owing to recent discoveries, are less imperfect than they were. The discovery of the Institutions of Gaius [Gaius, P. C.] has rendered that part of the Breviarium in which Gaius was epitomized of little value. The lacunae in Gaius cannot be filled up from the Epitome, because the compiler paid little attention to retaining the words of the original, but the Epitome shows what matters were discussed in those parts of Gaius where the MS. is defective. The whole of the Breviarium is contained the 'Jus Civile Antejustinianeum,' Berlin, 1815.

BREXIA'CEÆ, a natural order of plants belonging to Lindley's polycarpous group of monopetalous Exogens. This order contains at present but one genus, and was constituted by Lindley in the first edition of his 'Natural System of Plants.' The following is his description of the order:—Calyx inferior, small, persistent, 5-parted, æstivation imbricated; petals 5, hypogynous, imbricated in æstivation; stamens 5, hypogynous, alternate with the petals, arising from a narrow cup, which is toothed between each stamen; anthers oval, innate, 2-celled, bursting longitudinally, fleshy at the apex; pollen triangular, cohering by means of fine threads; ovary superior, 5-celled, with numerous ovules attached in two rows to placentæ in the axis; style 1, continuous; stigma simple; fruit drupaceous, 5-celled, many seeded; seeds indefinite, attached to the axis with a double integument, the inner of which is membranous; no albumen; cotyledons ovate, obtuse; radicle cylindrical, centripetal. The species are trees with nearly single trunks; the leaves are coriaceous, alternate, simple, not dotted, with deciduous minute stipules; the flowers are green in axillary umbels, surrounded by bracts on the outside.

Dr. Lindley remarks that the habit of Brexia is that of some Myrsinaceæ, especially of Theophrasta, from which it differs in being polypetalous and the stamens being alternate with the petals. Its relations are also strong with Rhamnaceæ and Celastraceæ, but its stamens are hypogynous, and its seeds indefinite. Some resemblance to Anacardiaceæ may be seen in the resinous appearance of the young shoots and in its habit. It agrees with Pittosporaceæ in its hypogynous definite stamens, its polyspermous fruit, and alternate undivided leaves. There are three species of Brexia, all of them elegant trees with a fine foliage. They grow well in a mixture of turfy loam and peat, and cuttings with their leaves not shortened strike readily in sand under a hand-glass in heat, or a leaf with a bud attached will grow. The leaves are covered with a resinous matter which causes rain to run off them immediately, and thus induced Noronha to give these plants the name of Brexia, from Brexis (Βρέξις), which signifies 'a wetting.' In gardens they are commonly called Theophrastus, but they differ considerably from that genus. All the species are natives of Madagascar. (Loudon, *Encyclopædia of Plants*; Lindley, *Natural System*, 2nd edit.; Don, *Gardener's Dictionary*.)

BRIBERY. [Election Committees, P. C. S.]

BRICK-MAKING BY MACHINERY. Within the last few years great improvements have been made in brick-making, mainly by the substitution of machinery for hand-labour in many of the processes. It has been found in some of the brickwork of railway arches and tunnels that the outer or most exposed bricks have a tendency to decay, from the alternations of temperature and moisture to which they are subjected; and it is as a means of lessening that tendency, by increasing the solidity and closeness in the adhesion of the clay of which the bricks are formed, that machine-made bricks have often been recommended.

About 1836 Messrs. Heaton of Birmingham, who had before introduced a mode of tempering the brick-clay by rolling, devised a machine for moulding the bricks as well as preparing the clay. The machine consisted of a horizontal wheel, round the margin of which were arranged a number of brass moulds, the proper size and shape for bricks. The bottom of each mould was loose and moveable vertically by a small apparatus beneath, connected with a little wheel. The wheels of all the moulds worked on a circular railway, having such an inclination as to leave the bottom of the mould in its proper position when at one part of the circular course, but lifting it up to the top of the mould when the latter had travelled round half a circle. When any of the moulds came to a particular part of the circuit, a loose board was put into it by an attendant, a stream of water was forced into it from a forcing pump, and the tempered clay, coming from the rollers through which it had been pressed, and passing through a hopper, was forced by a plunger into the mould; then, the mould advancing one step in its circuit, a knife-edge sliced off all the superfluous clay, and rendered the upper surface smooth. The mould continued to travel on in its circular path, and its bottom, with the newly-made brick, became lifted up gradually; until, by the time the half-circuit had been made, the brick was lifted wholly out of the mould: a man then took off the brick, and prepared it for burning in the usual manner. It was a necessary feature in this arrangement, that all the moulds were in different states or stages at any one instant of time; half of them contained bricks, half contained none; one was just receiving its supply of clay, while another, exactly opposite, was yielding a finished brick to the hands of the workman; and of the rest, some were having the loose bottoms slowly raised to elevate the bricks resting on them, while others were gradually resuming the form fitted for the reception of clay.

In 1838 M. Terrason introduced a mode of making bricks differing considerably from the above. There are three parts of the apparatus, destined respectively to kneading the clay, moulding the bricks, and transporting them when made to a yard or depository. In the first process, two horses, attached to the two arms of a lever, turn a large wheel connected with a trundle, which impels a vertical shaft working in a cylinder; the shaft being furnished with spiral cutters. The moistened clay being put into the cylinder, the cutters by their rotation knead it, divide it, and work it up most completely, so that it arrives at the bottom of the cylinder in a uniform state; it then passes out at a hole in the lower part of the cylinder in a continuous rod or fillet. The second machine, destined to mould the bricks, is placed near the former one, and receives the fillet of clay as it exudes from the cylinder. The mould for the bricks is simply an oblong channel or hollow frame, having neither cover nor bottom, but one roller working above it and another below it. The clay enters this trough, the width and height of which give the proper width and thickness of a brick; while the two rollers, pressing the clay above and below as it enters, give the proper flatness of form to the upper and lower surfaces, compress the clay into a solid consistency, and expel the superfluous portions. The clay, in fact, passes through a kind of rolling-press. When the oblong trough has been removed, by reciprocating action given to it by machinery, from this press, the board on which the clay rests becomes released from the side-boards of the trough; then on passing under a particular part of the apparatus, the oblong fillet of clay is cut into ten or twelve bricks, by the descent of as many wires stretched across above them. By means of a long row of cylinders, working on an inclined plane, the board of bricks is carried to any convenient distance, where they are deposited previous to burning.

In the same year another machine was invented by Mr. Jones, in which the clay, being mixed with a less quantity of water than usual, was kneaded in a 'pug-mill' to a stiffer consistence than ordinary, thereby rendering a shorter period for drying sufficient. The rate at which the bricks were made by this machine was stated to be from one to two thousand per hour.

The Marquis of Tweeddale's invention, which bears a considerable resemblance in principle to that of M. Terrason, arose out of a wish on the part of that nobleman to aid in forwarding improvements in the draining of land for agricultural purposes. It has been ascertained that the best mode of removing the surplus water from land is by means of drains or conduits formed of tiles, and laid beneath the surface of the ground; and it was with the hope of enabling these tiles to be made quickly and cheaply that the machine in question was invented. A very few words will suffice to explain in what degree this machine differs from that of M. Terrason. The clay, in the first place, is forced between two rollers placed half an inch apart, so as to crush any stones contained in it; and is then worked up to the proper consistence in a revolving cylinder. The clay passes between two cylinders, which give it the proper thickness for a tile, while two side pieces give the requisite width: it traverses an endless apron which carries it to a piece of apparatus where the long slid of clay is bent to the requisite concave form, and where a descending wire cuts off, by separate movements and at successive instants, pieces of the proper length for tiles. The action of the machine is continuous; for the long ribbon of clay is formed at one end as fast as it is cut off at the other, and by modifying the adjustments of the apparatus, the pieces so cut off may have the proper form for draining-tiles, house-tiles, flat roofing-tiles, or bricks. One man and two boys, with the aid of this machine, can make in one day ten thousand drain-tiles, or twelve thousand roofing-tiles, or twenty thousand flat tiles for the draining-tiles to lie upon; and the tiles so made are said to be stronger, more impervious to water, and smoother than those made by hand.

From about the year 1840 to 1842 the suggested or patented improvements in brick-making were very numerous; but they do not call for lengthened description. In Mr. M'Nab's method there is a sliding-frame beneath the bottom of the mill, in which the clay is ground; and this frame contains two brick-moulds, so arranged that while one of them is under an opening in the bottom of the mill, receiving clay from thence, the other is outside the mill delivering a moulded brick; the two moulds being alternately placed in communication with the mill. The bottom of each mould consists of a moveable bed, which, when the mould has arrived outside the mill by the movement of the frame, forces the brick up out of the mould, to be removed by an attendant. Another method introduced about the same time is nearly on the principle of the Marquis of Tweeddale's, but differs from it in the mode whereby a screw forces the clay out of the mould, and also in the way in which the wires descend to cut it into bricks. A method patented by Messrs. Cook and Cunningham is on a different principle. Here a sliding mould-frame, containing two moulds, is applied to the side of the mill in which the clay is prepared. The clay is forced, by the rotation of arms within the mill, through an opening into a box; and a piston working in this box presses the clay into one of the moulds in the sliding frame. When one of the moulds has been thus filled, the frame moves forward, which brings the other mould under the box, while the first mould is carried over an empty moveable mould placed on a table; a piston presses the brick into the empty mould, and the mould thus set free returns to receive a fresh supply from the box. The mode is thus so far a continuous one—that while one mould is emptying its contents into the moveable one, the other is receiving a fresh supply at the box; while a boy receives the moulded bricks from the moveable mould as fast as they are deposited in it. Mr. White's patent, of the same year, related principally to an improvement in the mode of supplying the clay from the mill, in the Tweeddale machine.

Mr. Gibbs has proposed a method in which both the materials of the bricks and the mode of manufacture are taken into account. He proposes to use Merstham sand or pulverized Merstham sandstone, combined with London clay or pipe-clay; in proportions varying according as bricks, tiles, or pottery are the object of manufacture. The mode of making bricks under the patent embraces two or three modifications, of which one consists in rolling the clay out into a sheet of uniform thickness, then cutting it by machine-worked knives or wires into brick-shaped pieces, and compressing these by a separate machine. An American method introduced more recently by Messrs. Beach and Lukens, seems to be founded mainly on the plan of Messrs. Heaton, but to contain a provision for transporting the bricks to any convenient spot by means of an endless belt.

Mr. Prosser has introduced a method of making bricks, tiles, and small articles of earthenware, from earth or clay almost in a state of dryness. This subject is noticed in connection with some of the recent inventions relating to Mosaic Pavements. [P. C. S.]

A communication was made to the 'Surveyor, Engineer, and Architect,' a year or two ago, concerning the use of *floating* bricks. The Romans were acquainted with the use of bricks which would float in water; and M. Fabbroni, in 1790, discovered a kind of earth which he thought to be fitted for this purpose. It occurred near Castel del Prano in Sicily; and the earth consisted of silica, clay, magnesia, lime, iron, and water. Bricks made from it floated in water, conducted heat with extreme slowness, and could not be fused in an ordinary fire. It is proposed in the paper just alluded to, that bricks so formed would present many advantages on ship-board, in all erections connected with furnaces and fire-places; and also that a novel kind of ornamental pavilions or houses might be formed on lakes in pleasure-grounds; the base being a platform of durable wood, and the superstructure of these buoyant bricks. The *weight* of the bricks, made by any method, is an important matter in relation to the purpose for which they are to be applied. In a conversation at the Institute of Civil Engineers, after the reading of a paper relating to bricks, several engineers objected to the use of bricks made wholly by machinery, on the ground that their extreme compactness made them heavier and more costly than common bricks, and delayed their drying. Mr. Hunt has, for this reason, brought into use a contrivance something like that of the Marquis of Tweeddale, but where hand-power and slight pressure are substituted for machine-power and heavy pressure. The decision as to the general introduction or not of machine-made bricks, will probably depend, as in most other cases, on the relative expense in comparison with the hand method; hitherto they have been rather too costly.

BRIDGES are of two classes, public and private. Public bridges may be considered either as county bridges or as highways, although the principle of that distinction does not seem very clear. Every county bridge is a highway, inasmuch as it is a bridge over which a highway passes; it is therefore in that respect strictly a highway: so also is every other public bridge over which a highway passes. The usual distinction drawn between them is derived from the nature of the space over which the bridge gives a passage. A county bridge, or, in other words, a bridge which the county is bound to repair, is usually defined to be 'a common and public building over a river or water flowing in a channel more or less definite; whether such river or channel is occasionally dry or not. This is evidently a very loose definition, for it does not prescribe the width of the river or the nature of its channel; but it seems clear that a county bridge must pass over a water, as the county would certainly not be bound to repair a bridge erected across a ravine, or over an antient road crossed by a new road, having no reference to water. A county bridge may be either a foot, horse, or carriage bridge. A private bridge is any bridge which does not answer the description of a county bridge or a public highway. It is subject to no other laws than the general laws of property.

The liability to repair a county bridge depends either on the common law or on the statute law. By the common law the expense of maintaining both county bridges and highways is to be defrayed by the public, this having been part of the trinoda necessitas to which every man's estate was formerly subject. [Trinoda Necessitas, P.C.] But the burden of repair of county bridges is thrown on the whole county, that of highways on the inhabitants of the parish wherein such highways lie. Primâ facie, therefore, by the common law the whole county is liable to repair a county bridge; but they may rebut this presumptive liability by showing that for some reason or other the burden has been shifted from them on another. They may either show that a hundred, or a parish, or some other known portion of a county is by custom chargeable with the repair of a bridge erected within it; or that some person, individual or corporate, is liable to that expense. In the case of private individuals, such liability may depend either on tenure, that is, by reason that they and those whose estates they have in the lands or tenements are liable in respect thereof;—or on prescription. In the case of corporate bodies, on prescription only. With regard to corporate bodies, Lord Coke says, 'If a bishop or prior, &c. hath at once or twice of almes repaired a bridge, it bindeth not (and yet is evidence against him, until he prove the contrary); but if time out of mind they and their predecessors have repaired it of almes, this shall bind them to it.' (2 *Inst.* 700.) Any bridge answering the definition above given of a county bridge may become a charge upon the county even though not originally built by the county; as, for instance, if it be built by the crown or by a private individual: but not every bridge which answers the above definition is therefore chargeable to the county for repair, unless it be also used by and useful to the public. The public use and benefit seem to be the criterion: and if a private individual build a bridge of any sort, which is principally for his own benefit and only collaterally of benefit to others, he will be liable to the repair, and not the public: but where the public derive the principal benefit, they must sustain the burden of repairing it, on the ground that it would greatly discourage public-spirited persons from erecting useful bridges if they were ever after to be burdened with the costs of repair. The county are even liable to the repair of a public bridge erected by commissioners under an act of parliament, even though the commissioners are empowered to raise tolls in order to support it, or though other funds are provided for the repairs; unless there be a special provision for exonerating them from the common law liability, or transferring it to others. This common law liability of a county to repair a public bridge is so strong, that although it has been erected and constantly repaired by trustees under an act of parliament, and although there are funds for the repairs, the county are still liable to it. And where trustees under a turnpike act build a bridge across a stream, where a culvert would have been sufficient, but a bridge was better for the public, it was held that the county could not refuse to repair such bridge on the ground that it was not absolutely necessary.

The first statute on this subject is the 22 Henry VIII. c. 5, called 'the Statute of Bridges.' This statute is merely in affirmance of the common law. In course of time, owing to the indistinctness of the principle on which public bridges were divided into county bridges and highways, it was found expedient to pass an act to clear up the doubts and difficulties arising from this principle. In order, therefore, to ascertain more clearly the description of bridges hereafter to be erected, which inhabitants of counties shall and may be bound or liable to repair and maintain, it is enacted by stat. 43 Geo. III. c. 59, § 5, that no bridge hereafter to be erected in any county at the expense of any individual or private person, body politic or corporate, shall be deemed to be a county bridge, unless it shall be erected in a substantial and commodious manner under the direction or to the satisfaction of the county surveyor, or person appointed by the justices of the peace at quarter-sessions to superintend and inspect the work. This act applies only to bridges newly built, and not to those repaired or widened.

It was found in very early times that many practical difficulties arose from the indistinctness of the common law as to the precise limits of a bridge—that is to say, as to the precise point where it ceased to be a bridge and began to be a highway; and vice versâ. This indistinctness gave rise to many disputes about the liability to repair, and it was found expedient to enact, by stat. 22 Henry VIII. c. 5, § 9, that such part and portion of the highways as lie next adjoining to the ends of any bridges within this realm, distant from any of the said ends by the space of 300 feet, be made, repaired, and amended as often as need shall require; and that the justices of the peace should act respecting the repairs of such highways as they were empowered to act respecting the bridges themselves. The effect of this statute was merely to limit or fix the length of road which the county was to repair at 300 feet. By the common law the county was bound to repair the roadway at the end of every county bridge, but the length was not precisely determined till the passing of the above statute.

But this liability of the county has been very much narrowed by the stat. 5 & 6 Will. IV. c. 50, § 21 (the General Highway Act), which, with respect to bridges to be built after the 20th of March, A.D. 1836, enacts, 'that if any bridge shall hereafter be built, which bridge shall be liable by law to be repaired by and at the expense of any county, or part of any county, then and in such case all highways leading to, passing over, and next adjoining to such bridge shall be from time to time repaired by the parish, person, or body politic or corporate, or trustees of a turnpike road, who were by law, before the erection of the said bridge, bound to repair the said highways: provided, nevertheless, that nothing herein contained shall extend to exonerate any county or part of any county from repairing the walls, banks, or fences of the raised causeways and raised approaches to any such bridge or the land arches thereto.'

Till late years no persons could be compelled to build or to contribute to the building of any new bridge, except by act of parliament; and even when the county was bound to repair a bridge, it was not therefore bound to widen it. Nor could the inhabitants of a county by their own authority change the situation of a bridge. But by the stats. 14 Geo. II. c. 33, § 1, and 43 Geo. III. c. 59, § 2, the justices in quarter-sessions are enabled to compel the county to widen or change the situation of old bridges, or build new ones. (See also 54 Geo. III. c. 90, which extends some of the provisions of those statutes.)

With respect to the appointment of surveyors of county bridges, their duties and powers, and the modes in which such powers are to be exercised, see stats. 22 Hen. VIII. c. 5, § 4; 43 Geo. III. c. 59 (coupled with stat. 5 & 6 Will. IV. c. 50); 54 Geo. III. c. 90; 55 Geo. III. c. 143. The various provisions of these statutes are very numerous.

For the mode of taxing and collecting the moneys necessary for the repairs of bridges and the highways at the ends thereof, see stat. 22 Hen. VIII. c. 5; Anne 1, stat. 1, c. 18; 12 Geo. II. c. 29; 52 Geo. III. c. 110; 55 Geo. III. c. 143.

In case of non-repair or nuisances, either to bridges or highways, the modes of prosecution are the same: namely, by criminal information, presentment, or indictment. Generally speaking, an action cannot be maintained against the county by an individual for the non-repair of a county bridge, unless in some cases of special damage accruing to such individual from the non-repair.

A criminal information is very rarely resorted to, and only in cases of either very aggravated neglect or where there seems to be little chance of obtaining justice by preferring an indictment.

The presentment of a public bridge for non-repairs, &c. may by common law be before the Queen's Bench or at the Assizes. By the stat. 22 Hen. VIII. c. 5, § 1, presentments may be made before the justices in general sessions, and they may proceed therein in the same manner as the judges of the Queen's Bench were in the habit of doing, 'or as it should seem by their directions to be necessary and convenient for the speedy amendment of such bridges.' See also for minor regulations respecting presentments, 1 Anne, sess. 1, c. 18; 12 Geo. II. c. 29, § 13; 55 Geo. III. c. 143, § 5.

The indictment of a county bridge is subject to the same rules as any other indictment. And though the whole county be liable to the repairs, any particular inhabitant of a county, or tenant of land charged to the repairs of a bridge, may be made defendant to an indictment for not repairing it, and be liable to pay the whole fine assessed by the court for the default of repairs, and shall be put to his remedy at law for a contribution from those who are bound to pay proportionable share in the charge.

The malicious destruction or damaging of public bridges is said to be punishable as a misdemeanour at common law, since it is a nuisance to all the king's subjects. By 7 & 8 Geo. IV. c. 30, § 13, it is enacted, 'that if any person shall unlawfully and maliciously pull down or in any wise destroy any public bridge, or do any injury with intent and so as thereby to render such bridge, or any part thereof, dangerous or impassable, every such offender shall be guilty of felony.'

(For further information see Lord Coke's *Second Inst.*; Burn's *Justice*; Russell *On Crimes*. For the law of bridges, viewed as highways, see WAYS, P. C.)

BRIDGEWATER TREATISES, a series of works which were published in accordance with the last Will of the Right Honourable and Reverend Francis Henry, Earl of Bridgewater, who died in February, 1829. The Will, dated February 25, 1825; directed certain trustees to invest in the public funds 8000*l.*, which sum, with the dividends accruing thereon, was to be at the disposal of the President, for the time being, of the Royal Society of London, to be paid to the person or persons nominated by him. The testator further directed, that the person or persons selected by the said President should be appointed to write, print, and publish 1000 copies of a work 'On the power, wisdom, and goodness of God, as manifested in the creation; illustrating such work by all reasonable arguments, as, for instance, the variety and formation of God's creatures in the animal, vegetable, and mineral kingdoms; the effect of digestion, and thereby of conversion; the construction of the hand of man; and an infinite variety of other arguments; as also by discoveries antient and modern, in arts, sciences, and the whole extent of literature.' He also desired that the profits arising from the sale of the works so published should be paid to the authors of the works.

The then President of the Royal Society, Davies Gilbert, requested the assistance of the Archbishop of Canterbury and of the Bishop of London, in determining on the best mode of carrying into effect the intentions of the testator. Acting with their advice, he appointed eight gentlemen to write separate treatises on the different branches of the subject, which have been published, and are as follows:—

1, By the Rev. Thomas Chalmers, D.D. 'The Adaptation of External Nature to the Moral and Intellectual Constitution of Man,' 2 vols. 8vo., Glasgow, 1839.

2, By John Kidd, M.D. 'The Adaptation of External Nature to the Physical Condition of Man,' 8vo. Lond., 1837.

3, By the Rev. William Whewell. 'Astronomy and General Physics considered with reference to Natural Theology,' 8vo., London, 1839.

4, By Sir Charles Bell. 'The Hand, its Mechanism and vital Endowments, as evincing Design,' 8vo., London, 1837.

5, By Peter Mark Roget, M.D. 'Animal and Vegetable Physiology, considered with reference to Natural Theology,' 2 vols. 8vo., London, 1840.

6, By the Rev. Dr. Buckland. 'On Geology and Mineralogy,' 2 vols. 8vo., London, 1837.

7, By the Rev. William Kirby. 'On the History, Habits, and Instincts of Animals,' 2 vols. 8vo., London, 1835.

8, By William Prout, M.D. 'Chemistry, Meteorology, and the Function of Digestion, considered with reference to Natural Theology,' 8vo., London, 1834.

The Earl of Bridgewater also left upwards of 12,000*l.* to the British Museum, the annual income arising from which he directed to be employed in the purchase of manuscripts, and in taking due care of them for the use of the public.

BRIEVE, a term of frequent use in the law of Scotland, which, like the English brief, has a common root with the German brief, a letter or written paper. Its general character is that it contains permission or directions to make an inquiry regarding certain matters. It would appear that when the supreme civil court consisted of a committee of Parliament, permission to pursue before such a body was granted by brieve from the Chapel Royal of Chancery, containing the questions on which a decision or answer was required. Of the inquiries now conducted by brieves, the most important is the inquest for service of heirs. This form is necessary for feudally investing an heir in his ancestor's landed property. If the ancestor was himself feudally invested, the heir sues out a brieve from Chancery, directed to the sheriff of that county where the lands lie, or if they lie in different counties, to the sheriff of Edinburgh, requiring him to empanel a jury, and through their finding to return answer to certain questions. The brieve and corresponding answer, or 'Retour,' set forth the death of the person who was last invested in the property; the shape, whether as heir at law or by special provision, in which the heir succeeds, &c. This process is termed a Special Service. If the last proprietor was not feudally invested, the process is called a General Service, or a General-special Service: the former, when the claimant is heir at law; the latter, when he claims under any particular provision. In both these kinds of service, the brieve is the same as that in a special service, but the retour leaves the particular questions unanswered. Where there is more than one person claiming the character of heir, separate brieves may be taken out, and a competition may take place before the jury, which may be, and generally is, carried into the Court of Session. The other brieves known in the law of Scotland are:—the brieve of Tutory, by which an inquiry is made as to the person legally entitled to be tutor to a minor pupil, or, as it is termed in England, an infant; the brieves of Idiotcy and Furiosity, by which inquiry is made as to the question of his imbecility or insanity, before a person is judicially deprived of the management of his affairs; the brieve of Terce, for assigning the portion of the deceased husband's property, which is to be the widow's terce; the brieve of Division, for settling the claim of heir's portioners; and the brieves of Lining and of Perambulation, for settling disputed boundaries.

BRIGGS, HENRY PERRONET, R.A. This distinguished painter, both in history and portrait, died in London, in January, 1844, aged fifty-one. He was of a Norfolk family, and was related to Opie the painter. He commenced his career as a portrait-painter, and first appears as an exhibiter on the books of the Royal Academy in 1814. In 1818 he exhibited a picture of 'Lord Wake of Cottingham setting fire to his castle, to prevent a visit from King Henry VIII., who was enamoured of his wife.' In the year following he exhibited a subject from Boccaccio (Gior. viii. Nov. 3), representing Calandrino, a Florentine painter, thinking he had found the 'Elitropia,' and thereby become invisible, pelted home by his companions Bruno and Buffalmacco. These were followed by others of a higher class, as Othello relating his adventures to Desdemona; the first Interview between the Spaniards and the Peruvians; and George III. on board the Queen Charlotte, presenting a sword to Earl Howe, after the victory of the 1st of June, 1794. The last picture was presented in 1825 by the British Institution to Greenwich Hospital. In 1831 he exhibited a large picture of the antient Britons instructed by the Romans in the Mechanical Arts, for the Mechanics' Institute at Hull. He was elected an Academician in the following year, from which time he was nearly exclusively employed in portrait-painting. His portraits are very effective as regards colour; but the colouring is rather conventional, and the features are not sufficiently modelled. Many of the nobility have been painted by Briggs, and also the following well-known persons:—Sir S. Meyrick, Baron Alderson, Sir Fowell Buxton, Rev. Sidney Smith, Mrs. Opie, Mrs. Siddons, Charles Kemble, Duke of Wellington, and many others. (*Art Union*, March, 1844.)

BRIL, PAUL, a celebrated landscape painter, was the younger brother and pupil of Matthew Bril, whom he greatly surpassed. He was born at Antwerp, according to Van Mander, in 1556, and received his first instruction from D. Wortelman; but having heard of the success of his brother at Rome, who was in great esteem there as a landscape painter during the pontificate of Gregory XIII., Paul joined him at Rome, and soon became not only a sharer of his brother's prosperity, but acquired a much greater reputation there. Matthew died in 1584, aged 34, and from that time Paul pursued an unrivalled career at Rome. No Italian had up to this period turned his attention exclusively to landscape with success, and Paul's ability was the more valued. He executed several large landscapes in oil, in the apartments of the Pope and other dignitaries of the church; in many cases, views of the villas or summer residences of his employers, all painted from nature, views, no doubt, in their town residences, if well executed, calculated to afford the highest gratification. He painted landscapes also in several churches, some in fresco, and of very large dimensions. In many of his works he introduced figures from the stories of ancient mythology, and Annibal Carracci is said to have sometimes painted the figures. He painted also many small easel pictures, often on copper, which are very highly finished; the foregrounds are fresh and bold, and the distances are well managed. His masterpiece was considered a large landscape in fresco, in the Sala Clementina in the Vatican, painted in 1602 for Clement VIII., and representing the Martyrdom of St. Clement: it was sixty-eight feet long and of considerable height. Paul died at Rome in 1622: his age and death are differently given by Baldinucci, who says he died in 1626, aged 72.

Several of Paul Bril's pictures have been engraved, and he executed a few etchings himself. There is a print of him by De Jode after a portrait by Vandyck.

(Van Mander, *Het Leven der Schilders*, &c.)

BRITISH INDIA. [INDIA, P. C. S.]

BRITISH HUSBANDRY. [HUSBANDRY, P. C.]

BRIZA, a genus of grasses [GRAMINACEÆ, P. C.] belonging to the tribe Festucineæ, of that order. It has nearly equal, broad, 3-ribbed glumes; 3-8 flowers densely imbricated in a short distichous spikelet; the outer palea navicular, heart-shaped, obtuse, rounded on the back, unarmed; the glumes and paleæ membranous with a scarious margin; terminal styles. Two species of this grass are natives of Great Britain, the *B. minor* and *B. major*. They are known by the common names of Quaking-grass and Maiden's-hair. Their dense clusters of flowers are hung upon the ends of a very delicate filamentous peduncle, forming an elegant panicle which shakes with the slightest breath of air, hence the name quaking-grass. Both the species grow in pastures, but do not yield much nutriment for animals, which feed upon it.

(Babington, *Manual of Botany.*)

BRI'ZIO, FRANCESCO, a distinguished Bolognese painter, and one of the best of the scholars of the Carracci, was born at Bologna in 1574. He was a journeyman shoemaker until his twentieth year, when by the permission of an uncle, he was allowed to learn painting under Passerotti. He however soon made sufficient progress to perceive that the school of Ludovico Carracci was a surer road to success than the instruction of Passerotti, whom he accordingly left, and in the school of the Carracci he became a favourite of both Ludovico and Agostino, for he devoted himself to engraving as well as painting. In painting also, Brizio did not, as is too often the case, restrict his studies to the human figure and its draperies, but he divided his labours between the figure, perspective, architecture, and landscape. He was superior in these accessory parts of painting to all his Bolognese contemporaries, and, says Lanzi, was, with the exception of Domenichino, the most universal genius of the school of the Carracci. His masterpiece is the Coronation of an image of the Virgin in the church of San Petronio. He died in 1623, aged 49. His son Filippo Brizio, and Domenico degli Ambrogi, called Menichino del Brizio, were his principal scholars, and were both very able painters.

Gandellini describes many prints by Brizio after the Carracci, Correggio, and others; 31 are noticed by Bartsch in the 'Peintre-Graveur.' They are executed in the style of Agostino Carracci, are scarce, and are much prized by collectors. Brizio is better known for his prints than his pictures.

(Malvasia, *Felsina Pittrice;* Gandellini, *Notizie Istoriche degli Intagliatori*, &c.; Lanzi, *Storia Pittorica*, &c.)

BROME, RICHARD, originally a servant of Ben Jonson, gained a well-merited reputation as a comic dramatist. Of his life hardly any particulars are known; and it is only by inference that he is set down as having died in 1652. His extant comedies are fifteen. The earliest of these, 'The Northern Lass,' was printed in 1632. Five others appeared in one volume, in 1653; and five more in a second volume, published in 1659. His 'Jovial Crew, or the Merry Beggars,' has a place in the tenth volume of Dodsley's 'Old Plays.' Both it and several of the others are good specimens of dramatic composition in the school of Brome's old master. They possess, in particular, great force in the representation of character. Altogether he may fairly be ranked among the best of our old dramatists of the second class.

BROME, ALEXANDER, born in 1620, became an attorney in London. He was attached to the royalist party throughout the civil wars; and, while his bacchanalian poems were popular among the cavaliers, he rendered them more direct service by his satirical attacks on their enemies. He was the reputed author of most of the songs and epigrams in which the Rump Parliament was held up to ridicule. A collected edition of his poems, original and translated, was published in 1661. Several of his smaller pieces, lively and playful, though not very vigorous or original, are given by Campbell in his 'Specimens.' Among his compositions were contributions to a translation of Horace, by Cowley, Fanshaw, and others. He left also a comedy, 'The Cunning Lovers,' printed in 1654. He died in 1666. The first collected volume of Richard Brome's plays was edited by him.

BROMIDE OF POTASSIUM—*Medical Properties of.* This salt may be formed by direct combination of its constituent ingredients by dissolving bromine in liquor potassae, a method preferable to the indirect and circuitous plan ordered in the London Pharmacopœia. The crystals, which are destitute of water of crystallization, form transparent cubes or quadrangular prisms, resembling those of iodide of potassium (from which they may be distinguished by evolving, when added to sulphuric acid, not violet fumes, but red suffocating ones, and by the solution giving to starch an orange colour). They are persistent at the ordinary temperature of the air, decrepitate by heat, are very soluble in water, both cold and hot, especially the latter, and sparingly so in alcohol. The taste is penetrating, saline, and cooling, not unlike common table-salt, which the crystals resemble in form, but from which it is most necessary to distinguish them, owing to the great potency of the bromide of potassium. In case of accidental poisoning by bromide, vomiting should be immediately excited.

Bromine, in its action on the human system, resembles iodine, but is more potent, and the same holds respecting the greater activity of bromide of potassium, compared with iodide of potassium. It is requisite therefore to give it in smaller doses and to suspend its use from time to time.

Bromine, mostly in the form of hydrobromate of magnesia, having been found in sea-water, and in many saline springs, such as that of Epsom, and that of Pittville, Cheltenham, and in most springs the water of which resembles sea-water, except Droitwich, either alone or associated with iodine, particularly those of Kreuznach in Rhenish Prussia, it was inferred that it would prove useful in the treatment of scrofulous diseases. It may be given in the form of pills, or preferably in solution with excess of potass, in diluted liquor potassae. It is in this latter way that it has proved most useful. It has also been used in baths, and likewise as an ointment.

The fact that many enlarged glands have lessened under its employment, led Dr. Williams to surmise that it would prove beneficial in enlargements of the spleen. He is sanguine of good results, but the number of cases in which it has been used is insufficient to warrant any general conclusion; and as this condition mostly happens in persons whose health is much impaired, either from a long residence in hot countries or from having long suffered from agues, little can be expected from any agent. (Dr. Robert Williams, *Elements of Medicine*, i. p. 333.)

A bromide of iron has been formed, which is worthy of attention, as well as a bromide of mercury: there is likewise a bi-bromide of mercury.

BROMLEY, WILLIAM, a distinguished line-engraver, born at Carisbrooke in the Isle of Wight, in 1769. He served his time with an engraver of the name of Wooding, and in London soon attracted the notice of several eminent painters by his works. He was very much esteemed by Stothard, Flaxman, Fuseli, and Sir Thomas Lawrence. The most popular of his early works are the prints to 'Macklin's Bible' and a 'History of England' after Stothard. He engraved several portraits after Sir T. Lawrence, including two of the Duke of Wellington, one on horseback, and Young Napoleon. He engraved also the Woman taken in Adultery, after Rubens. He was latterly almost exclusively engaged by the Trustees of the British Museum, especially in engraving the Elgin Marbles from drawings made by the late H. Corbould. Bromley survived his son John Bromley, likewise an eminent engraver, three years; he died in London in 1842, having been for many years an associate engraver of the Royal Academy of London, and a member of the Academy of St. Luke at Rome.

John Bromley was born in Chelsea in 1795. He followed his father's profession, but he chose a different branch of it; his works are in mezzotinto, in which line he has had few superiors. He died in 1839, aged only 44, leaving a widow and a large family to lament his loss.

Among his principal works are the following:—The Trial of Lord William Russel, after Sir G. Hayter; Lady Jane Grey refusing the Crown, after G. R. Leslie, R.A.; the Monks preaching at Seville, after J. Lewis; the Duke of Athol hunting in Glen Tilt, after E. Landseer, R.A.; the Trial of Queen Caroline, after Sir G. Hayter; and the Reform Banquet, after B. R. Haydon.

(*Art-Union Journal*, June, 1839; December, 1842.)

BROMUS. [Brome-Grass, P. C.]

BRONCHO'TOMY. [Tracheotomy, P. C.]

BRÖNDSTED, PETER OLUF, a distinguished Danish archaeologist, was born on the 17th of November, 1781, at Horsens in Jütland, where his father was pastor. He afterwards studied at Copenhagen, and in 1806 he accompanied his friend Koes to Paris. After a stay of two years in that capital, both friends went to Italy. In 1810 a party consisting of Bröndsted himself, Koes, the architect Haller von Hallerstein, Linckh, and Baron Stackelberg, undertook a journey to Greece, where Bröndsted and Stackelberg in particular made very extensive excavations, by which great light was thrown upon various subjects of antiquity. In 1813 Bröndsted, on his return to Copenhagen, was appointed professor of Greek literature in the university of that city. He mainly occupied himself with preparing the results of his investigations in Greece for publication, but as he found that the literary resources of Denmark would not enable him to carry out his plan as he wished, the Danish government was prevailed upon to appoint him agent at the papal court of Rome, which post he entered upon in 1818. After having settled at Rome, he visited, in 1820 and 1821, the Ionian Islands and Sicily; and when the artistic portion of his work was completed, he obtained leave to visit Paris, to begin the printing of the work itself. From Paris he made a journey in 1826 to England, and the year after to Denmark, where he was honoured with the title of counsellor of legation. In

1832, on his return to Copenhagen, he was appointed Director of the Royal Museum of Antiquities, and ordinary professor of philology and archaeology. In 1842 he was Rector of the university; but, in consequence of a fall from his horse, he died in the same year, on the 26th of June.

The principal works of Bröndsted are his 'Travels and Investigations in Greece, with Representations and Explanations of newly discovered Monuments,' which were published simultaneously in German and French, Paris, 1826-30, 2 parts, 4to. After the publication of this work he was severely attacked in the journal called 'Hermes' (vol. xxxii.), for having made too free use of Villoison's MSS. in the royal library at Paris, especially with respect to the island of Ceos. Bröndsted defended himself in a pamphlet entitled 'Ueber den Aufsatz im Hermes: ein Beitrag zur Geschichte der Pasquille,' Paris, 1830; another defence had been published the year before by his friend Hage, under the title 'Bröndsted und Villoison,' Copenhagen. Among his numerous antiquarian dissertations, the two principal were published in English, 'A brief description of Thirty-two painted Greek Vases found near Vulci,' London, 1832, and 'The Bronzes of Siris,' London, 1836, fol., published at the expense of the Society of Dilettanti. A translation, in German, of this work with some additions, &c. by the author, appeared at Copenhagen in the following year, 4to., 1837. Two other works of his may be mentioned as of considerable value to the historian, first, 'Beiträge zur Dänischen Geschichte aus Nordfranzösischen Manuscripten des Mittelalters,' Copenhagen, 1817-18, 2 parts, and secondly, 'Denkwürdigkeiten aus Griechenland in den Jahren 1827 und 28, besonders in Militärischer Beziehung,' Paris, 1833. This last however was only edited by Bröndsted, the substance being taken from the posthumous papers of Major Frederic Müller of Altdorf, who had served in the Greek war.

Besides the above publications, most of them pointing to the illustration of antient Greek art, and highly characteristic of the warm devotion of Bröndsted to that subject, he had been long occupied on the elaborate essays on the composition and details of the sculptures on the pediments of the Parthenon of Athens—in aid of which he had had engravings executed of each of the entire groups, and of the separate figures—the former became a few years ago the property of the Society of Dilettanti. The essays, although never completed for the press, were liberally communicated by the author to others, and they have formed the basis of some of the most recent lectures and publications on the subject.

Bröndsted was also the author of a paper addressed to the present King of Denmark, and printed at Naples, in 1840, in the Italian language, on the bronze helmet discovered in 1817, near Olympia, bearing the inscription of Hiero, son of Dinomenes; and a memoir on the Panathenaic Vases, published by the Royal Society of Literature, London, 1833.

(Brockhaus, *Conversations-Lexicon*, 9th edit.; *MS. Communication.*)

BRONZI'NO, A'NGELO, a celebrated Italian historical and portrait painter, was born at Montecelli, near Florence, in 1501 or 1502. He was the scholar of Pontormo, and the friend and contemporary of Vasari, and like him an enthusiastic admirer of Michelangelo. Though Bronzino was not himself one of the gross anatomical mannerists with which Florence abounded in the latter part of his own life, he was one of the most influential causes of the predominance of the anatomical school, for by his unbounded admiration of Michelangelo, he set an example to the younger artists less able to discriminate the good from the bad in Michelangelo's style, and they of course appropriated what was most obvious to their senses and most easy of acquirement. Alessandro Allori, the nephew and favourite pupil of Bronzino, was one of the most uncompromising leaders of this school.

Bronzino painted in fresco and in oil; and executed many altar-pieces and other smaller easel pictures, which are scattered over various parts of Europe, but his reputed masterpiece is still in the Imperial Gallery at Florence, and represents the Descent of Christ into Hell, or Limbo; it has been engraved by J. B. Cechi. He was also a poet: he died in 1570 or 1571. Alessandro Allori and his son Christofano Allori frequently adopted the surname of Bronzino, and it is a name often applied to them in catalogues.

(Vasari, *Vite de Pittori*, &c.; Lanzi, *Storia Pittorica*, &c.)

BRORA COAL. Beds of very poor coal, lying in the midst of the oolitic deposits in the district of Brora in North Scotland and near Scarborough in Yorkshire, are thus termed. The coal is perhaps composed principally of Equiseta.

BROWN, THOMAS, better known by the familiar name of 'Tom Brown,' was born in Shropshire, in the year 1663. At the age of fifteen he entered as a servitor of Christ Church, Oxford; but he left the university in disgrace without taking a degree, and, going to London, became a Grub-street writer. The most respectable part of his career was his holding for a short time the mastership of the free school at Kingston-upon-Thames. Among those hangers-on of literature whose character and conduct made the title of author disreputable in the latter part of the seventeenth century, Tom Brown was one of the most notorious. He was habitually attached to vicious indulgences, inveterately fond of low society, and indolent to a degree which made him unfit to earn his bread steadily by the equivocal kind of literary labour which was his trade. But his talents were of no mean order. His published writings, almost all of which were satirical squibs in prose or verse, are full of coarse and humourous buffoonery. Their gross personalities, however, more than once brought him into trouble, and were restrained by no considerations either of safety or of decency. Dryden, Sherlock, and Titus Oates, alike suffered under his lash. His earliest pamphlet, 'The Reason of Mr. Bayes' changing his Religion,' appeared in 1688; and from that time till his death in 1704, he continued, by a series of ephemeral productions, to justify Anthony Wood's description of him as 'a frequent and satirical writer.' Wood gives a catalogue of his publications. They are not nearly all included in a collection professing to contain his works, which appeared in four small volumes in 1707, and was several times reprinted before the middle of the last century.

BROWN, LANCELOT, styled by Repton 'the immortal Brown,' but more frequently designated by the familiar *sobriquet* of 'Capability Brown,' who was originally a kitchen-gardener, raised himself to be the eminent landscape-gardener of his day, and 'improver of grounds,' as to which he was considered the oracle of taste; and he also acquired no small degree of reputation by his skill in architecture. He was born at Kirkharle in Northumberland, in 1715, and in the early part of his life was in the service of Lord Cobham as one of the persons employed in the gardens and grounds at Stowe. After which he was similarly engaged by other persons of distinction, but of his rise until he formally established himself *professionally* as an artist-gardener, we have no account. His personal history is a scanty but an enviable one; he not only realized a handsome fortune, but he graced his acquired station of gentleman by the manners and feelings of one. After having arrived at the dignity of high sheriff for the county of Huntingdon, which office he filled in 1770, he died in 1773. Testimony to his private worth as a man is borne not only by the character given of him by Repton and others, but the epitaph on him by Mason, who says,

'But know that more than genius slumbers here,
  Virtues were his that art's best powers transcend;
Come, ye superior train, who these revere,
  And weep the Christian, husband, father, friend.'

Great however as was his vogue as a landscape-gardener, his taste has since been very much questioned, and even severely so by Price, who accuses him of having done sad mischief by attempting to reform natural scenery and reduce it to rule, and of having thereby sinned against good taste even more than his predecessors by their formally laid out gardens and straight hedges and avenues. In fact, while endeavouring to avoid the formality which had become 'old-fashioned,' Brown fell into what was little better than formal mannerism and routine, applying to every scene alike the same set of features—'clumps,' 'belts,' and 'serpentine canals.' As an architect, in which profession he naturally confined himself to country mansions, he excelled in all that related to internal arrangement and accommodation, for the houses erected by him have been allowed to be models of comfort and convenience. Among those executed or altered by him, is the Earl of Coventry's at Croome, with the lodges, church, and other buildings, the recorded date of which, 1751, shows that he was then in practice as an architect. At Fisherwick he erected the house, offices, and bridge for the Earl of Donegal; made additions at Burleigh, for the Earl of Exeter; additions at Prior Park near Bath, 1765; the picture-gallery at Corsham; considerable alterations at Trentham (now succeeded by more extensive ones by Barry); mansion for the Earl of Newbury at Redgrave, 1765; alterations at Nuneham, and the house at Claremont, now occupied by Queen Victoria. This list might be considerably extended, for it happens very singularly that we possess a fuller and more authentic catalogue of Brown's architectural labours than of those of any one else in that profession; we shall however merely add that he designed several of the buildings in the gardens at Stowe.

(Repton *On Gardening*, by Loudon.)

BROWN, DR. JOHN, an unfortunate man of letters, was born in 1715, at Rothbury, in Northumberland, where his father, a Scotchman, was curate. He studied at St. John's College, Cambridge, and took his degree with reputation: after which he resided for some years at Carlisle on a minor canonship and lectureship, and distinguished himself by acting bravely as a volunteer in the rebellion of 1745. He successively held and resigned several livings in the church. Of these one at least was procured through the influence of Warburton; a patron however whose letters show him to have treated with little tenderness Brown's capriciousness of temper, caused doubtless in part by his latent tendency to mental derangement. In 1766 the reputation which his writings had obtained gained for him an invitation from the Empress of Russia to visit St. Petersburg, and assist in organizing a scheme for public education. Ill heath compelled him to decline the engagement. Other vexations preyed upon his spirits; and in September of the same year, seized with a fit of insanity, he cut his throat. Brown's works were both numerous and diversified, in verse as well as in prose. His versified 'Essay on Satire, was prefixed by Warburton to his editions of Pope's works. His tragedy of 'Barbarossa,' brought upon the stage in 1755, was highly successful for a time in spite of its extravagance and feebleness, and has been reprinted in more than one collection. Its successor, 'Athelstan,' was not so fortunate. His principal prose writings were the following:—'Essays on the Characteristics of Lord Shaftesbury,' 1751; 'An Estimate of the Manners and Principles of the Times,' 1757, 2 vols. 8vo., a work which went through seven editions before the end of the next year, and received, abroad as well as at home, an attention which it owed to its severity of animadversion on national vices rather than to its merits as a philosophical speculation; an 'Additional Dialogue of the Dead, between Pericles and Cosmo,' 1760, which was a defence of the political character and conduct of Lord Chatham; and a 'Dissertation on the Rise, Union, and Power, the Progressions, Separations, and Corruptions of Poetry and Music,' 1763, a treatise of considerable ingenuity. All his works are enumerated in the long article under his name in the 'Biographia Britannica.'

BROWNE, WILLIAM, one of our minor English poets, was born in 1590, of a good family, at Tavistock in Devonshire. He resided at Exeter College, Oxford, but left the university without a degree, and went to London, where he entered at the Inner Temple. In 1624 he returned to his college, and acted as private tutor to Robert Dormer, afterwards Earl of Caernarvon; and the degree of M.A. was then conferred on him. He afterwards resided in the family of the Earl of Pembroke; and it is said by Anthony Wood that he was able to amass money enough to purchase an estate. The time of his death is uncertain; but it may have happened in 1645. His principal poems are Eclogues; a long series entitled 'Britannia's Pastorals;' a shorter entitled 'The Shepherd's Pipe.' In the narration of events, and in the delineation of characters or passions, he is feeble, confused, and tedious, especially in his more elaborate series of pastorals. But his poetry abounds in beautiful landscapes, painted with much delicacy of feeling and not without frequent richness of fancy. In 1772 there was published a complete edition of his poems, in three volumes, 12mo., which contained his 'Inner Temple Masque,' printed for the first time from a Bodleian manuscript, transcribed by Dr. Farmer.

BRU'CEA, a genus of plants named in honour of James Bruce, the celebrated traveller in Abyssinia, belonging to the natural order Rutaceæ. It has the following characters:—Flowers monœcious; calyx 4-parted; petals 4, hardly equal the length of the calyx; stamens 4, inserted round about a 4-lobed gland-like central body; the pistilliferous flowers with four abortive stamens; ovaries 4, seated on a 4-lobed receptacle, each terminated by a single, acute, reflexed stigma; fruit a drupe, 1-seeded. The species are shrubs, with unequally pinnated leaves, 6 pairs of opposite, entire, or serrated leaflets, without dots.

B. antidysenterica (*Brucea ferruginea* of L'Heritier), Woodginoos, has entire leaflets covered with rusty villi on the nerves beneath; racemes simple, spike-like. This plant is a native of Abyssinia, and is said to be a tonic and astringent, and to act favourably in dysentery. By some mistake it was at one time supposed to be the plant which yielded the false Angostura bark of the shops. By the substitution of the false Angostura for the true Angostura bark, [GALIPÆA, P. C.] fatal effects have been known to follow. At the time that the false Angostura bark was supposed to be the produce of *Brucea ferruginea*, an alcaloid was discovered in it which had been called on that account Brucia. [BRUCIA, P. C.] It appears now however, that there can be little doubt that the false Angostura bark of the shops is a species of *Strychnos*. On this subject Dr. Christison, in the last edition of his Dispensatory, has the following remarks:—The 'Angostura bark (*Galipæa Cusparia*) of this country is seldom adulterated. But on the Continent a most serious fraud has been often practised, by the substitution of a highly poisonous bark, long erroneously conceived to be that of the *Brucea ferruginea*, or *antidysenterica*. This bark, commonly called false Angostura, presents externally a dirty greyish yellow ground with numerous irregular spots or tubercles of a lighter grey tint; which appearances are in the larger pieces displaced in patches, or entirely, by a uniform, loose, bright, rusty-coloured efflorescence. The speckled grey pieces alone bear some resemblance to the smaller pieces of true Angostura, but are easily distinguished by their greater thickness, their far more intense bitterness, without either aroma or pungency, and also, as the Edinburgh College has indicated, by the transverse fracture becoming bright red when touched with nitric acid. Another excellent character mentioned by the College, but applicable only where rusty specks exist, is that such spots become deep bluish green with the same acid; which, on the other hand, scarcely affects the true bark. Nitric acid does not similarly alter the spurious bark, where it is quite free of rusty efflorescence. Fatal accidents from the substitution of the spurious for the true bark were at one time not uncommon on the Continent; and in Austria they were so frequent, that upon one occasion the government ordered the whole Angostura bark in the empire to be destroyed. This adulteration has never been publicly noticed in Britain, and experienced wholesale and retail dealers, whom I have consulted, both here and in London, were unaware of its existence. A few weeks ago, however, Dr. Moore Neligan of Dublin informed me that on inquiring for Angostura bark at an extensive and respectable drug-warehouse in that city, he got the spurious bark; which proved to have been part of a considerable stock kept in the establishment, since at least the beginning of this century, but never previously displaced. From specimens I owe to the kindness of Dr. Neligan, there can be no doubt of the accuracy of his observation; so that druggists ought to be aware of the possible risk, even in this country, of so serious an error.'

B. Sumatrana has serrated leaflets villous beneath, the racemes usually compound, the petals longer than the calyx. This plant is a native of Sumatra, the Moluccas, China, and Cochin-China. The leaves are intensely bitter, and possess the same medicinal properties as the former.

(Christison, *Dispensatory*, 1842; Don, *Gardener's Dictionary*.)

BRUGES, ROGER VAN, an old Flemish painter, and a pupil of John Van Eyck, is called by Vasari, Ruggieri da Bruggia, but is not the same person as Roger Van der Weyde, as some have supposed. Van Mander notices both as distinct persons; the subject of this article, he calls Rogier van Brugge, and speaks of him as an excellent draughtsman and good painter, but he does not give any personal information concerning him: the years of his birth and death are both unknown, but several works are attributed to him, bearing various dates between 1445 and 1462. He is mentioned several times by Bartholomaeus Facius, 'De Viris Illustribus,' Florence, 1745; and Rathgeber, 'Annals of Painting, &c. in the Netherlands,' p. 105, enumerates twenty-nine works attributed to him. He is styled by Facius, Rogerius Gallicus Joannis Discipulus, and he is probably the same person as Magister Rogel of Flanders, by whom there are three pictures, in one, painted in 1445, in the sacristy of the Carthusian church at Miraflores, near Burgos in Spain, the donation of Don Juan II.

Roger painted in water-colours, with white of egg or with size, and in oil, which last method he had learned of Van Eyck. He painted also on canvas, a rare practice in that early period: Van Mander speaks of Roger's paintings on canvas, of which he had seen many in churches, and in private houses, where they were adopted as substitutes for the ordinary hangings of drapery.

There are at Munich three admirable old pictures in the Pinakothek (Cabinet iii. Nos. 35, 36, 37), assigned in the catalogue to John Van Eyck, which a writer in the 'Kunstblatt' (1841, No. 5) has attributed to Roger van Bruges; they are three of the best and most interesting in the collection: they are included in the twenty-nine pictures enumerated by Rathgeber.

(Van Mander, *Het Leven der Schilders*, &c.; Rathgeber, *Annalen der Niederländischen Malerei, Formschneide- und Kupferstecherkunst.*)

BRULLIOT, FRANZ, author of the 'Dictionary of Monograms,' &c., was born at Düsseldorf in 1780, and was the son of Joseph Brulliot, a native of Mannheim, and inspector of the celebrated Gallery of Düsseldorf, which was removed in 1805 to Munich. Joseph and his son Franz, who had adopted engraving as his profession, removed thither at the same time, and in 1808 Franz Brulliot was appointed assistant keeper of the king's prints. From this time he gave up the practice of engraving and devoted himself entirely to the study of prints and the history of engraving, and in 1817 he published, at Munich, in 4to., a Dictionary of the Monograms, &c. of artists—'Dictionnaire des Monogrammes, Chiffres, Lettres Initiales,' &c., to which, in 1820, he commenced the publication, in the same form, of a supplementary work, entitled 'Table Générale des Monogrammes, Chiffres,' &c., but which was never completed. His great work did not appear till after an interval of twelve years from that date, the whole of which time was exclusively devoted to it. He visited the principal collections of France, Germany, and Holland, to the same end, and his occupations as keeper of the prints of the king of Bavaria, to which post he had been appointed, gave him peculiar facilities for his labour. The complete work was published in Munich in three volumes, imp. 8vo., in 1832-33-34, under the title 'Dictionnaire des Monogrammes, Marques Figurées, Lettres Initiales, Noms Abrégés, &c., avec lesquels les Peintres, Dessinateurs, Graveurs, et Sculpteurs ont désigné leurs Noms.' It is a work of immense labour, is very accurate, and is incomparably the most complete work of its kind. In vol. i., containing the monograms, there are 3292 articles; in vol. ii., containing the initial letters, there are 2936 articles; and in vol. iii., containing the abbreviations and appendices to the three parts, there are 1818 articles; and the work contains also facsimiles, cut in wood, of all the marks and letters, &c. treated of, amounting to many thousands. Brulliot did not long survive the publication of his work; he died of the cholera in 1836, at Munich. He was an honorary member of the Academies of the Arts of Munich and of Vienna.

BRUNONIA'CEÆ, a natural order of plants belonging to Lindley's aggregose group of monopetalous Exogens. This order was defined by Robert Brown, and has for its type a genus which was named after him. He placed it as a section of the natural order Goodenoviæ, but it is raised to the rank of an independent order by Professor Lindley. It has an inferior calyx in 5 divisions, with four bracts at the base; a monopetalous corolla, almost regular 5-parted inferior withering; definite hypogynous stamens, alternate with the segments of the corolla; the anthers collateral, slightly cohering; a 1-celled ovary, with a single erect ovule; a single stigma enclosed in a 2-valved cup; a membranous fruit (a utricle) enclosed within the indurated tube of the calyx; a solitary erect seed without albumen; the embryo with plano-convex, fleshy cotyledons, and a minute inferior radicle. This order has but one genus, of which there are two species. They are herbs, natives of New Holland, having flowers of an azure blue, which are on scapes, collected in heads, and surrounded by enlarged bracts.

Although placed by Brown in Goodenoviæ, Lindley thinks it differs essentially from that order 'in the superior 1-celled ovary and capitate flowers, thus approaching some species of Dipsaceæ, but differing in the want of an involucel, the erect ovule, superior ovary, and peculiar stigma.' It agrees with Compositæ in inflorescence, in the æstivation of the corolla, in the remarkable joint or change of texture in the apex of its filaments, and in the structure of the ovarium and seed. Brown remarks, that 'in the opposite parietes of the ovarium of Brunonia two nerves or vascular cords are observable, which are continued into the style where they become approximated and parallel. This structure, so nearly resembling that of Compositæ, seems to strengthen the analogical argument in favour of the hypothesis advanced in the present paper of the compound nature of the pistillum in that order, and of its type in phænogamous plants generally; Brunonia having an obvious and near affinity to Goodenoviæ, in the greater part of whose genera the ovarium has actually two cells, with one or an indefinite number of ovula in each; while in a few genera of the same order, as Dampiera, Diaspasis, and certain species of Scævola, it is equally reduced to one cell and a single ovulum.'

(R. Brown, *Linn. Trans.*, xii. 132; Lindley, *Natural System*, 266.)

BRU'SA', PRU'SA', or BU'RSA' (Προῦσα), a celebrated town in the antient province of Bithynia, now Kójá-ílí, in Asia Minor, lies in 40° 11′ N. lat., 29° 26′ E. long., and is situated at the northern foot of the Bithynian Olympus, in a most picturesque and fertile country. Prusa is mentioned by Strabo (p. 564, Cas.) as a well-governed town, situated near the Mysian 'Olympus,' which is the same as the Bithynian; it must not be confounded with Prusa, the Prusias of Stephanus Byzantinus, formerly called Cius (Κῖος, Strabo, p. 563, Cas.), and Prusa ad Hypium, two towns which were likewise situated in Bithynia. Strabo (p. 564) says that Prusa was founded by Prusias, who carried on war against Crœsus, and his statement deserves more credit than that of Pliny (*Hist. Nat.*, v. 32), who says that it was built by Hannibal, alluding to the time when he was staying at the court of Prusias, king of Bithynia. Strabo's account is also followed or confirmed by that of Stephanus Byzantinus (v. Προῦσα), who calls Prusa a small town. The town rose only to importance after its capture by Orkhán, the son and successor of Osmán, the first sultan of the Osmanlis, who took it by capitulation a few weeks before the death of his father, in A.H. 726 (A.D. 1326). Prusa surrendered after a blockade of ten years, effected by means of two castles which Osmán built in the immediate neighbourhood of the town, one of which, the castle of Bálábánjik, is still standing. This event took place towards the end of the reign of the Greek emperor Andronicus II.

Prusa, or as we shall now write it, Brúsá, became the residence of Orkhán, and this sultan, as well as Múrád I., Bayázíd I., and Mohammed I., and several Turkish princes were buried in the new capital. The count of Nevers, a French prince of royal blood, and many French nobles who were taken prisoners in the battle of Nicopoli, were confined for several years in this place. Brúsá remained the capital of the Turkish empire to the capture of Constantinople in 1453, though during the last twenty years previous to this event the sultans used to reside at Adrianople. During several centuries it was the principal seat of Turkish learning, and its divines were notorious for their prejudices and fanaticism; but its inhabitants are now distinguished for their toleration and hospitality towards Europeans. The population is about 35,000; one quarter of the town is entirely peopled by Armenians; and there are also many Jews, the descendants of Spanish Jews who were driven from Spain towards the close of the fifteenth century, and who still speak Spanish among each other. A rapid torrent flows along a deep gap through the town, and divides the Turkish quarter from the Armenian. Brúsá is well supplied with fountains, and contains several very fine buildings, among which the great mosque is the most remarkable; in the mosque of Daúd Monasteri, rather a small building, is the tomb of Sultan Orkhán. There is a considerable trade at Brúsá in silk, saffron, Angora goat-wool, and other products of the country, and its carpets are renowned all over Turkey. There are several permanent European residents, mostly agents of German and Italian merchants. The port of Brúsá is at Mudánieh, on the Sea of Marmara, six leagues from Brúsá. The beauty of the environs of Brúsá baffles description, but the principal features of the town as well as the environs are the hot springs. The chief source is about a mile and a half west of the town; it rises out of a calcareous tuff or travertine, the formation of which is still going on in some places. Hamilton found the heat of the water to be 184° Fahrenheit; about a hundred yards farther west there is another spring, the temperature of which is 180° Fahrenheit, and there are several more in the neighbourhood, in some of which there is a considerable escape of sulphuretted hydrogen gas. The water of the springs unites in a warm stream of a temperature of 97° Fahrenheit, which is inhabited by the Melanopsis buccinoidea, a univalve shell of frequent occurrence in the rivulets of Asia Minor, but which prefers warm water to cold. Baths have been built at the two principal sources, which are much frequented by the Turks, and are used by the men and women on alternate days. In later years these baths have been visited by European patients, mostly residents of Constantinople.

(Baron von Hammer, *Umblick auf einer Reise nach Brusa und dem Olympos;* Hamilton, *Researches in Asia Minor*, vol. i. p. 71, &c.)

BRUSASORCI. [Ricci, Domenico, P. C. S.]

BRUSH. Notwithstanding the great variety of forms and qualities, adapted for uses the most different, brushes may here be considered under a few well-defined classes, to one or other of which every article of the brush kind may be assigned, and each of which, though comprising many very different kinds, is distinguished by an obvious character.

The first great distinction is that between what may be called *simple* brushes, which consist of a single bundle or tuft of bristles, hairs, or vegetable fibres, whether large or small, and *compound* brushes, which consist of several small bundles or tufts, separately inserted in a stock, foundation, or handle, of wood or other material, so as to act in combination with each other, but to present a mass of hairs or fibres of less solidity or density than a single or simple bundle of equal magnitude or brushing surface. Of what we here term simple brushes, an illustration is afforded by the kind of small brush used by artists under the name of a pencil, whether of camel's-hair or any other hairs. This instrument consists of a small tuft or bundle of hairs, carefully laid with their taper ends all in one direction, and having the opposite or root ends bound round tightly with thread. In order the better to secure the cylindrical tuft of hair thus formed, and also to afford convenient means for attaching it to a stick or handle for use, the tuft or pencil of hairs is passed through a quill tube of a slightly conical shape, which has been previously softened and enlarged by wetting; the points of the hairs being temporarily bound together and passed completely through the quill, from the larger to the smaller end, while the tied portion of the tuft, being larger than the point end, remains firmly fixed in the smaller end of the quill, which, as it dries, contracts upon the hairs with considerable force. As the quill is considerably longer than the portion of tuft or pencil left in it, its larger end forms a tube or socket for the reception of the pencil-stick. When well made, the hairs of such a brush should, if wetted, adhere together and terminate in a fine point; but if they are not properly put together, or are too tightly compressed by the small end of the quill, they will not do so, and the pencil is rendered unfit for delicate work. Hair pencils of this kind are made of every variety of size, from the smallest pigeon or crow quill to the largest quills of the goose, turkey, or swan; and as even the largest quills are not large enough for some kinds of brush or pencil, while in other cases quills are not sufficiently strong and durable, tin tubes are occasionally substituted for them, the handle or pencil-stick being then firmly fixed in the tube. Even the smallest kinds of pencil made of bristles, or of the harder kinds of hair, for oil-painting, are usually mounted with tin, and are known by the general name of *tools*. For some purposes tin-mounted tools are made flat instead of round, the hairs being arranged in a flat, or chisel-like, instead of a cylindrical form. The larger kind of bristle tools are not inserted in tubes, but are bound round very tightly and tied to the end of a wooden stick or handle, which is cut into a forked shape, so as to have a projecting fin on each side of the bundle of hairs. The tuft or pencil being laid in between these projecting pieces, the whole is very firmly and closely bound round with twine or thread, which is subsequently smeared over with glue, with which red-lead is occasionally mixed.

In all the cases above mentioned the brush may be said to be inserted in the handle. The next class of brushes to be mentioned comprises such as have the handle inserted in the tuft or bundle of bristles or hair. Among these are the large painting and dusting brushes used by house-painters, the bristles of which are first tied or wrapped round, with the smaller end of the conical wooden handle in their centre. The brush is then placed upon a block of iron perforated with holes to receive the handle, with the points of the bristles uppermost, and the conical handle is driven in with considerable force until the greater part of its length has passed through the brush to form the handle, while the thicker end remains in the middle of the tied portion as a sort of core. Such brushes are in fact hollow cylinders of bristles, although when new they appear solid, or nearly so; and, although they seem to be held together only by the quantity of string wrapped round them, they really owe their firmness to the compression occasioned by driving in the handle after the wrapping is completed. Excepting in the peculiar mode of tightening the brush by the insertion of the handle, carpet-brooms and birch-brooms resemble, on a larger scale, this kind of brush, to which, to distinguish them from *tools*, the name of *brush*, with some prefix descriptive of size or quality, is especially applied.

Intermediate between what we have distinguished as simple and compound brushes are a kind used by house-painters and plasterers under the names of *stock-brushes*, or whitewash and distemper brushes, which may be described as consisting of two, three, or more simple bristle brushes placed side by side, and secured separately upon the edge of a flat board-like stock or handle, each brush or tuft being divided into two semicylindrical portions, which are separated sufficiently to admit the thin edge of the stock between them.

Of compound brushes, which consist of numerous tufts or pencils of bristles or fibres, technically called *knots*, inserted separately in holes bored in a stock or back of wood or other materials, there are two principal classes, distinguished by the mode in which the knots are inserted and secured. The holes which receive the knots are, in both kinds, usually bored in a lathe contrived for the purpose, in which the mandril, or axis to which the boring tool is fixed, projects in a direct line from the operator, and forms a right angle with, instead of, as in the common lathe, lying parallel to, the front of the bench. The former practice, which is still occasionally resorted to in boring the heads or stocks of large brooms, was to bore the holes with a bit and brace, the stock being, during the operation, firmly secured in an apparatus attached to the bench. The holes are bored just as deep as it is intended to insert the knots; and where bristles are intended to radiate or spread out from the stock, they are bored at such an angle with its face as to give the required obliquity. In many cases however the face of the stock is curved or otherwise shaped in accordance with the intended spread or splay of the brush, so that though the bored holes may not be parallel with each other, they may all be at right angles with the surrounding surface of the stock. The mode of making and fixing the tufts or knots in the kind of brush the manufacture of which is termed pan-work or set-work, is as follows:—In making these, the brushmaker takes in his hand, and arranges by striking their ends on a board or piece of marble, usually termed a draw-board, until the end of the bundle presents an even surface, a sufficient quantity of bristles to form a knot or tuft which will just enter one of the holes in the stock. Grasping these firmly with the fingers near the end which has been struck even, he dips that end into a pan of melted pitch, which, when necessary, is tempered with tallow or oil, and then scrapes off the superfluous pitch by passing the tuft across the edge of a metal scraper; an action which also tends, by momentarily opening or flattening the bundle of bristles, to make the pitch penetrate into the heart of the knot. He then takes a piece of strong thread called a *thrum* (usually one of the refuse ends of a weaver's warp-threads, which, being short, would be useless for any purpose in which more than a few inches of thread is required), and quickly and securely ties and binds it round the bristles. The end of the knot is then again dipped in the pitch, after which it is inserted in its proper hole in the stock with a peculiar twisting or screwing motion, which, coupled with the almost instantaneous setting of the pitch, renders it very firm and secure. In this way are manufactured long-brooms, bannister-brushes, hearth-brushes, and many other kinds of house-broom, and also many of the lighter kind of brushes, such as the dusting-brushes used for pictures and furniture, which are technically called *set dusters*, to distinguish them from the house-painters' dusters above described.

In most of the brushes hitherto described the bristles are used of their full length; or, if not so, the points, or, to use the term employed in the trade, the *flags* of the bristles are presented outwards, and are either left uncut, or cut very little, where it is necessary to trim the ends in order to improve the appearance of the brush. In such brushes however as are used rather for what would be generally termed *brushing*, or scrubbing, than for laying on colour, dusting, or sweeping, much greater stiffness is required, to obtain which the tufts or knots must be made short and cut at their ends to a square even surface, and the root ends of the bristles must be brought to the surface as much as possible, instead of the flag or taper ends. Clothes-brushes and some other brushes of this character are or have been occasionally made by the process last described, which, for fine work, may be varied by the use of various kinds of cement in lieu of pitch; but by far the more usual practice is to form all such stiff and short-haired brushes by the process of *drawing*, by which all kinds of brushes comprised in our remaining genus of compound brushes are manufactured.

The stock of a drawn brush is bored in a similar manner to that of a set brush, excepting that, to enable the operator to bore the holes with greater accuracy, both as to their relative position and the angle they may be required to make with the surface of the stock, and at the same time to enable him to proceed the more rapidly with his work, the stock is, during the operation, attached by clamps to a ready-bored pattern of hard wood, the holes in which, though somewhat larger than those required in the stock, are arranged precisely in the desired position, and, when any of the knots are to be inserted in an inclined position, with the required degree of obliquity. This pattern, however, is not used for boring the holes for knots inserted in an oblique position upon bevels formed upon the edge of the brush, such holes being bored by the eye like the stocks of set brushes. After each knot-hole has been thus bored into the stock just as far as the knot is intended to go, and no farther, a smaller boring instrument, called a *bore-through-bit*, is fixed in the lathe, and with it a small hole is bored completely through the stock, in continuation of each knot-hole. The brush-maker then, instead of taking in his hand as many bristles as will fill the hole, takes about half that number, and passes a portion of their root ends, of a length somewhat exceeding the intended length or projection of the tuft, through the bight or loop of a fine and flexible wire, which, with the other hand, he has passed double through the stock from the small hole which penetrates it. Having done this, he gives a smart pull to the wire, the effect of which is to pull it back through the hole so far as the knot or tuft of bristles will allow it to come, the knot itself being, at the same time, drawn into a bight or double, which enters the hole in the stock, and is drawn in until stopped by the shoulder which is formed at the termination of the larger bore and commencement of the smaller hole produced by the bore-through-bit. Passing his wire, which is almost as pliable as thread, through the next hole, the workman applies another knot in like manner, and so on until a row is completed, when he cuts the ends of the whole row off with a pair of powerful shears, to which is attached by screws a gauge to regulate the precise length of tuft to be left. If the drawing has been skilfully performed, the shears will take off little or nothing from the roots of the bristles, but the pieces cut off from the flag ends are, in many cases, long enough to form a fresh series of knots. As these are inferior in strength to the knots formed of the root ends, they are either used for inferior brushes, or are worked up in a row of knots just within the edge of the brush, where, having the heart or centre of the brush on one side, and the outermost row of knots on the other side, of root-ends, to protect them, they are somewhat shielded from wear. As the drawing-wires at the back of the stock would, if exposed, hurt the hand and be very liable to injury, it is usual to cover them, even in the commoner kinds of brushes, with a thin piece of wood as a veneer. In scrubbing-brushes, which are much exposed to moisture, the wire soon gets corroded and broken, in spite of this precaution; but if the drawing has been properly performed, the knots will be so tightly secured in their holes as not to give way, even after the destruction of the wire, unless the brush be allowed to get too dry, so that both the stock and the bristles shrink. Drawn brushes comprise, together with many other varieties of brush, all kinds of scrubbing-brushes, shoe-brushes, clothes-brushes, and tooth and nail-brushes, although, from their small size and the greater neatness required in their workmanship, the latter form a distinct branch of the manufacture. As veneering would be a difficult operation to perform upon tooth-brushes, these and other small brushes mounted in bone or ivory are frequently drawn with silver wire, which is either left visible, or sunk in fine grooves cut in the back of the brush, which are afterwards filled up with a hard red cement; but in the best sorts a very ingenious process called *trepanning* is substituted for the ordinary mode of drawing. In trepanned work the drawing holes are not continued through to the back of the stock, but are formed laterally in its thickness, from the end or sides, in such a way that after the drawing, which is then performed with thread or silk instead of wire, is completed, all traces of the operation can be concealed by filling up a few minute holes in an unconspicuous part of the stock with small plugs of bone or ivory.

The operation of drawing, in the larger and coarser kinds of work, requires great strength of hand and arm, and is performed by men, who, in the most approved mode of proceeding, have the stock held fast in a vice, while with the left hand they gather up and apply the bristles, and with the right hand, which is protected from injury by a leather shield, they work and pull the wire. Some workmen use no vice, but hold the brush between their body and the front of the bench, but this is a most injurious, and, for short brushes, also a very inconvenient practice. In the finer kinds of brush-drawing, in washing and picking the bristles, and in various operations connected with the manufacture of fancy brushes, women are extensively employed; and as the manufacture is one usually conducted upon rather a small scale, so as to partake of the character of a private or domestic manufacture, it appears to be well adapted for the employment of females and children.

There are a few other kinds of brush, such as bottle-brushes, which consist of tufts fixed so as to radiate from a stem of twisted wire, which it is needless here to particularize. Dr. Ure, in his 'Dictionary of Arts,' p. 196, describes a new mode of fixing the knots or tufts of brushes in dovetailed grooves formed in the stock, which was the subject of a patent granted in 1830 to Mr. Mason; but as the plan has not, we believe, realized any decided advantage, it does not claim further notice here. More recently a patent has been obtained by Mr. Hancock for the manufacture of flexible back brushes, in which the knots are attached to yielding backs of leather instead of wooden stocks, and for some purposes such brushes seem to possess considerable advantages over those of the common construction.

Of the materials employed in the brush manufacture the most important are hogs' bristles, of which a very large quantity is imported, chiefly from Russia and Poland. As taken from the animal they consist of various colours intermixed, but before use, and in some cases before importation, they are sorted by hand into the several varieties of colour termed in the trade black, grey, yellow, white, and *lilies*, which are the lightest of all; but, excepting in the case of lilies, a bundle of any one of these kinds will be found to contain many shades or varieties of colour, which are carefully intermixed in the process of dressing whenever it is intended to use them together. In *dressing*, the bundle is repeatedly opened and combed with an instrument resembling a wool-comb, and, when a further separation of tints is not intended, the darker and lighter bristles are distributed as equally as possible among one another by separating and doubling the bundle. In all those operations the root-ends are carefully kept together, and in the dressing the bristles are separated into lots according to their length. If intended for fancy purposes requiring great neatness, the dressed hairs are subjected to the process of *picking*, which is frequently performed by children, in which every hair that differs much in colour from the mass is picked out by hand. Some bristles are also scoured or bleached, by which process they may be rendered almost perfectly white. An ornamental appearance is often produced by the insertion, in one brush, of knots of picked bristles of various colours; and it is a common practice to put white or yellow bristles at the outside of a brush intended to look neat, while the centre is filled with those of a dark colour. For very soft brushes, such as hat-brushes, horse-hair, goats'-hair, and other kinds of hair are used, and for purposes which require unusual stiffness, fibres of whalebone, either alone or mixed with bristles, are sometimes employed, though the present high price of that material restricts its use. For very coarse brooms, for stable and out-door use, a hard and tough dark-coloured vegetable fibre called *bass* is much used, brooms made of it superseding, in a great measure, those of birch or heath. *Wisk* is a light-coloured vegetable substance of much finer quality, used principally for carpet-brooms, and a very fine article of the same character has been recently employed in making brushes for velvet. The woods chiefly used for the stocks of the common kinds of drawn brushes are beech and oak, and among those employed in ornamental articles are sycamore, lime, rosewood, and satinwood. For brooms, in which lightness is desirable, alder and birch are much used. The wire employed for drawing is mostly a peculiar kind of brass wire made for the purpose, copper having been found too brittle; but a very superior article of compound metal, which has much the appearance of copper, but is very strong in proportion to its extreme tenuity, and soft and pliable to a degree which appears surprising in any metal, has recently been introduced under the name of red brass wire.

BRYUM, a genus of plants belonging to the natural order of Mosses. It has a terminal footstalk; double peristome, outer one of 16 teeth, inner one of a membrane cut into 16 equal segments with filiform processes often placed between them; the calyptra dimidiate. The species of this genus are exceedingly numerous. They are found in great abundance in Great Britain. They are all very small, produce a large number of capsules, and are found growing in wet places. They resemble forests of larger plants in miniature. In *B. palustre* are found terminal capitular bodies which resemble what are called the anthers of *B. Androgynum;* but in *B. palustre* they are considered gemmæ, and arise not only from the main stems, but also from the innovations.

(Loudon, *Encyclopædia of Plants.*)

BUCKLANDIA, a liliaceous (?) fossil plant from the Stonesfield oolite.

BUDDLEA, a genus of plants named after Adam Buddle, a botanist of the time of Ray, who contributed to Ray's 'Synopsis,' and whose Herbarium is now in the British Museum. Buddlea belongs to the natural order Scrophulariaceæ. It has a campanulate 5-toothed calyx; tubular corolla with the limb 4-5-cleft, equal, spreading; 4-5 stamens nearly equal, inclosed, the anthers composed of two parallel distinct cells; the stigma clavate, 2-lobed; the capsule crustaceous with a dissepiment formed from the inflexed edges of the valves, inserted in the thick spongy placenta; the seeds angular; testa loose, membranous; albumen fleshy. The species are shrubs, with mostly quadrangular branches, opposite leaves; terminal, capitate, spicate or panicled, usually orange-coloured flowers.

B. globosa has branches clothed with hairy tomentum, as well as the under sides of the leaves; the leaves lanceolate, acuminate, petiolate, crenate; the heads terminal, globose, pedunculate. This plant, now so common in our gardens, is a native of Chili.

B. Americana, branchlets clothed with hairy tomentum, leaves ovate, acuminate, narrow at the base, crenate, rather pilose above, but clothed with a yellowish tomentum beneath; spike panicled, flowers glomerate. It is a native of the mountains of Peru, and also of the West Indies. Browne says that it is used in Jamaica as an emollient. Its properties however are not active.

There are about sixty species of Buddlea, all of which are worth cultivating on account of their showy blossoms. *B. Neemda*, a native of the peninsula of India, is said to be one of the most beautiful plants of that country. The *B. globosa* will bear with a little care our winters, as well as the *B. salvifolia*. All the flowers are sweet-scented. They grow best in a light rich soil. Cuttings will strike readily in mould under a hand-glass. Those of the stove species require heat.

(Loudon, *Encyclopædia of Plants;* G. Don, *Gardener's Dictionary.*)

BUDE LIGHT is a flame producing a strong illumination, and is now the means extensively employed in lighting churches and other great buildings. Originally it was obtained from an oil-lamp, the flame from which was acted on by a current of oxygen gas: subsequently oil-gas was substituted for the liquid oil; but now the gas which is made for lighting the streets of towns is employed to produce the flame, and the brilliancy is increased by a current of atmospherical air ingeniously introduced. This is designated the Atmospheric Bude Light, and it is the result of numerous experiments made by Mr. Goldsworthy Gurney, of Bude in Cornwall, who is also the inventor of the oxy-hydrogen light which is used with the microscope of that name.

The apparatus being suspended from the ceiling, the gas, either as it comes from the street or purified by chemical processes, passes up a number of short tubes into concentric annular receivers, the upper surfaces of which are pierced on the whole of their circumferences with many small holes. On issuing from the perforations the gas is ignited, and thus there are formed as many cylinders of flame as there are rings; while between and round the exterior of the cylinders the atmospheric air rises from below to support the combustion: a hollow frustum of a cone, of glass, open at both extremities and having its greatest end downwards, surrounds the tubes above mentioned; its lower part resting on the base of the framework within which they are suspended, and its upper part approaching very near the bottom of the flame, so that the atmospheric air in rising is confined between the upper or smaller end of the cone and the flame. The distances between the cone and the rings, and between the rings themselves, are regulated by experiment so that the quantity of air may suffice to bring the temperature of the gas to exactly the degree necessary for causing a separation of the charcoal from the flame, as nearly as possible at the moment that the latter issues from the perforations: the flame from each interior ring serves to augment the heat of that which is on the exterior of it, by which means an increased intensity of light in each is produced; and almost the whole of the light which emanates from the interior rings passes through the flame on its exterior, into the apartment.

A cylindrical glass chimney rests at its lower extremity on the margin of a circular aperture in the middle of a circular disk of iron, from 18 inches to 2 feet in diameter, the under surface of which serves as a reflector: this disk, and with it the chimney, is capable of being raised or lowered, by means of adjusting screws, till it conceals the upper extremities of the flame; and thus the latter presents the appearance of a brilliant zone of white light, which is from three inches to six inches high, according to the pressure of the gas.

A machine of this kind supersedes the employment of many separate lamps; and, being placed at a considerable height from the floor, it is possible to apply above the glass chimney a pipe which, while it conveys the impure results of the combustion through the ceiling, may serve to ventilate the building or apartment.

Equal intensities of light may be produced by the Bude apparatus at about one-third of the expense of common oil, at about one-ninth of the expense of composition candles, and at about one-eleventh of that of wax candles. The Bude light, produced from coal-gas, began to be used for lighting the House of Commons in the year 1842.

BUFFALMACCO, an old painter of Florence, of the beginning of the fourteenth century, and a scholar of Andrea Tafi, celebrated for his humour by Boccaccio and Sacchetti, and for his ability by Ghiberti and Vasari. The name of Buffalmacco appears to have been a nickname as given to him by Boccaccio: his real name is said to have been Buonamico di Cristofano, but some have supposed the name of Buonamico, which is used by Ghiberti, to have been a nickname also. Rumohr and others have even doubted his actual existence, supposing that Vasari himself has given him his historical existence by confounding together the real Buonamico of Ghiberti and the imaginary Buffalmacco of Boccaccio—an idea which does not seem to have occurred to either Baldinucci or Lanzi, or any of the Italian editors of Vasari's work. This however is certain, that Vasari has gleaned most that is interesting and all that is amusing in his Life of Buffalmacco from the novels of Boccaccio and Sacchetti; and some of his narrations of the ready humour of this painter are the most amusing passages in his Lives: they are from the following novels of Boccaccio:—'Decamerone,' viii. 3, 6, 9; ix. 3, 5; and the following of Sacchetti—161, 169, 191, 192.

Vasari enumerates many of Buffalmacco's works, of which however scarcely anything now remains. Of those attributed to him there are still some in the Campo Santo at Pisa, and at Arezzo. At Pisa there is a Creation of the Universe, some stories from the life of Noah and his sons; and the Crucifixion, the Resurrection, and the Ascension of Christ; but though there is some meaning in them as compositions, as designs they are barbarous works; they are engraved in Lacinio's 'Campo Santo.' Vasari however speaks of other works which have perished as very superior to these, and he says that Buffalmacco, when he chose to exert himself, which was not often, was equal to any of his contemporaries. In some of his works in Pisa he was assisted by Bruno di Giovanni, who is also mentioned by Boccaccio. On the picture of the Creation just mentioned, there is a sonnet which Vasari has copied into his book, and which, in the opinion of the editor of the Roman edition of Vasari, proves that Buffalmacco was a much better poet than he was a painter. He died poor, according to Vasari, in 1340, aged seventy-eight, but according to Baldinucci he was still living in 1351; he was therefore probably a younger painter than Giotto, who died in 1336, aged sixty, though Vasari's account makes Buffalmacco the elder.

(Vasari, *Vite de' Pittori*, &c.; Baldinucci, *Notizie dei Professori del Disegno*, &c.; Lacinio, *Pitture a Fresco de Campo Santo di Pisa.*)

BUFFO'NIA, a genus of plants named in honour of Count de Buffon, the celebrated French writer on natural history, belonging to the natural order Caryophyllaceæ, and the suborder Alsineæ. The calyx has 4 sepals; the petals are 4, entire; stamens 4; styles 2; capsules compressed, 1-celled, 2-valved, 2-seeded. The species are insignificant slender herbs, resembling the species of Arenaria. *B. amua* is a native of the south of France, and is said to have been found in England on the sea-coast of Lincolnshire.

(Babington, *Manual.*)

BUFONITES (in Palæontology), the term commonly applied, previously to the investigations of M. Agassiz, to the roundish teeth of fishes, frequent in the oolitic strata. They belong to the genera Sphærodus, Gyrodus, Pycnodus, &c.

BUILDING, or the art of constructing edifices, is defined by some writers as practical, in contradistinction to theoretical, architecture; but, without a previous explanation of the meaning of the term architecture, such a definition is imperfect, since, although building is necessarily included or involved in the execution of all architectural works, many of the works produced by the builder have either no claim at all, or a claim by no means generally admitted, to be considered architectural works. In the practice of civil architecture, the builder comes between the architect who designs the work and the artisans who execute it; and, in a commercial point of view, between the party by whom the capital is provided on the one hand, and the merchants and manufacturers who provide the necessary materials, and the workmen whose office it is to shape and unite them, on the other. For the temporary employment of his own capital and the exercise of his directing skill, he is usually remunerated by charging his employer for labour and materials at a higher rate than he has paid himself; and, for the mutual security of all parties, he generally works by contract, either undertaking to execute the building, with all contingent works, for a given gross sum, which is termed a lumping contract, or agreeing to perform the whole work at certain specified rates per yard, rod, foot, &c., according to the nature of the work, the quantities being measured according to established rules.

An article upon the multifarious operations connected with building would not only require more space than is consistent with the plan of this work, but would also involve the repetition of much information already given under various heads. Such a general treatise is supplied in the long and elaborate article 'Building,' in the new edition of the *Encyclopædia Britannica*, contributed by Mr. Hosking; a treatise which may be consulted with advantage by readers who wish to go very fully into the subject. Here we propose to do little more than give such an outline as may enable the reader to turn readily to those portions of the work in which the various branches of the general subject are treated of.

Of the distinction between building, properly so called, and architecture, some account is given, together with remarks on the most antient styles of building, in the article ARCHITECTURE, P. C., p. 282; and under HOUSE, P. C., p. 323, the subject of domestic architecture, which it is all-important for a builder to be well acquainted with, is treated at some length. From the last-mentioned article it will be evident that the attention of the builder should be directed rather to matters of utility and comfort than to such as relate to ornament; although, as many houses are erected without the aid of a professed architect, it is desirable that he should be so far acquainted with the principles of architectural design as to avoid displeasing proportions and incongruity of ornament. Where the choice of site remains with himself, he should avoid a low and damp situation, and also a situation exposed to cold winds. A good supply of water to the house, and sufficient fall to ensure perfect drainage, are essential; and as a general rule, the advantage of southern and western frontages should be secured as much as possible. The direction of the prevalent winds is a point to be carefully considered, in order that the openings of doors and windows may be so arranged as to avoid drafts and smoky chimneys, which are not unfrequently occasioned by want of due attention to this matter. [SMOKE, P. C., 155.] Such points being duly considered, drawings of the intended building, showing not only its exterior form, but also its interior arrangements and the substance of its walls and partitions, as explained under DESIGN, ARCHITECTURAL, P. C., p. 437, are prepared; after which the actual construction commences by the preparation of a firm foundation for the structure, as described under FOUNDATION, P. C., p. 383. The excavation formed for the foundation should be executed with the utmost care, and the level must be produced by the removal of earth until an even surface is produced; the production of a level by filling up hollows with loose materials is extremely hazardous. For the mode of laying foundations under water see COFFERDAM, P. C., p. 324.

The articles BRICKWORK, P. C., p. 410, and MORTAR, P. C., p. 419, contain information on the construction of brick walls, but the provisions of the new Metropolitan Buildings Act, of which an abstract is given in the next article, render it necessary to substitute for the directions given under BRICKWORK, relative to the thickness of walls, the following new regulations for the thickness of external and party walls of dwelling-houses. First-rate buildings, which are such as range from 70 to 85 feet in height, cover more than ten and not more than fourteen *squares*, or areas of 100 superficial feet, or contain seven stories, including the basement, are to have their external walls at least 21½ inches thick from the top of the footings of the foundation 'up to the under side of the floor next but three below the topmost floor,' that is to say, in a seven-story house, the full height of the basement and the next story above it. From this point 'to the underside of the floor next below the topmost floor,' a further height of three stories, the thickness is to be at least 17½ inches; and the remainder of the wall to the top at least 13 inches. In a building of this kind the requisite thickness of the party walls is precisely the same as that of the external walls; but in buildings exceeding 85 feet in height, covering more than fourteen squares, or containing more than seven stories (which buildings are considered as extra first-rate), the thickness of 21½ inches is to be carried up to the floor next but two below the topmost floor, and that of 17½ up from that point to the top of the building, in the external walls, and the party walls must be at least 21½ inches thick from the footing to the floor next but three below the topmost floor, 17½ inches from this point to the under side of the topmost floor, and 13 inches from the topmost floor to the top of the wall. Second-rate buildings, which are such as range from 52 to 70 feet in height, cover from six to ten squares, or contain six stories, must have both the external and the party walls at least 17½ inches thick from the footing to the under side of the floor next but one below the topmost, and 13 inches above that point to the top. Third-rate buildings, or such as range from 38 to 52 feet in height, cover from four to six squares, or contain five stories, must have their external walls at least 17½ inches from the footing to the floor next but two below the topmost floor, and 13 inches thence to the top of the wall, and their party walls the same, excepting that from the topmost floor to the top of the wall the substance may be further reduced to not less than 8½ inches. Fourth-rate buildings, or such as do not exceed 38 feet in height, do not cover more than four squares, or contain more than four stories, must have their external walls at least 13 inches thick from the top of the footing up to the under side of the floor next below the topmost, and at least 8½ inches thence to the top of the wall, while the party walls must be at least 13 inches up to the floor next but one below the topmost, and 8½ inches above that point. Thus a four-story house, if not exceeding 38 feet in height, or covering more than four squares, must have its external walls 13 inches thick for the full height of the basement story and the next story above it, while in the party walls that thickness need not be carried up beyond the top of the basement story. The above regulations relate only to dwelling-houses, which are considered buildings of the first class; distinct regulations being provided for buildings of the second or warehouse class, which comprises, besides warehouses and storehouses, granaries, breweries, distilleries, manufactories, workshops, and stables, and for buildings of the third or public building class, which includes churches, chapels, colleges, halls, hospitals, theatres, public concert, ball, lecture, and exhibition rooms, and all places used either temporarily or permanently for the assemblage of persons in large numbers. Buildings of the second class are divided into four rates, according to their height; those exceeding 66 feet being deemed first-rate, those from 44 to 66 feet second-rate, those from 22 to 44 feet third-rate, and those not exceeding 22 feet fourth-rate. First-rate buildings of this class must have both the external and party walls at least 26 inches thick from the top of the footing to within 76 feet of the height of the topmost ceiling, 21½ inches from that point to within 36 feet of the topmost ceiling, and 17½ inches above that point to the top of the wall if it be an external wall, though in the case of a party wall the thickness may be further reduced to 13 inches above the level of the topmost ceiling. Those of the second-rate must be, whether external or party walls, 21½ inches thick to within 58 feet of the topmost ceiling, 17½ inches to within 22 feet of the same, and 13 inches above that point. Those of the third-rate must have their external walls of the thickness of 17½ inches to within 28 feet of the topmost ceiling, and 13 inches above that point; the party walls being the same, excepting that above the level of the topmost ceiling they may be reduced to 8½ inches; and those of the fourth-rate must have their external walls 13 inches thick to within 9 feet, and the party walls of the same thickness to within 16 feet of the topmost ceiling, the upper portion of the wall, in each case, being at least 8½ inches thick. The substance or thickness of the walls of buildings belonging to the third or public class is to be computed by reference to the rate of such buildings of either the first or second class as they may most nearly resemble, four inches being in every case added to the thickness directed for such first or second class building, and special cases being dealt with by official referees appointed under the Building Act. [Building, Acts for Regulating, P. C. S.] It should be observed respecting the provisions above quoted, that it is usual to make the outer face of an external wall vertical, whatever may be the changes introduced in the thickness of the brickwork. Wherever a change is made in the exposed face of a wall, the projecting ledge or set off thereby produced should be finished with a stone string-course, to answer the purpose of a coping.

The various modes of bonding brick walls are sufficiently described in Brickwork, P. C., but these relate simply to the mode of arranging the separate bricks or component parts into a solid and cohesive wall or mass of brickwork. Much more than this, however, is required in building the walls of a house, in order to prevent, as much as possible, their strength from being impaired by the necessary openings for doors and windows, and to afford the means required for connecting the door and window frames, floors, partitions, and other woodwork, with the shell of the structure. The effect of apertures in a wall is counteracted by the introduction of inverts, or inverted arches, in the portion of wall beneath them, and of discharging arches, which may either be left visible or not, over them. The fixing of door and window frames, and other small woodwork, is provided for by the insertion in the wall of *wood-bricks*, or blocks of seasoned wood resembling bricks in form and size. *Lintels* are bars of wood inserted, in lieu of arches, over the apertures of doors and windows, but they should always be surmounted by discharging arches abutting upon the solid brickwork beyond the ends of the lintel, which, in such a case, may be made to tail into the wall to a very short distance only beyond the sides of the aperture. Where, however, there is to be no discharging arch over the lintel, it should be of sufficient length to tail considerably into the wall, and its ends should rest upon transverse templates or wood-bricks built into the wall. *Templates* are pieces of timber often three or four feet long, which are let into the wall after the manner of wood-bricks, either for the purpose of fastening to, or to support the ends of beams let into the wall, and distribute their pressure over a considerable space. Discharging arches should be turned over these, and over the ends of beams, so that their shrinking, or even their decay or destruction by fire, should not be sufficient to affect the stability and cohesion of the wall. Some floors are so framed together that they may be connected with the walls by a few principal beams, the ends of which rest upon templates; but more usually the ends of the joists rest upon long pieces of timber called *wall-plates*, which are let into the brickwork, and serve to distribute the weight equally. *Bond-timbers* are occasionally inserted with a special view to the distribution of strain, but their liability to swelling and shrinking, as well as their perishable and combustible character, render it desirable to bond the structure as perfectly as possible without them. Timbers should, in all cases, be kept clear of the chimney-flues, or, if this be impossible, should be guarded with iron so as to prevent the possibility of a spark coming in contact with them. The various plans which have been introduced of late years for securing timber from the ravages of dry-rot, and rendering it incombustible, greatly lessen the risk of employing it in walls. [Timber, Preservation of, P. C. S.] The variations of size occasioned by changes of temperature render the combination of iron with brickwork even more hazardous than the use of timber, though the employment of straps of hoop-iron laid in the mortar between the courses of bricks is found advantageous under certain circumstances. An instance of its employment in the construction of arches without centreing is mentioned under Scaffolding, P. C., p. 499. The brittleness of cast-iron renders it very unfit for use where unequal settlement may occur. The construction of efficient drains should be attended to in an early stage of the building. This subject is fully treated under Sewers, P. C., p. 314, and it is only necessary here to observe, that in order to increase the current and prevent the deposit of sediment, all drains should be concave at the bottom, and that where they pass through houses, or in any case in which it is probable that they may have to be opened, it is desirable to make the top consist of flat paving-stones or tiles, laid in cement; as a circular, barrel, or, as it is sometimes called, a gun-barrel drain, unless its fall be very considerable, will be likely to involve much trouble and expense in opening and cleaning. Where the drain is straight, and short enough to be raked, this matter is not of consequence. It is a usual and convenient plan to conduct the drain under a doorway, between the sill and the invert; but when this cannot be done, an arched opening, called a bull's eye, must be made in the wall where it passes through. In addition to the air-traps which, as described under Sewers, should always be placed at the entrance of drains, a very simple trap may be formed at any convenient point in their course, by sinking a small well a few inches below the bottom of the drain, and building in with the brickwork of the drain a flat piece of flag-stone in such a manner as to form a dipping-valve resembling that shown in Sewers, *Fig.* 4, so that no water can escape until the well is filled, and no air can pass the trap unless the well becomes, by evaporation, so dry as to allow it to pass under the edge of the dipping-valve.

As the erection proceeds, contrivances for supporting the workmen and materials are required, of which an account is given under Scaffolding, P. C., p. 497. Under Wheels, P. C., p. 313, allusion is made to a very convenient apparatus invented by Dr. (there misprinted Mr.) Spurgin, for lightening the labour of raising bricks and other materials on to a scaffold. In the basement story of a building, the partition walls as well as the external and side or party walls of a house are usually formed wholly of brickwork, but in the upper stories they are generally of lath and plaster, on a framed and trussed timber foundation, or of what is technically called *brick nogging*, which consists of a framework of quartering, similar to that used for lath and plaster, but having the intermediate spaces between the timbers filled up with brickwork, thus forming a wall either 4½ or 3 inches thick, according to whether the bricks are laid flat or on edge. Though strengthened by the upright quarterings or timbers, the brickwork, being so thin, should be strengthened or bonded further by the introduction, at intervals of not more than six courses, of horizontal bars of wood called *interties*, or *nogging-pieces*, skew-nailed at each end to the quarterings. Some builders, in lieu of brick nogging, use half-brick, or 4½ inch, walls carefully built in cement, and strengthened with iron hooping, a plan which has the advantage of greater security from fire. Such partitions also check, more effectually than those in which much timber is introduced, the transmission of sound from one room to another. The joints of brickwork in internal walls, and in such external walls as are to be covered with plaster, stucco, or cement, are left rough, with the mortar projecting from the joints, because the inequality of surface thus produced causes the plaster to adhere better; but in such external walls as are to be exposed to view, the superfluous mortar is removed, and each joint is *drawn*, by applying the point of the trowel so as to flatten the joint, or rather to leave it slightly concave. The use of thick beds of mortar between the bricks is not only injurious from the settlement thereby occasioned, but also because the compression of the mortar causes it to bulge out at the joints, and so to counteract the effect of drawing with the trowel. The joints, being thus rendered convex instead of concave, catch and absorb the rain which trickles down the wall, and when a frost comes this absorbed moisture freezes, and occasions the mortar to crumble away, thus involving the necessity of *pointing*, or filling in the joints with new mortar, to preserve the wall. To do this, the old mortar must be scraped out to the depth of three-eighths of an inch, or further if needful, and the joints must be thoroughly cleaned and moistened before inserting the new mortar, which should be of the best quality. Mortar for this purpose is commonly mixed with forge ashes, which give it a bluish tinge, and renders it better fit to resist injury from weather. Cement is sometimes used for the purpose in lieu of mortar. If the work be required to be very neat, each joint is finished with a narrow line or parallel ridge of fine white putty or mortar, made principally of bone-lime. In the application of this kind of pointing, which is termed *tuck-pointing*, to an old wall it is usual to wash and colour the whole surface of the brickwork; and when, by the carelessness of the bricklayer, the vertical joints which should come in a line over each other, technically called the *perpends*, have not been properly attended to, the misplaced joints may be filled up with brick-coloured putty, and false joints made in the proper places. Mortar used for the *pargetting*, or internal plastering, of brick chimney flues is mixed with a little cow-dung, to prevent its peeling off from the heat. The top of a brick-wall, whenever it is not covered by the roof, must be protected by coping [Coping, P. C., p. 501], which in single-brick walls is often formed simply by a row of bricks set on edge in cement across the wall, and called a *barge-course*, a name which is also given, with more propriety, to the projection of a roof over a gable-end. Barge-Course, P. C., p. 450.] This kind of coping is very imperfect, because, as it has no projection or inclination, it does not throw off the water. It may be improved both in appearance and efficiency by laying underneath the barge-course two double courses of plain tiles, with their joints broken, and their edges projecting about an inch and a half on each side of the wall, or by a similar application of paving-tiles. Stone coping however, which can be made of any width, and properly sloped or weathered and throated, is far better. For ornamental brickwork proper coping-bricks are made, which if well set in fine mortar or cement may be equally efficient with stone, and have a better architectural character. It may be remarked generally that brick walls often suffer injury in consequence of the insufficient projection of copings and cornices, which ought to throw off water as much as possible from the face of the wall.

The established mode of measuring brickwork is explained under Brickwork, P. C. Brick and tile paving, which are noticed under Floor, P. C. S., are measured by the superficial yard of nine feet, and tiling, for which see Roof, P. C., p. 148, and Tile, P. C., p. 446, by the *square* of 100 superficial feet.

Of the use of stone in building some account has been given under Masonry, P. C., p. 481; Ashler, P. C., p. 451; and Rusticated Work, P. C., p. 271. Rubble-work is more difficult to execute well than building with cut or squared stones, since there is great danger of trusting too much to the mortar. Unwrought stones, however irregular in shape, ought to be so laid together that the wall would stand if laid to a considerable height without mortar. It is of course desirable to give the outside of a rubble wall as neat an appearance as possible; but care must be taken in doing so to bond the facing stones as thoroughly as possible with the centre of the wall, and not, for the sake of show, to expose the bed of the stone, or the flat surface formed by its stratification, in the face of the wall, as a stone so applied cannot be firmly bonded into the wall, and its flat surface is far more liable to injury from the action of the atmosphere than a surface cut at right angles with its plane of stratification. It is better to bond the wall by means of many stones extending partly through its thickness, alternately from each side, than to use a few thorough stones, or stones reaching completely from face to face, and yet leave the greater part of the wall like two shells inclosing an irregular core of coarse rubble. Stone copings and some other kinds of stone-work are frequently cramped together with fastenings of iron or copper, run in with melted lead; but unless these metal fastenings, especially those of iron, can be thoroughly secured from the influence of the atmosphere, they are liable, from oxidation and the effect of changes of temperature, to produce much harm, and therefore it is better, if possible, to use tenons, dowels, joggles, or dowels of stone or wood, protecting them also from the weather. An ingenious mode of dowelling, adapted to the restoration of defective arch-stones, is described under Blackfriars Bridge, P. C., p. 485. The principal purposes for which stone is introduced in brick buildings are enumerated under Masonry, P. C., to which we need only add that the setting of stone window and door sills is usually delayed as long as possible, to give the brickwork time to settle, because a very slight inequality in the settlement would cause them to break, being long and thin. The brittleness of stone, indeed, renders it always unadvisable to use it in pieces of great length of bearing, and very important to make the joints perfectly even. In the jointing of columns, for example, the ends of the adjacent stones must not be worked hollow, with a view to making the joint perfect at the edges. A better plan is to work them flat, and insert a thin sheet of lead between them, cut a little smaller than the column itself, thereby leaving a small open joint all round, to be filled up with fine putty. Stone walls are usually measured by the perch of 21 superficial feet, of an assumed standard thickness of 18 inches, and therefore containing 31½ cubic feet; but sometimes the rod is used as a measure, as in brickwork, assuming however a thickness of 18 instead of 13½ inches.

Besides brick and stone, other materials are occasionally employed for the construction of walls, of which we may allude to flints and earth. Houses built of flints, which can only be used to advantage in certain localities where that material abounds, necessarily depend much for the cohesion of their walls upon the strength of the mortar, and on the judicious introduction of bonding-courses of brick or larger stone, and of quoins or angles of the same. When well executed, the appearance of flint buildings is far from displeasing, and by a little management of the contrast afforded by the white outside and black centre of the flints, may be made absolutely ornamental. Building with compressed earth, or building *en Pisé*, is a very cheap, simple, and, when properly managed, durable mode of building, which has been long and extensively practised in some parts of France, especially in the neighbourhood of Lyon, and has been adopted in this country not only as a substitute for the rude plan of constructing cabins with mud tempered with straw, and held together by wattles and timber framework, but also in lieu of regular brickwork. In vol. xxvii. of the 'Transactions' of the Society of Arts, pp. 185-197, is a minute description, illustrated by a plate of the apparatus employed, of an improved mode of executing this kind of work, invented by Mr. Robert Salmon, of Woburn. The foundations, and the walls to a short distance above the level of the ground, are built of stone or brick, but all the upper part of the walls consists simply of earth, beaten or rammed into a compact mass between two boards, which are fastened in such a position that their inner surfaces correspond with the faces of the wall. The work proceeds in courses, and each course in portions of convenient length; and the boards, which serve as a mould, are so connected by bolts that they may be readily separated from one another, and from the completed portion of wall, and put together again in the required position for forming another portion of wall. The earth is thrown in in small quantities, so that every portion may be very completely beaten, and as it is thrown in, a little is drawn away from the surface of the mould, and its place supplied by a facing composition, consisting of about one-fourth lime and three-fourths of the earth used for walling, mixed together with water and slaked like mortar, but allowed to dry and pulverize before it is rammed in. This facing composition, which is applied about an inch thick, forms a cement-like face to the wall, which preserves the earth from the access of moisture. When the surface of one course of earth has become hard before another is added to it, a little thick grout of lime and earth is added to facilitate the adhesion of the new and old work. Mr. Salmon observes that the earth for this work 'should be neither sand nor clay, but partaking of both.' 'Clay,' he adds, 'is particularly objectionable, as is also chalk or calcareous earth of any sort. Sand is also not proper, unless accompanied with some binding quality: the bolder and coarser the sort of earth the better. When used, it should retain no more moisture than just to make it adhere together under the pressure of the thumb and finger.' Earths containing a mixture of grit or fine gravel he considers generally the best. Bond-timbers, wall-plates, and all other pieces of wood inserted in the walls, are kept as thin as may be, to avoid disagreement from shrinkage; and doorways and openings for windows may be conveniently formed by the insertion of temporary frames of stout planking, against which the earth is rammed as against the mould. In this mode of building labour forms the most important item of cost. At Woburn, with labourers at 1*s.* 10*d.* per diem, Mr. Salmon found the expense of a 16-inch wall to be about 2*s.* 8*d.* per superficial yard if faced and finished on one side only, and 3*s.* 4*d.* per yard if faced and finished on both sides; while the value of a superficial yard of brickwork, 14 inches thick, would have been more than 10*s.* at the same time and place. The walls may be finished externally by lime-washing, and, if intended to look very neat, wetting and rubbing the surface with a plasterer's float, until it is smooth and even. A full account of the French mode of executing this kind of building is given in the sixteenth volume of the 'Dictionnaire Technologique' (8vo., Paris, 1829), art. 'Pisai, Pisè,' and in a briefer notice in the fourth volume of the 'Dictionnaire de l'Industrie' (8vo., Paris, 1795), article 'Murailles Economiques,' are some remarks respecting the meaning of the term *Pisé*, or, as it is sometimes written, *Pisè*. If the projection of the roofs be sufficient, and other precautions are taken to keep the walls dry, buildings of this character may be safely constructed of two or three stories in height, and they will prove very durable, many such buildings in France having stood more than a century without any symptom of decay.

Respecting the means of protecting walls from damp, whether arising from the foundation or not, some information is given under Asphalte, P. C. S., p. 144. Double walls, in which a space is left between the external brick or stone wall, and the lining of the room, of whatever kind it may be, are sometimes resorted to as a means of preventing the passage of damp, and a simple mode of producing the same effect, which answers well when great strength is not required, is accomplished by the use of bricks laid on their edges instead of their flat sides. In a single brick or 9-inch wall of the ordinary construction there are no hollow spaces, because, the bricks being laid flat, the width of two stretchers, being 4½ inches each, is exactly equal to the length of the headers, that is to say, 9 inches. If, however, the bricks be laid on edge, but otherwise disposed in the same way, while the headers are, of course, of the same length, the width of the stretchers will be only 3 inches each, so that if they are laid to the face of the wall they will leave an intermediate space of 3 inches. Of course a less number of bricks will be required to produce an equal surface of wall by this than by the ordinary mode of laying.

Of the various departments of building relating to CARPENTRY and JOINERY brief notices will be given under those heads in P. C. S., with references to the various articles relating to them in P. C. Here it is only needful to observe that the portions of a building supplied by the carpenter should be so contrived as to strengthen and bind together the whole structure. The ROOF, especially, of which a full account is given under that head in P. C., should contribute greatly to the solidity of the building, as well as answering the primary purpose of a covering. In London houses, owing to the great value of space, sleeping-rooms are very often formed in roofs; and in certain cases, when the ridge of the roof is made parallel to the front of the house in order to secure as much internal space as possible, the front gutter is connected with that at the back of the house by a covered trough passing through the apartment formed in the roof, so that although the fall of water from the roof may be equal towards the front and back, the pipes for conducting the water to the ground may be confined to the back of the house. The provisions of the New Building Act respecting such rooms are alluded to in the next article. For the external covering of walls in which the brickwork is coated by a stone-like composition, see STUCCO, P. C., p. 166; and for the lining of walls, the formation of ceilings, &c., see PLASTERING, P. C. S. Internal decorations are treated of under PAINTING, HOUSE, P. C., p. 145, and PAPER HANGINGS, P. C., p. 215. More specific information respecting the various parts of a building will be found in such articles as STAIRCASE, DOOR, WINDOW, ARCH, and DOME, in P. C., and CHIMNEY, in P. C. S.; and under FIREPROOF BUILDINGS, P. C. S., will be noticed some important deviations from the ordinary mode of building, in order to diminish the risk of fire.

BUILDING, ACT FOR REGULATING. Provisions for regulating the construction of buildings are generally introduced into acts for the improvement of towns. To permit houses of wood or thatched roofs in confined and crowded streets, would be to sacrifice the public welfare to the caprice or convenience of individuals. There is no general measure ensuring uniformity of regulations for buildings throughout the country. In the session of 1841 the Marquis of Normanby, then a member of the government, brought in a bill 'for the better Drainage and Improvement of Buildings in large Towns and Villages,' but it did not pass; and a bill of a similar nature was unsuccessful in the session of the following year. In the session of 1844, however, an act was passed (7 & 8 Vict. c. 84) entitled 'An Act for Regulating the Construction and the Use of Buildings in the Metropolis and its Neighbourhood;' and this measure, though applicable at present only to London, promises to be an important step towards improving the condition of large towns, and with certain modifications it will probably be extended to other places. The act came into operation on the 1st of January, 1845. London has had Building Acts ever since the reign of Queen Anne; but their object was chiefly to enforce regulations calculated to check the spread of fire. The last Building Act, commonly called Sir Robert Taylor's Act (14 Geo. III. c. 78), was passed in 1774, 'for the further and better regulation of buildings and party walls, and for the more effectually preventing mischiefs by fire." It extended to the cities of London and Westminster, and their liberties and other places within the bills of mortality, and to the parishes of St. Marylebone, Paddington, St. Pancras, and St. Luke's, Chelsea. The administration of the act was confided to district surveyors, each of whom had independent authority within his own district; but the magistrate at the nearest police-office might enforce or not, at his own discretion, the decisions of the surveyor. The technical regulations of this act were many of them, generally speaking, of so impracticable a nature that their evasion was connived at by the officers appointed to superintend the execution of the law; and it did nothing to discourage the erection of imperfect buildings in districts which have become a part of the metropolis since it was passed. Whether the new act (7 & 8 Vict. c. 84) contains regulations equally impracticable remains to be seen. Some of them probably are of this nature, as may be expected in attempts to legislate on technical matters of detail; but the object of the act is excellent, and any defects in carrying it out may be corrected without much difficulty. The removal of sources of danger and disease in crowded neighbourhoods, by enforcing ventilation and drainage, and by other means, is in itself both wise and benevolent. The window tax will prove a great impediment to the act being fully carried out in several respects.

The objects of the Metropolitan Buildings Act may be gathered from the preamble, which is as follows:—'Whereas by the several acts mentioned in schedule (A.)* to this Act annexed provisions are made for regulating the construction of buildings in the metropolis, and the neighbourhood thereof, within certain limits therein set forth; but forasmuch as buildings have since been extended in nearly continuous lines or streets far beyond such limits, so that they do not now include all the places to which the provisions of such acts, according to the purposes thereof, ought to apply, and moreover such provisions require alteration and amendment, it is expedient to extend such limits, and otherwise to amend such acts: and forasmuch as in many parts of the metropolis and the neighbourhood thereof, the drainage of the houses is so imperfect as to endanger the health of the inhabitants, it is expedient to make provision for facilitating and promoting the improvement of such drainage; and forasmuch as by reason of the narrowness of streets, lanes, and alleys, and the want of a thoroughfare in many places, the due ventilation of crowded neighbourhoods is often impeded, and the health of the inhabitants thereby endangered, and from the close contiguity of the opposite houses the risk of accident by fire is extended, it is expedient to make provision with regard to the streets and other ways of the metropolis for securing a sufficient width thereof; and forasmuch as many buildings and parts of buildings unfit for dwellings are used for that purpose, whereby disease is engendered, fostered, and propagated, it is expedient to discourage and prohibit such use thereof: and forasmuch as by the carrying on in populous neighbourhoods of certain works, in which materials of an explosive or inflammable kind are used, the risk of accidents arising from such works is much increased, it is expedient to regulate not only the construction of the buildings in which such dangerous works are carried on, but also to provide for the same being carried on in buildings at safe distances from other buildings which are used either for habitation or for trade in populous neighbourhoods; and forasmuch as by the carrying on of certain works of a noisome kind, or in which deleterious materials are used, or deleterious products are created, the health and comfort of the inhabitants are extensively impaired and endangered, it is expedient to make provision for the adoption of all such expedients as either have been or shall be devised for carrying on such businesses, so as to render them as little noisome or deleterious as possible to the inhabitants of the neighbourhood; and if there be no such expedients, or if such expedients be not available in a sufficient degree, then for the carrying on of such noisome and unwholesome businesses at safer distances from other buildings used for habitation; and forasmuch as great diversity of practice has obtained among the officers appointed in pursuance of the said acts to superintend the execution thereof in the several districts to which such acts apply, and the means at present provided for determining the numerous matters in question which constantly arise tend to promote such diversity, to increase the expense, and to retard the operations of persons engaged in building, it is expedient to make further provision for regulating the office of surveyor of such several districts, and to provide for the appointment of officers to superintend the execution of this Act throughout all the districts to which it is to apply, and also to determine sundry matters in question incident thereto, as well as to exercise in certain cases, and under certain checks and control, a discretion in the relaxation of the fixed rules, where the strict observance thereof is impracticable, or would defeat the object of this Act, or would needlessly affect with injury the course and operation of this branch of business: now for all the several purposes above mentioned, and for the purpose of consolidating the provisions of the law relating to the construction and the use of buildings in the metropolis and its neighbourhood, be it enacted,' &c.

---

* These acts are 14 Geo. III. c. 78, partly repealed; 50 Geo. III. c. 75, wholly repealed; and 3 & 4 Vict. c. 85, repealed so far as it relates to flues and chimneys.

The principal officers appointed to carry the act into effect are two Official Referees, a Registrar of Metropolitan Buildings, and Surveyors. The immediate superintendence of buildings is confided by the act to the surveyors, who are appointed by the court of aldermen for each district in the city, and by the justices at quarter-sessions for other parts of the metropolis. In all cases of dispute or difficulty the official referees appointed by the Secretary of State and the Commissioners of Woods and Forests will determine the matter, instead of the appeal being to the police magistrates, as was formerly the case. The official referees are also empowered to modify technical rules. The registrar, who is appointed by the Commissioners of Woods and Forests, is required to keep a record of all matters referred to the official referees, and to preserve all documents connected with their proceedings.

The third section of the act defines the limits to which the act shall extend, which are as follows:—'To all such places lying on the north side or left bank of the river Thames as are within the exterior boundaries of the parishes of Fulham, Hammersmith, Kensington, Paddington, Hampstead, Hornsey, Tottenham, St. Pancras, Islington, Stoke Newington, Hackney, Stratford-le-Bow, Bromley, Poplar, and Shadwell; and to such part of the parish of Chelsea as lies north of the said parish of Kensington; and to all such parts and places lying on the south side or right bank of the said river, as are within the exterior boundaries of the parishes of Woolwich, Charlton, Greenwich, Deptford, Lee, Lewisham, Camberwell, Lambeth, Streatham, Tooting, and Wandsworth; and to all places lying within two hundred yards from the exterior boundary of the district hereby defined, except the eastern part of the said boundary, which is bounded by the river Lea.

By § 4 power is given to the queen in council to extend the above limits to any limits within twelve miles of Charing Cross, notice of such extension being published in the 'London Gazette' one month previously.

The surveyor and overseers of the place in which buildings in a ruinous state may be situated, are required to apply to the official referees to authorize a survey to be made thereof. A copy of the surveyor's certificate is to be forwarded to the overseers (or to the lord mayor and aldermen, if within the city of London), and they are required to cause such ruinous building to be securely shored or a sufficient hoard to be put up for the safety of all passengers; and they are also to give notice to the owner to repair or pull down the whole or part of the building within fourteen days. An appeal lies to the official referees, and if the owner refuses to repair or pull down premises certified to be in a ruinous state, this may be done by the overseers, or in the city by order of the lord mayor and aldermen; and the materials may be disposed of to pay the costs of every description which may have been incurred; and if any surplus remains, it is to be paid to the owner. But if the proceeds from this sale of materials are not sufficient to cover the expenses, the deficiency is to be made up by the owner of the property, and may be levied under warrant of distress; and if there are no goods or chattels to levy, the occupier of the premises may be required to pay, and he can deduct the amount from his rent. The same course which the act directs as to buildings in a ruinous state may also be followed in reference to chimneys, roofs, and projections, so far as relates to repairing or making them secure. If the projection be from the front walls of any building and be in danger of falling, the occupier, or if not the occupier, the owner, may be required to take down or secure the same within thirty-six hours; and a penalty of five pounds is incurred for every day during which the projection complained of is allowed to remain unrepaired or in a dangerous state.

The subject of party walls, party fences, and intermixed buildings is regulated by §§ 20 to 39, and the following provisions are made as to their reparation, pulling down, or raising. If the consent of the adjoining owner is not obtained, notice must be given to him three months before the work is commenced, and the adjoining owner may obtain an order on application to the official referees for such a modification of the work as will render it suitable to his premises. If the consent of the adjoining owner cannot be obtained, the matter is to be referred to the surveyor, and the official referees may reject or confirm his certificate, and award the proportion of expenses, &c. The decision of the official referees is to be final and conclusive.

The 51st clause provides for a proper drainage. Before the walls of any building shall have been built to the height of ten feet, drains must have been properly built and made good leading into the common sewer, or if there be no sewer within one hundred feet, then to the nearest practicable outlet. If there be a common sewer within fifty feet of a new building, a cesspool must not be made without a good and sufficient drain leading to it. A cesspool under a house or other building must be made air-tight. Privies built in the yard or area of any building must have a door and be otherwise properly enclosed, screened, and fenced from public view.

The act also fixes the width of new streets and alleys. Every street must be of the width of forty feet at the least; and if the buildings be more than forty feet high from the level of the street, the street must be at least equal in width to the height of the houses or buildings. Every alley and every mews must be at least twenty feet in width, and if the buildings are higher, the width must be increased in proportion, so as to be at least equal to the height.

The 53rd clause is of great importance in reference to the sanitary condition of the poor. It provides that, from and after July 1, 1846, it shall not be lawful to let separately to hire as a dwelling any room or cellar not constructed according to the rules specified in schedule K, nor to occupy or to suffer it to be occupied as such, nor to let, hire, occupy, or suffer to be occupied any such room or cellar, built under ground for any purpose, except for a warehouse or storeroom. The official referees and the registrar of metropolitan buildings soon after the passing of the act issued forms to the overseers of the poor within their district, in order to assist the parochial authorities in making a return, which was to be ready by January 1, 1845, of all rooms which under the act are deemed unfit for dwellings, but which are now occupied as such. The building regulations contained in schedule K are as follows:—'With regard to back yards or open spaces attached to dwelling-houses, every house hereafter built or rebuilt must have an enclosed back yard or open space of at the least one square [a square is defined by the act to be 100 square feet], exclusive of any building thereon, unless all the rooms of such house can be lighted and ventilated from the street, or from an area of the extent of at the least three-quarters of a square above the level of the second story, into which the owner of the house to be rebuilt is entitled to open windows for every room adjoining thereto. And if any house already built be hereafter rebuilt, then, unless all the rooms of such house can be lighted and ventilated from the street, or from an area of the extent of at the least three-quarters of a square, into which the owner of the house to be rebuilt is entitled to open windows for every room adjoining thereto, there must be above the level of the floor of the third story an open space of at least three-quarters of a square. And to every building of the first class must be built some roadway, either to it or to the enclosure about it, of such width as will admit to one of its fronts of the access of a scavenger's cart. With regard to the lowermost rooms of houses, being rooms of which the surface of the floor is more than three feet below the surface of the footway, and to cellars of buildings hereafter to be built or rebuilt, if any such room or cellar be used as a separate dwelling, then the floor thereof must not be below the surface or level of the ground immediately adjoining thereto, unless it have an area, fireplace, and window, and unless it be properly drained. And to every such lowermost room or cellar there must be an area not less than three feet wide in every part, from six inches below the floor of such room or cellar to the surface or level of the ground adjoining to the front, back, or external side thereof, and extending the full length of such side; such area, to the extent of at least five feet long and two feet six inches wide, must be in front of the window, and must be open, or covered only with open iron gratings. And for every such room or cellar there must be an open fireplace, with proper flue therefrom, with a window-opening of at the least nine superficial feet in area, which window-opening must be fitted with glazed sashes, of which at the least four and a half superficial feet must be made to open for ventilation. With regard to rooms in the roof of any building hereafter built or rebuilt, there must not be more than one floor of such rooms, and such rooms must not be of a less height than seven feet, except the sloping part, if any, of such roof, which sloping part must not begin at less than three feet six inches above the floor, nor extend more than three feet six inches on the ceiling of such room. With regard to rooms in other parts of the building, every room used as a separate dwelling must be of at the least the height of seven feet from the floor to the ceiling.

§§ 54 and 55 provide for the restraint and eventual removal from populous neighbourhoods of trades which are dangerous, noxious, or offensive. Businesses dangerous as to fire must not be nearer than fifty feet to other buildings; and new businesses of this character must be forty feet from public ways. Persons are not in future to establish or newly carry on any such businesses within fifty feet of other buildings or forty feet from public ways; and all such businesses now carried on within the distances limited by the act must be given up twenty years after the passing of the act. A penalty of 50*l.* is incurred for erecting buildings in the neighbourhood of any such businesses, and 50*l.* per day for carrying on businesses of a dangerous kind contrary to the act. The persons offending may be imprisoned for six months if the penalty be not paid. The businesses of a blood-boiler, bone-boiler, fellmonger, slaughterer of cattle, sheep, or horses, soap-boiler, tallow-melter, tripe-boiler, and any other business offensive or noxious, are subject to similar regulations as those deemed dangerous as to fire, and are to be discontinued at the end of thirty years after the passing of the act. Trades deemed nuisances may be removed by purchase at the public cost on memorial by two-thirds of the inhabitants, and on the issue of an order in council. Public gas-works, distilleries, and other works under the survey of the Excise are exempted from the operation of the provisions contained in §§ 54 and 55.

The whole number of clauses in the act is 118; and there are schedules of great length. They involve matters of technical detail which it would be useless to give: our object is only to exhibit the general character of this important legislative measure.

BUILDING STONE. [Stone for Building, P. C. S.]

BULARCHUS, of Lydia, in Asia Minor, has the distinction of being the earliest painter on record. He was a distinguished painter at least as early as 720 years before Christ. Pliny (*Hist. Nat.* xxxv. 34) tells the following story about him:—He painted a battle of the Magnetes, for which Candaules, king of Lydia, about 716 B.C., gave him either the weight of the picture in gold or as much gold coin as would cover it. Neither of these versions may be true, but it appears evident that the picture was purchased by Candaules at a high price. Pliny in another part of his work (vii. 39) speaks of this picture as representing the destruction of Magnesia; and the late K. O. Müller has, in his 'Archæology of Art,' on this account rejected the tradition, because the only known destruction of Magnesia took place, according to Archilochus, about forty years after the death of Candaules, through Ardys, the successor of Gyges. Pliny however in the first instance mentioned, where he treats more particularly of art, calls it a Battle of the Magnetes, 'in qua erat Magnetum prœlium.' This may appear a singular and incredible incident, but it is not an isolated fact regarding the early existence of painting in Asia Minor. There is much evidence in antient writers to show that painting was comparatively an old art in Asia Minor and among the Ionian Greeks, while at the same period in Greece itself there is scarcely any evidence of its existence.

(*Dictionary of Greek and Roman Antiquities*, edited by W. Smith, Ph. D., article 'Painting.')

BULLANT, JEAN, one of the few early French architects of modern times, or of the *Renaissance* period, whose names have acquired historical celebrity, is supposed by Callet to have been born at Ecouen, at which place he died, in 1598, at the age of seventy-eight; accordingly the year of his birth must have been about 1520. All that is known of his origin is that he was a retainer of the Montmorency family; that he visited Italy in his early youth, and returned from Rome in 1544. For an adequate opportunity of displaying his professional acquirements he had not to wait long, having been employed the following year by the celebrated Constable Anne de Montmorency, to erect, conjointly with Jean Goujon, the Château d'Ecouen, in which work he took especial pains to show how diligently he had studied classical antiquity and imbibed its spirit, by parading the 'orders' in a variety of ways. Yet notwithstanding the 'purity' and 'correctness' of taste claimed for its decorations of that kind, the whole pile was a grotesque mixture of the antique, or rather the modern Italian orders, applied to what was in all other respects decidedly French in physiognomy, with immense roofs, large and fantastically ornamented lucarnes, and other characteristics of that age and country. Nay, even the ogive or French-Gothic style of the period was allowed to show itself externally and very conspicuously also in the two windows of the chapel placed in one wing of the entrance-front, while the entrance itself formed a portal or lofty frontispiece, decorated with Doric and Ionic columns, and a third order of *termini* in half-length figures. The principal altar of the chapel (now removed to that at Chantilly) was entirely in the antique or modern-antique style of the time, and has been considered Bullant's masterpiece,—supposing him to have designed the sculpture also. At the time of the Revolution (1789), and subsequently, such very great changes were made, that the present condition of this château affords little idea of the original design. Of the palace erected by Bullant for Catherine de Médicis (originally called L'Hôtel de la Reine, and afterwards L'Hôtel Soissons), not even so much remains—in fact, nothing save the astrological column which stood at one angle of the court, and is now attached to the Halle aux Blés, which occupies the site of what was Catherine's residence. For the same princess he also altered and enlarged the Château de Chenonceau—the scene of fêtes and revelries more magnificent than decorous. Another work attributed to him is the Hôtel de Carnavalet at Paris, but this is somewhat doubtful. It is certain however that he was employed upon the palace of the Tuileries (begun 1564), although it is not exactly known what was his share in the work, and what that of his associate Delorme. After having enjoyed the favour not only of Catherine, but of Henri II. and Henri III. (under both of whom he held the office of comptroller of the royal buildings), he found another royal patron in Henri IV., for whom he build a portion of the Gallery of the Louvre at the end next the Tuileries. Bullant was the author of two works, viz. 'Règles Générales d'Architecture,' 1563; and 'Traité de Géometrie et Horolographie,' 1567; the former of which is regarded as the earliest authority in the language on the subject of the so-called *five* orders.

(Callet, *Notice de quelques Architectes Français du Seizième Siècle.*)

BUMASTES, a genus of Trilobites, thus named by Mr. Murchison, includes the B. Barriensis or Barr Trilobite, which occurs in the upper Silurian strata.

BU'NIUM, a genus of plants belonging to the natural order Umbelliferæ, the suborder Orthospermeæ, and the tribe Ammineæ. It has an obsolete calyx; obcordate petals with a broad obtuse inflexed point; an oblong fruit, the carpels with 5 filiform equal ridges; the interstices with 1 or 3 vittæ; the stylopodium conical. The species are perennial herbs with usually tuberose and globose roots, square stems, compound leaves, and white flowers.

B. flexuosum, Pig-nut, has a general involucre of 1-3 leaves, partial more numerous; fruit oval, narrowing upwards, crowned with the elongated stylopodium and erect styles, interstices with 3 vittæ. This species is the B. *denudatum* of De Candolle: it is a native of the west and south of Europe, and plentiful in Great Britain. It has a nearly globular root, of a black or chestnut colour on the outside and white inside. It has an aromatic sweet taste, and is frequently dug up and eaten by children. It is called in this country by many names, as earth-nut, ar-nut, kipper-nut, hawk-nut, jur-nut, earth chestnut, and ground-nut. The synonymes are almost as numerous in the French and German languages. Pigs are very fond of this nut, and get fat when they are allowed to feed on them. When boiled they are a pleasant and nutritious food. Roasted, they are preferred by some people to chestnuts, and are often in this country and on the Continent added to soup or broth.

B. Balbocastanum of Linnæus is a different species from the latter, though often confounded with it. Its general and partial involucres are composed of numerous leaves, the fruit oblong, crowned with the short stylopodium and reflexed styles, the interstices with single vittæ. This plant has lately been discovered in chalky fields in Cambridgeshire and Herts, and is probably more generally diffused. George Don enumerates in the 'Gardener's Dictionary' sixteen species of Bunium.

(Babington, *Manual of Brit. Bot.*)

BUNTER SANDSTEIN, the lowest arenaceous member of the triassic system of strata, as understood in Germany (the lowest part of our Mesozoic series). The three parts are—

Keuper above, marly.
Muschelkalk in middle, calcareous.
Bunter Sandstein below, arenaceous.

This classification is applicable to England by retrenching the middle term. Mr. Murchison is of opinion that part of the

Bunter Sandstein (Grès bigarrè of France) belongs to the Palæozoic series, but no proof of this is yet published.

BUONARRUOTI, MICHEL-AGNOLO, the Younger, was born in 1568, in the city of Florence. He was the son of Lionardo di Buonarruoto, brother of the great Michel-Agnolo, or Michel-Angelo, as the name is now usually written; his mother was Cassandra di Donato Ridolfi. The Ridolfi and Buonarruoti were both families of the nobility of Florence. Michel-Agnolo the Younger was born between four and five years after the death of his uncle. He displayed a taste for literature and science at an early age, and studied mathematics and natural philosophy under Galileo. He became a member of the Academy of La Crusca at the early age of seventeen, his introductory lecture having been delivered in 1585. He was also a member of the Florentine Academy, and was appointed to offices of the highest dignity in both academies. He constructed a gallery in his house, and filled it with a splendid collection of works of art and Florentine antiquities, and held assemblies of the most distinguished artists and literary men in Florence. Soon after Urban VIII. became pope, he invited Michel-Agnolo to Rome, where he resided some time, and gave instructions in the mathematical sciences to the pope's nephews. He died January 11, 1646.

Michel-Agnolo Buonarruoti the Younger is chiefly distinguished as the author of two dramatic compositions—'La Tancia' and 'La Fiera.'

'La famosissima Tancia,' as Crescimbeni calls it, though written in ottava rima, is not a poem, but a play in five acts. The characters are all peasants of the neighbourhood of the city of Florence, except two, who are citizens, and, except these two, they all speak in the country dialect of Tuscany. La Tancia is the name of the principal female character, a country beauty more distinguished for simplicity than wit. This rustic drama is a composition of great excellence. The characters are exhibited with great distinctness and without exaggeration; the dialogue is rapid and animated; and the humour, which arises chiefly from the simple notions and natural expression of the country people, exhibiting their feelings and modes of living and superstitions, is highly amusing, and without any taint of grossness. There is not much action, and some of the circumstances are extravagant. As a specimen of the country dialect of Tuscany at the period when it was written, 'La Tancia' is a work of the highest reputation. It was first exhibited in 1611, and first printed in 1612, without the name of the author.

'La Fiera' is a series of five comedies, of five acts each, forming altogether a connected exhibition of characters (it cannot be called a dramatic fable, or interwoven series of events) in twenty-five acts. It was written especially for the use of the Academy of La Crusca in the composition of the first edition of their great 'Vocabulario' or Dictionary of the Italian language. The purpose for which it was written will be best explained by an extract from Dr. Johnson's Preface to his Dictionary.

'That many terms of art and manufacture are omitted must be frankly acknowledged; but for this defect I may boldly allege that it was unavoidable. I could not visit caverns to learn the miner's language; nor take a voyage to perfect my skill in the dialect of navigation; nor visit the warehouses of merchants and the shops of artificers to gain the names of wares, tools, and operations, of which no mention is found in books. What favourable accident or easy inquiry brought within my reach has not been neglected; but it had been a hopeless labour to glean up words by courting living information, and contesting with the sullenness of one and the roughness of another.

'To furnish the Academicians della Crusca with words of this kind, a series of comedies called "La Fiera," or the Fair, was professedly written by Buonarroti; but I had no such assistant, and therefore was content to want what they must have wanted likewise, had they not luckily been so supplied.'

The number and variety of characters exhibited in 'La Fiera' is so great as not to be easily counted; they are of all grades of society, and of all professions and trades,—besides numerous allegorical characters, which give the work as much the appearance of a series of masques as of comedies. In its style of composition it is also more poetical than 'La Tancia,' with many chorusses and lengthened lyrical dialogues; and has altogether less of dramatic interest and animation. In the purity of the terms selected, as well as of the idiom, the work is of high repute.

'La Fiera' was first performed in the Carnival of 1618 in the theatre of the great Hall of the Offices (Sala degli Ufizj) in Florence. It was never printed till 1726, when 'La Fiera' and 'La Tancia' were published in folio, with copious explanatory and philological notes by Salvini. 'La Fiera, Commedia di Michelagnolo Buonarruoti il Giovane, e La Tancia, Commedia Rusticale del Medisimo, coll' Annotazioni dell' Abate Anton Maria Salvini, Gentiluomo Fiorentino e Lettor delle Lettere Greche nello Studio Fiorentino.' The notes of Salvini to both pieces are very useful, though somewhat pedantic.

Two other dramatic pieces by Michel-Agnolo the Younger, 'Il Natale d' Ercole' and 'Il Giudicio di Paride,' have been printed; they are of the class called masques. The 'Cicolate' is printed in the 'Prose Fiorentine.' He also was the first publisher of the poetry of his uncle, 'Rime di Michel-Agnolo Buonarruoti, raccolte da Michel-Agnolo suo Nipote,' Firenze, 4to. 1623. Many other works in MS. are said to be in the possession of the descendants of his family.

(*Life* annexed to Salvini's edition of 'La Fiera' and 'La Tancia.')

BUONINSEGNA. [Duccio di Buoninsegna, P. C. S.]

BUOYANCY is the power which certain materials have of being supported at the surface of a fluid so as to sink in it as much only as a part of their depth or thickness; thus ice, some woods, &c. are said to have buoyancy in water. Almost all solid bodies have the power of floating on mercury. The term is frequently used to designate the weight by which a solid mass of wood, or a vessel of wood or metal, can be made to sink in water till its upper surface is on a level with that of the water, or till a horizontal section of the body, at a given distance from the upper or lower surface of the latter, is on that level.

It is shown [Hydrostatics, P. C.] that, when a body is immersed in a fluid, the weight of the body with whatever it may carry is equal to the weight of as much of the fluid as is equal in volume to the immersed part of the body. Hence, if the specific gravity of a body and that of a fluid are given (the former being less than the latter), the buoyancy may be found. Thus, by the rules of mensuration, find in cubic feet the volume of the body, if it is to be wholly immersed, or the volume of the part only which is to be under water, and multiply it by the specific gravity of water (the weight of a cubic foot of the fluid), the product will be the weight of the water displaced: subtract, from this product, the weight of the body; and the result will be the required buoyancy, or the weight which it will carry without sinking lower than the given depth. If the body, suppose it to be a log of timber, cannot be actually weighed, the product of its volume by its specific gravity will express its weight.

If it be required to find the volume of a rectangular mass of timber, of given depth, which will support a given weight, the following equation may be formed:—

Let s be the unknown area of a horizontal section through the mass of timber, and consequently the horizontal surface of the displaced water. Let d be the given depth of the mass of wood and d' the given depth to which it is to be immersed. Let g be the specific gravity of the wood and g' that of the water; also let W be the given weight which is to be supported:

$$\text{Then } s \times d \times g + \text{W} = s \times d' \times g' ;$$

$$\text{whence } s = \frac{\text{W}}{d'g' - dg}$$

and this value of s being multiplied by d, will give the required volume.

In a similar manner may the buoyancy of casks or other vessels be found, or the number of vessels which would be required to float any given weight; the volumes being found by the rules of mensuration, and the weight of a vessel by experiment or by the volume and specific gravity of its solid part.

This proposition is useful in determining the amount of volume which would have buoyancy sufficient to raise a sunken ship, or in determining the dimensions of a floating bridge which may support a given weight of troops or artillery.

BUOYS AND LIFE-PRESERVERS. Many ingenious plans, more or less practicable, have been proposed within the last few years, for saving from drowning those who may be in peril by shipwreck or otherwise. In Life-Buoy, P. C., several contrivances are noticed, which up to that time had been suggested for this purpose, such as those of Lukin, Greathead, Wilson, Bremmer, Bray, Gordon, Ansell, &c. Those which have since been brought forward may be grouped together under three headings, according as they relate to *boats*, *buoys*, or *garments*.

Safety-Boats.—In 1839 Mr. Mackintosh of New York took out a patent for a sort of temporary life-boat. It consists of canvas rendered impervious to water by being saturated with a solution of caoutchouc. A square piece of this canvas is so hemmed at the edges as to leave a hollow tube or channel, which, when filled with air, may act as a buoyant cell or air-chamber. The opposite edges of the piece of canvas are partially sewn together, so as to give to it the semblance of a boat; the sewn edges being cemented with caoutchouc to render them air and water tight. A small tube, having a stop-cock attached to it, furnishes the means of filling the sewn tubes with air from the mouth. The views of the inventor are, that if the air-tubes, forming a sort of gunwale to the boat, be of moderate size, there will be sufficient buoyancy in the boat to support a person who might get into it on a sudden emergency. Water-tight coverings may be placed over the boat if necessary; and by making loops of thongs in the edge of the boat, oars might be used to propel it. The notion of the inventor seems to be, that a boat, capable of being folded up like a piece of cloth when not in use, may thus be made available in the water when necessary; and he also suggests certain modes of bringing the ship's mattresses to aid in the construction of a boat of larger size.

Mr. Adams, shortly after this time, contrived a form of safety-boat of more substantial construction. It has two bows, so that both ends are alike, thereby enabling the rowers to change their course without moving the head of the boat round. There is a steerer at each end, who steers with an oar instead of a rudder. The dimensions are recommended by the inventor to be about thirty feet long, nearly six wide, and rather more than two feet deep in the middle. The upper part of the boat is lined on the inside with cork; and an air-tight vessel, capable of containing from thirty to fifty gallons, made of tin-plate, copper, or India-rubber cloth, is fitted under the decks at each end; or else a large bulk of cork is used instead. When made of such dimensions, it is supposed that, with twenty persons in the boat, it would not sink even if filled with water.

In 1841 Mr. Salt of Shrewsbury described, in the 'Mechanics' Magazine,' a life-boat, the principle of which depends mainly on having a false bottom made water-tight. The boat is thirty feet long by seven or eight wide; it has hanging-doors to let off the water; iron paddle-wheels to be worked by hand; and has ballast enough to sink it to the depth of about eighteen inches.

In the next following year a contrivance was introduced at New York, called the 'Man-overboard Boat,' being intended to be thrown hastily into the sea to save any one who might have fallen overboard. It was, in a course of experiments, suspended from the yard-arms of a ship, at heights of thirty, forty, and fifty feet from the water; when let go, it descended into the water, but righted itself instantly; and the idea seems to be that such a boat might be made available with great quickness, in case of accident.

Holcroft's pontoon, or safety-boat, also of recent origin, has some peculiarities about it, on account of its portability. It is formed of a skeleton frame, easily detached and folded into one-sixth of the space which it occupies as a boat. The frame is covered with layers or folds of strong canvas saturated with India-rubber; and in various parts are cases or air-cells, partitioned off one from another. The thickness of the canvas is increased according to the size of the boat, so as to give it a great degree of toughness, and at the same time an elasticity fitted to yield to any sudden shock without fracture. The portability of the boat is brought about by having the framework hinged to the keel, so that the sides close together like a portfolio; various minor arrangements being made to give fixity to the shape when the boat is in use. The invention is a French one, but patented both in England and France. As an example of strength, lightness, and portability, a large boat in this form was tried in France in 1841. It was more than a hundred feet long; and, although formed of canvas sides, it was loaded with nearly one hundred tons of wood and wine, which it safely conveyed from Auxerre to Paris, down a shallow and much interrupted stream. It was then taken to pieces in three or four minutes, and all the materials packed in two carts, which took it to Auxerre for another cargo.

Captain Smith's paddle-box boats, for steam-vessels, originated from that officer having observed that there is room, upon such paddle-boxes, for a life-boat, without encumbering the ship in any way; and builders of steamers have devised a mode of making the inverted boat a covering for the paddle-box. Many lives were saved by such a boat at the shipwreck of the Solway, and afterwards of the Isis, of which accounts have appeared in the public papers. The boats are capable of being launched into the sea from the ship very expeditiously.

Minor varieties of arrangement have appeared in great number. Thus, Mr. Hennessey's elastic boat has a flexible framework of iron, wood, and whalebone, and a covering of water-proof cloth; something like the French boat; and Dr. Patterson has described to the British Association a life-boat with a bottom so constructed, that any water which washes over into the boat may find its way out at valvular openings.

Safety-Buoys.—Captain Beadon, in 1843, communicated to the Society of Arts a description of a buoy, in which a person might row himself with oars. Lieutenant Cooke had previously introduced a life-buoy, which is much used in the navy, and which, being hung from the stern of the vessel, is let go when wanted, and then floats upon the water. The buoy is formed of two hollow copper spheres connected by a horizontal rod; and from the middle of the rod rises a vertical stem containing a fuse at the top. The fuse is lighted, the buoy is lowered, and the person in the water, attracted towards the buoy by the light (if at night), seeks safety by clinging to the floating mass. Captain Beadon has sought to avoid certain (alleged) imperfections in this arrangement. His buoy consists of a metal tube, eight feet long by one foot in diameter, tapered at its after end: it is divided into water-tight compartments, and has a keel ten or twelve inches deep. There is a kind of saddle across the cylinder, on which a man may sit; a staff on which a light may be kindled; and a paddle to work the buoy, or two oars hinged to it.

In 1843 Mr. Hobbs devised a curious kind of buoy, which is intended not so much to save persons by clinging to it, as to warn off ships from a dangerous spot. It consists of a hollow apparatus so formed that when rocking about by the motion of the waves on which it floats, the entry of the water into certain compartments or chambers may cause a rush of air through a small aperture, thereby giving a whistling sound capable of being heard at a considerable distance. Such a buoy must be fixed in position, to answer its object.

Lieutenant Irvine has proposed a safety-portmanteau, so constructed that neither water nor damp air can enter any part of it, though immersed in water for months. It is so buoyant, even when filled with clothes, as to be able to support one or two persons clinging to it, and the use of such a buoy has been proposed because it may save clothes and papers withinside, and their owner outside; while at the same time it is easily thrown from a vessel into the sea. Captain Henvey's life-buoy consists of a light wooden frame, shaped like a horse-shoe, but sufficiently wide to admit a man's body, and rendered buoyant by plates and disks of cork attached to it: the hinder part is open, but the front is fashioned into the shape of a beak; for more readily cutting through the water. Mr. Taylor, of Leith, has devised a kind of deck-chair, twenty-eight inches long by eighteen broad: it is capable of being quickly converted into a water-tight boat-shaped vessel, nearly four feet long, and capable of holding and supporting one person.

A number of other recent contrivances bear more or less on this matter; such as Captain Dansey's kite (1840) and Mr. Carte's rocket (1841) for carrying a rope to a wrecked or stranded ship; but most of these are similar to some or other of the contrivances proposed earlier.

Safety-Garments.—Corks and air-bags, attached in some way to the person, have often been regarded as a probable means of saving life. Recently however an 'air-hat' has given a new form to such contrivances. The upper part of the crown of the hat is made air-tight and water-proof, so that in the event of the wearer falling into the water, its buoyancy may (according to the intention of the inventor) save him from being drowned. The lining of the hat is capable of being loosened, and the vacant space expanded by air being blown into it, so as to form a buoy capable of being grasped by any one immersed in the water, instead of being worn like a hat.

Messrs. Macintosh have introduced a 'life-cloak' or cape, differing but little in appearance from those which are frequently worn in the streets; but capable, by the introduction of air through a stop-cock into a vacancy formed by a double thickness of cloth, of being converted into a life-buoy. In a description of this cape, it is stated that the inventor adopted three modes of testing its efficiency. First, he calculated that the volume of air would support 15 lb. in the water—equal to the tenth part of the weight of an individual of about 10 stone; and therefore would keep the head and neck, at east, above water. Secondly, he floated by its means a weight of between fifteen and sixteen pounds. Thirdly, he personally tested the contrivance in water six inches deeper than his own height; when he floated, with head, neck, and shoulders above water.

Mr. Reece, in 1843, introduced a contrivance in which floating and respiration are both attended to. There is an inflated pad or cushion of India-rubber attached to the back to enable the wearer to float in water with his face uppermost; and there is a wire-gauze protector fixed over the mouth and nostrils, sufficient to admit air for respiration, but to repel water. Another contrivance, that of Mr. Symington, consists of a peculiarly formed jacket or belt, capable of being quickly bound round the waist, and having buoyancy enough to keep the head of the wearer above water.

BU'PALUS, an early Greek sculptor of the island of Chios, and of a family long celebrated as statuaries, was the son of Anthermus mentioned by Pliny, and the brother of Athenis, and lived about the sixtieth Olympiad, or 540 B.C. He is better known for the enmity between him and the poet Hipponax than for his works, though both Pliny and Pausanias notice several of them. The quarrel between Bupalus and Hipponax is supposed to have originated in the sculptor refusing to give his daughter in marriage to the poet: who accordingly used his well-known satirical weapons against him; upon which the sculptor retaliated by executing a ridiculous statue of Hipponax, who, it seems, from some peculiarities of his person, was easily made ridiculous. This plastic satire was revenged by the poet by some satirical iambics upon Bupalus, of so pungent a nature, according to a report, no doubt false, as to make the sculptor hang himself. The story seems to have been common centuries after the time of Bupalus, for Horace (*Epod.*, ode vi.) has the words 'Acer hostis Bupalo' as a sufficient indication of Hipponax. Pliny (*Hist. Nat.*, xxxvi. 5) speaks of works by the brothers Bupalus and Athenis, at Chios, Lesbos, Delos, and at Rome. Their father Anthermus was the son of Micciades, who was the son of Malas. Upon some of their works at Delos they wrote, 'Chios is not to be celebrated for its vines only, but also for the works of the sons of Anthermus.' There is a sitting naked Venus in the Vatican, with Βούπαλος ἐποίει on the base; but it is evidently, from its fully developed style, of a much later period than that of the subject of this notice. (*Museo Pio Clementino*, i. tab. 10.)

(Junius, *Catalogus Artificum*; Sillig, *Catalogus Artificum*; Thiersch, *Epochen der Bildenden-Kunst*, &c.)

BUPLEURUM (from βοῦς, ox, and πλευρόν, side), a genus of plants belonging to the natural order Umbelliferæ, the suborder Orthospermeæ, the tribe Ammineæ. It has an obsolete calyx; entire, roundish petals, with a closely involute, broad, retuse point; the fruit subdidymous; carpels with equal winged or filiform and sharp or obsolete ridges; interstices with or without vittæ; stylopodium depressed. The species are quite smooth, herbs or shrubs. The leaves are rarely cut, in most instances being quite entire. This arises from their possessing no lamina; they are composed entirely of the petioles, and are in fact phyllodia. The flowers are yellow.

There are about fifty species of Bupleurum. They are natives of temperate climates in most parts of the world. They are known by the common name of Hare's-ear. When eaten by cattle they are supposed to injure them and cause distension of the abdomen; hence the generic name. *B. rotundifolium* is the Thorow-wax of the herbalists. It has a branched stem, with oval perfoliate leaves, and the fruit with striate interstices. It was supposed to possess especial virtues as a vulnerary, but there is no question now that wounds are better without any such applications. There are three other British species, *B. tenuissimum*, *B. aristatum*, and *B. falcatum*. The species are sometimes cultivated in gardens. The annual species only require to be sown in the open ground early in the spring. The perennial may be increased by dividing their roots; the shrubby by cuttings.

(Don, *Gard Dict.*; Babington, *Man. of Brit. Bot.*)

BUPRESTIS (Fossil). The elytra of beetles found at Stonesfield have been referred to this genus.

BURBURRA. [BERBERRA, P. C. S.]

BURDER, REV. GEORGE, was born in London on the 25th of May, or, according to the New Style shortly afterwards introduced, the 5th of June, 1752. As he showed an early taste for drawing, he was placed under the tuition of an artist named Isaac Taylor. About 1773 he became a student in the Royal Academy; but shortly afterwards he began to preach, and at length determined to relinquish his profession, and to devote himself wholly to the Christian ministry. In 1778 he became pastor of a Congregational or Independent church at Lancaster; in 1783 he removed to Coventry, during his residence in which city he took an active part in the formation of the London Missionary Society; and in 1803 he accepted a unanimous call to the pastorship of the Congregational church in Fetter Lane, London, his removal to the metropolis being further urged by a request to undertake the offices of secretary to the London Missionary Society, and editor of the 'Evangelical Magazine,' then vacant by the death of the Rev. John Eyre. The duties of these offices were performed by Burder with much zeal and peculiar talent, until increasing years and infirmities compelled him to resign them; and, during a period of more than twenty years after his removal to London, he took a prominent part in the various religious movements of the body with which he was connected, and of which he was one of the most influential and universally respected members. Burder died at the age of eighty, on the 29th of May, 1832. His publications, which were numerous and exceedingly useful, consisted chiefly of religious essays and sermons of a peculiarly simple character, which have gained a high reputation far beyond the limits of his own religious denomination. Of these the 'Village Sermons,' of which six volumes appeared at various times between 1799 and 1812, and which have been repeatedly reprinted, and translated into several European languages, are perhaps the best known. Of forty-eight 'Cottage Sermons,' 'Sea Sermons,' and 'Sermons to the Aged,' written for the Religious Tract Society, the aggregate circulation during his life amounted to little short of a million copies. Among his other publications were, 'Evangelical Truth Defended,' 8vo., 1788; an abridgement of Dr. Owen's 'Treatise on Justification by Faith,' 8vo., 1797; 'The Welsh Indians, or a Collection of Papers respecting a people whose ancestors emigrated from Wales to America in 1170, with Prince Madoc, and who are said now to inhabit a beautiful country on the west side of the Mississippi,' 8vo., 1797; 'Missionary Anecdotes,' 12mo., 1811; and a new edition, revised and considerably extended, of the Rev. Laurence Howel's 'History of the Bible,' in three volumes, 8vo. and 12mo., 1807. Burder also edited Bunyan's 'Pilgrim's Progress' and 'Holy War,' and Matthew Henry's 'Commentary,' and published several other works, some of which are mentioned in an obituary notice in the 'Gentleman's Magazine' for July, 1832, and in the 'Memoir' published in 1833 by his eldest son, Henry Forster Burder, D.D., which is partly autobiographical. There is also a pretty full account of Burder in Dr. Morison's 'Fathers and Founders of the London Missionary Society.'

BURDETT, SIR FRANCIS, BART., was born on the 25th of January, 1770, and was the third son of Francis Burdett, second son of Sir Robert Burdett, Bart., of Bramcote, Warwickshire. His mother was Eleanor, daughter and co-heiress of William Jones, Esq., of Ramsbury, in Wiltshire. Before the death, in 1797, of his grandfather, Sir Robert, who had also succeeded his grandfather in the title, the subject of the present notice had lost both his father and his two elder brothers; and, his father's elder brother having previously died, he became baronet. His father had died in 1794; and Sedley, the last of his two elder brothers, had been drowned, along with Lord Montague, in 1793, in attempting to cross the falls of the Rhine at Schaffhausen in a small boat. The baronetcy had been conferred in 1618 upon his great-great-great-grandfather, Sir Francis, said to be the nineteenth in lineal descent from Hugh de Burdett, who came over with the Conqueror. Thomas Burdett, who was put to death in the reign of Edward IV., for wishing that the man who had moved the king to kill a favourite white buck in his park at Yarrow had the horns in his belly, was an ancestor of the late baronet. Sir Francis was educated at Westminster School, and afterwards spent some years on the Continent. In 1793 he married Sophia, youngest daughter of the late Thomas Coutts, Esq., banker. In 1796, being still Mr. Burdett, he was, by the interest of the Duke of Newcastle, returned for Boroughbridge, in Yorkshire, his colleague being Sir John Scott, afterwards Earl of Eldon and Lord Chancellor. A few years subsequent to this, on succeeding to the estates of his mother's family, he assumed, in addition to his paternal name, that of Jones, which however he soon afterwards resigned. From his first entry into parliament Sir Francis had followed an extreme course of popular politics, opposing the government and the war, advocating a reform in the representation, and especially distinguishing himself by an inquiry which he got set on foot into the abuses of the Cold Bath Fields and other prisons. This led to his being brought forward at the general election in 1802 as a candidate for the representation of Middlesex, in opposition to Mr. Mainwaring, who was chairman of the County Sessions, and had been the person by whom the investigation into the prison abuses had been principally resisted and impeded in the House. The public excitement which this contest occasioned was unexampled. It ended on the 15th day by giving Sir Francis a majority of 371 votes over his opponent; but a committee afterwards declared the election void, and the House sent the two sheriffs to Newgate. A new election took place in July, 1804, the other candidate being now Mr. Mainwaring's son, the father having disqualified himself by an infringement of the Treating Act; and at the conclusion of the poll Burdett was left in a minority of five, the numbers being 2828 and 2823. But this election was also declared void by a committee, the report declaring at the same time that Sir Francis ought to have been returned. On this his return was also attacked; and eventually another committee, on the 8th of February, 1806, found that Mainwaring had a majority of one, and that he ought to be the member. Three of Burdett's voters, being afterwards prosecuted, were sentenced to transportation to Botany Bay; and the proceedings altogether are said to have cost Sir Francis above a hundred thousand pounds. At the next general election, in 1806, he was again proposed for the county; but this time he only polled 1197 votes, and Mr. Mellish was returned. In May, 1807, a duel took place between Sir Francis and Mr. James Paull, whom he had supported as the popular candidate for Westminster the year before: they fought at Combe Wood near Wimbledon Common, and at the second exchange of shots both were seriously wounded. While they lay ill, both were put in nomination for Westminster at the new general election; and the result was that, after a contest of fifteen days, Sir Francis was brought in at the head of the poll, having obtained 5134 votes (his colleague Lord Cochrane only polling 3708), and that Paull was left fifth, and at the bottom, with only 269. At the preceding election Paull had had 4365 votes, being only 277 under Mr. Sheridan, the successful candidate. Sir Francis continued to sit for Westminster from this time for nearly thirty years. The great event of his subsequent career is his committal to the Tower by the House of Commons, in March, 1810, for a letter to his constituents denying the power of the House to imprison delinquents, which he published in Cobbett's 'Political Register,' and which the House voted to be libellous and scandalous. He attempted to resist the Speaker's warrant, and some lives were lost in a street contest between the military and the people; but he eventually surrendered, of course, and he lay in prison from the 9th of April till the prorogation of parliament on the 21st of June. Sir Francis continued to adhere to the popular side in politics till some time after the appointment of the Melbourne ministry, in April, 1835, when he went into opposition against his old friends in the government, on the ground principally of the court he charged them with paying to Mr. O'Connell and his followers in their agitation against the Irish established church. In these circumstances he declined standing for Westminster at the general election in July, 1837; but he was returned for Wiltshire, and he sat for that county till his death, which took place on the 23rd of January, 1844. Lady Burdett had died only a few days before.

(*Public Characters*, vol. v.; Beatson's *Chronological Register of Parliament*; *Annual Register*; *Parliamentary History*; *Biographical Index to House of Commons*, &c. &c.)

BURDIE HOUSE, a locality near Edinburgh, where a thin band of carboniferous limestone, remarkably rich in Entomostraca, and containing Sphœnopteris, and other land plants, occurs. It has been described by Dr. Hibbert, in the Trans. of the Royal Soc. of Edinburgh.

BURGAGE HOLDING is one of the forms of feudal tenure in Scotland. The holders of the fiefs under the charters of privileges in favour of the burghs, held directly of the crown, returning service by watching and warding. The return is now merely nominal, but the holding is still of the crown, though the investiture is given by the magistrates of the burgh. The peculiar character of this holding has preserved in modern practice the important distinction, that while other descriptions of landed property may be subfeued ad infinitum, a burgage holding can only be transferred from one crown vassal to another, who comes in his place. All transfers, to constitute real rights, must be followed by sasine recorded in the books of the sheriff clerk of the burgh. All the lands held by or of a royal burgh are not necessarily held by burgage tenure. The community may, like an individual, obtain feu rights and grant subinfeudations; the proper burgage holding is applicable only to those lands to which the charter granting burgal privileges for the usual return, applies.

BURGKMAIR, HANS, a celebrated old German painter and wood-engraver, born at Augsburg in 1472. He lived some time in Nürnberg, and was the contemporary, and by some supposed to have been the scholar, of Albrecht Dürer. They appear to have worked together, but the scholarship is a mere conjecture, which, like many other similar conjectures, has apparently arisen from a species of hero-worship, or an anxiety to show that Albrecht Dürer was directly or indirectly the source of everything excellent in art that was produced in his own time and country.

There are still several excellent paintings in oil, for their period, by Burgkmair, preserved in the galleries of Vienna, Munich, and Schleissheim; and there are others at Nürnberg and at Berlin. He painted also in fresco and in distemper, and he illuminated manuscripts; but he is better known for his woodcuts, or at least those cut from his designs, which amount to nearly seven hundred, including some maps. The Triumph of the Emperor Maximilian I., in 135 large cuts, with a description by the emperor, is one of his chief works; it was executed in 1519, the year of Maximilian's death, chiefly by Burgkmair: some of the prints are marked with his name in full; others with merely H. B. He executed, likewise with assistance, another series of cuts in commemoration of the same emperor, entitled Der Weiss Kunig (The Wise King), of which there are 237 large cuts, being illustrations of the deeds of Maximilian, from the description of H. S. Sauerwein. The emperor is said to have superintended the work himself. The blocks are still preserved in the library of Vienna. There is also by Burgkmair an equestrian portrait of Maximilian, in chiaroscuro, dated 1518. He cut also an excellent portrait of Johann Baumgärtner, dated 1512, and a picture of St. George on horseback, both in chiaroscuro. On Burgkmair's prints in chiaroscuro another name occurs besides his own—Jost de Negker, to whom probably the execution of the chiaroscuro is due. Besides these and many other woodcuts, there are several etchings and two engravings attributed to Burgkmair. His paintings are carefully and solidly executed, but are Gothic in taste; there are ten in the Pinakothek at Munich, of which that of the three saints, Liborius, Eustace, and Roch, is strikingly excellent in its style (Cabinet ii. No. 24). In the gallery of the Belvedere at Vienna there is a picture by Burgkmair of himself and his wife, with their ages inscribed upon it, dated May 10, 1528, his fifty-seventh year. The year of his death is not known, but it is supposed to have been 1559. Sandrart has given a portrait of Burgkmair in his 'Teutsche Academie,' &c., and there is a print by G. C. Kilian, of the Vienna portrait of Burgkmair and his wife.

(Heineken, *Dictionnaire des Artistes*, &c.; Mechel, *Tableaux de Vienne*; Bartsch, *Peintre-Graveur*; Heller, *Geschichte der Holzschneidekunst*, &c.)

BURGLARY. [Housebreaking, P. C. S.]

BURIAL. [Interment, P. C.]

BURMA'NNIÆ, a natural order of plants belonging to Lindley's group of epigynous Endogens. It was first constituted by Sprengel as a separate order, and is sometimes made a section of Amaryllideæ. The species of plants belonging to this order are herbaceous, with tufted radicle, acute leaves, or none at all, with terminal flowers, which are sessile upon a 2- or 3-branched rachis, or solitary. The flowers are hermaphrodite; the perianth tubular, superior, coloured, membranous, with 6 teeth, the 3 inner ones minute, the outer larger with a wing or keel at the back; the stamens 3, inserted in the tube opposite the petals, with sessile 2-celled anthers opening transversely with a fleshy connective, and sometimes 3 sterile stamens alternate with them; the ovary inferior or 3-celled, many-seeded, with the dissepiments alternate with the wings of the perianth; the style single; the stigma 3-lobed, petaloid; the capsules covered by the withered perianth or 3-celled, bursting irregularly; the seeds being numerous, minute, striated with an aril, fleshy albumen, and minute embryo.

The genus Burmannia, on which this order has been founded, is variously assigned by different botanists. Jussieu placed it in Bromeliaceæ, Brown in Juncaceæ, Von Martius in Hydrocharaceæ, Blume places it between Juncaceæ and Iridaceæ, Lindley near Hæmadoraceæ, and there can be little doubt of the propriety of constituting it a distinct order. The species are natives of Asia, Africa, and America. The genera referred to this order are Burmannia, Tripterella, Gonyanthes, Gymnosiphon, Apteria. They have not very conspicuous properties; the Apteria setacea is said by Nuttall to possess tonic and astringent properties. Tripterella cærulea is also said to have a flavour very similar to that of green tea.

(Lindley, *Natural System*; Burnett, *Outlines of Botany*.)

BURNES, SIR ALEXANDER, was born May 16, 1805, at Montrose, in Scotland. His father was an active magistrate of Forfarshire, and held successively the chief official situations in the borough of Montrose. His grandfather was the brother of William Burnes, father of the poet Burns, who was the first to omit the letter e from the family. Alexander Burnes was educated at the Montrose Academy, in which he greatly distinguished himself. Having obtained a cadetship in the Bombay army, he left school at the age of sixteen, and arrived at Bombay Oct. 31, 1821. On the 25th of December, 1822, he was appointed interpreter in Hindustanee to the 1st extra battalion at Surat, and, on account of his proficiency in the Persian language, the Judges of the Sudder Adaulut appointed him, without solicitation, to the office of translator of the Persian documents of that court.

In consequence of disturbances in Cutch, the regiment to which Ensign Burnes was attached, the 21st Bombay native infantry, having been ordered to Bhooj, he joined it there in April, 1825. He was soon afterwards made quartermaster of brigade, and in November, 1825, when he was only twenty, was appointed Persian interpreter to a force of eight thousand men assembled for the invasion of Scinde. In August, 1826, he was confirmed on the general staff as deputy-assistant-quartermaster-general.

At this period he drew up an elaborate paper on the statistics of Wagur, for which, in 1827, Lieut. Burnes received the thanks of the Bombay government and the special commendation of the Hon. Mountstuart Elphinstone, the governor; and he obtained similar testimonies of approbation in 1828 for a memoir on the eastern mouth of the Indus. Lieut. Burnes was appointed assistant-quartermaster-general to the army, March 18, 1828, and in Sept. 1829, was appointed assistant to the political agent in Cutch, in prosecution of the survey of the north-west frontier. (He has given an account of this survey in the Transactions of the Royal Geographical Society for 1834.) He soon afterwards made a journey into Rajpootana, from which however he was recalled; and in 1830 was appointed by the Indian government to proceed to Lahore with some remarkably large horses, as a present from the king of England to Runjeet Singh, the ruler of the Panjab. The details of this expedition are given in the third volume of his 'Travels into Bokhara.' The mission was directed to proceed by the devious route of Scinde; the secret object being to obtain information concerning the Indus, the envoy was provided with letters to the Ameers, and, the better to obviate suspicion, he took with him a guard of wild Beloochees. The mission sailed from Mandavie in Cutch, Jan. 21, 1831, and on the 28th reached the western mouth of the Indus. After a long and tedious negotiation with the rulers of Scinde, Burnes received their full sanction to proceed by water from the mouth of the Indus. The delay however had been turned to account. Burnes had made a complete survey of the mouths of the river, and a map of the lower part of its course. After spending a week at Tatta, they set sail up the river, April 12th, and reached Hyderabad on the 18th, where he was received with great cordiality by the Ameers. The mission remained at Hyderabad till the 23rd of April, when they re-embarked on the Indus, and after visiting all the places of importance along the banks, on the 18th of July they arrived at Lahore, where their reception was magnificent, a deputation of nobles conducting the envoy and his suite to the door of the palace of Runjeet Singh, amid salutes of musketry and artillery. 'While stooping,' says Burnes, 'to remove my shoes at the threshold, I suddenly found myself in the arms and tight embrace of a diminutive old-looking man, the great maharaja Runjeet Singh, who conducted me by the hand to the interior of the court, and had advanced that distance to do us honour.'

After remaining till the middle of August with Runjeet Singh, who treated Burnes with the familiarity of a friend, the mission left Lahore, crossed the Sutlege, and proceeded to Loodiana, a frontier station of the Indian government, where Burnes became acquainted with the ex-kings of Cabool, Shah Zeman and Shah Shoojah, who were living there under the protection of the British government. From Loodiana the mission proceeded to Simla, where Burnes met the governor-general, Lord William Bentinck, who without delay entered into negotiations for laying open the navigation of the Indus to the commerce of Great Britain.

After his return from his mission, Lieut. Burnes proposed to Lord William Bentinck an expedition into Central Asia, which received from his lordship the most liberal encouragement. The sanction of the Indian government having been obtained, the journey was commenced in January, 1832. Lieut. Burnes was well provided with instruments, and made his journey a kind of flying survey. Arrowsmith's map, compiled from his labours and every other available source, is probably the most perfect now existing of the countries which it embraces.

Burnes left Delhi, accompanied by Mr. James Gerard, surgeon of the Bengal army, Dec. 23, 1831, and proceeded by express to Loodiana. Previous to entering on his journey, it was deemed necessary to obtain the sanction of Runjeet Singh to pass through Scinde. He descended the Sutlege, and reached Lahore Jan. 17, 1832, and was received by the maharaja with all his former affability. Their departure was delayed till the 11th of February, when, having crossed the Ravee, they put up for the night in one of the houses which surround the once splendid monument of Jehangeer. Here they divested themselves of every article of European costume and comfort, and adopted not only the costume of the Afghans, but their usages. The close dress, beds, boxes, tables, and chairs, were all discarded for a flowing robe, a coarse carpet, and a blanket; and their now diminished wardrobe, with the necessary books and instruments, were deposited in their saddle-bags, and thrown across their horses' quarters.

The troops of Runjeet Singh escorted them across the Chenab and the Jelum to their frontier, about three miles beyond Attock, where they met the Afghans, and proceeded with them to Acora. Thence they proceeded to Peshawur, which they left April 19, under the protection of one of Mohammed Khan's officers; and passing through Jellalabad, reached Cabool by the Latabund Pass, April 31. They departed from Cabool May 18, and leaving Ghuznee on the south, advanced by the pass of Oonna, about 11,000 feet high, continued their journey along the base of the Kohi Baba through the country of the Huzaras, and ascended the pass of Hageeguk, 12,400 feet high, May 22. The snow bore their horses, and the thermometer fell to 4° Fahrenheit. They attempted to ascend the pass of Kaloo, 1000 higher than that of Hageeguk, but were hindered by the snow, and passed round its shoulder, but were unable to continue their route on horseback, and reached Bameean. After stopping a day to examine the wonderful excavations and enormous idols of the so-called city of Ghoolgoola, they crossed the pass of Acrobat, which separates the dominions of modern Cabool from Turkistan, or Tartary. After crossing the Dundan Shikun, or Toothbreaker, and the Kara Koottul, or Black Pass, on the 30th of May they made their last march among the mountains of the Indian Caucasus, and descended into the plains of Tartary at Khooloom, the frontier town of Morad Beg, the chief of Khoondooz, and were delayed by receiving a summons to his presence, at the village of Kaumabad, about fifty miles distant. Burnes assumed the character of a poor Armenian watchmaker journeying from Lucknow to Bokhara, and in his torn and threadbare garments happily escaped detection, received a pass of safe conduct for himself and his party (nine or ten tea-merchants who accompanied him), and on the 7th of June rejoined his friend Mr. Gerard, who had been left at Khooloom.

On the 8th of June they again set forward, and reached Balkh on the 9th, and after stopping three days to examine the ruins of that antient and once magnificent city, on the 12th they set forward at midnight on camels bearing panniers which held one person on each side. On the 14th they entered the desert, and on the 16th reached the bank of the Oxus, here 800 yards wide and 20 feet deep, which they crossed in boats, each drawn by two horses, which swam across the stream.

On the 27th of June the party reached the great eastern capital of Bokhara, where they remained till the 21st of July. They then waited in the neighbourhood of Karakool till the 16th of August, when they accompanied a caravan, consisting of about 80 camels and 150 persons, some in panniers on camels, some on horses, and some on asses. In this manner they passed the great desert by Merve, and reached Meshed on the 14th of September. On the 17th they reached Koochan, a strong fortress, and here the two travellers separated, Mr. Gerard having resolved to proceed to Herat and Candahar, and then retrace his steps to Cabool.

On the 29th of September, Lieut. Burnes proceeded with a party of about 300 persons, Khoords, Persians, and Turcomans, and having passed by Shirwan and Boojnoord, left his companions, and travelled alone about eighty miles to the town of Astrabad. Thence, crossing an arm of the Caspian, he journeyed to Tehran, which he reached on the 21st of October, and having had the honour of being presented to the Shah of Persia, quitted the city on the 1st of November. Having passed through Ispahan and Shiraz, he embarked in a cruiser at Bushire, on the Persian Gulf, and reached Bombay on the 18th of January, 1833, the journey having thus occupied just a year.

Soon after his return, he set off for Calcutta, to lay the result of his travels before the governor-general, whose special thanks he received, and his memoirs were ordered to be transmitted to the Court of Directors. In June, Lieut. Burnes received orders to proceed to England as the bearer of his own dispatches. He left Calcutta June 10, and reached London early in October. His reception at the India House and by the Board of Control was in the highest degree flattering. On the 30th December he was presented at Court, and received the special acknowledgments of the king for the unpublished map and memoir which he had presented to his Majesty. His manuscripts were prepared for publication without delay, and Mr. Murray gave the author 800*l.* for the copyright of the first edition. The sale of the work was very large, nearly 900 copies having been sold the first day, and it was immediately translated into the French and German languages. Literary honours flowed fast upon him. He was elected a member of the Royal Asiatic Society, and on his admission, an emblazoned diploma was presented to him by Lord Munster. He was made a member of the Royal Geographical Society, and received the gold medal, and the royal premium of 50 guineas 'for the navigation of the Indus and a journey by Balkh and Bokhara across Central Asia.' The silver medal of the French Geographical Society was awarded to him, and on making a transient visit to Paris, his reception was enthusiastic.

After a stay of eighteen months in England, he departed for India, April 5, 1835, and proceeding by the south of France, Egypt, and the Red Sea, reached Bombay on the 1st of June, and was soon afterwards directed to resume his duties as assistant to the resident in Cutch, Colonel Pottinger.

In October, 1835, he was deputed on a mission to Hyderabad, in order to prevent the necessity of a war with Scinde. His mission was successful. The Ameers consented to a survey of the Indus, and to the abolition of the practice of robbing stranded vessels.

But a more important mission was prepared for him before he had completed his duties in Scinde. This was a mission to Dost Mohammed, at Cabool, primarily of a commercial nature. He was to proceed from Scinde through the Panjab, and by Peshawur to Cabool, and enter into commercial relations with Dost Mohammed; from Cabool to Candahar, to negotiate similar co-operation with the western chiefs; to institute inquiries as to the state of trade, and means of carrying it on; and to return by the Bolan Pass and through Scinde to India. The mission left Bombay Nov. 26, 1836, reached Hyderabad Jan. 18, 1837; Attock, August 4; and Cabool, Sept. 20.

Meantime, Mahomed Shah had besieged Herat with an army of 60,000 men, and the Indian government had become alarmed at the prospect of Persia and Russia uniting their forces with those of Afghanistan, and making a conjoint attack on our Indian Empire. This altered the object of Burnes's mission, and he made it his especial business to investigate the intentions of Dost Mohammed. The Persians indeed were compelled to retreat from Herat, but the presence of the Russian agent, Vicovitch, at Cabool, perplexed and alarmed Burnes, who pressed upon the Dost the propriety of dismissing Vicovitch, which the Dost however refused to do, and Burnes himself received his dismissal, April, 24, 1838.

Burnes was directed to repair to the governor-general at Simla, and he was there in August, 1838. Here it was resolved to replace Shah Shoojah on his throne at Cabool. Burnes preceded the army to make arrangements for the commissariat, and whilst at Shikarpoor, received a copy of the London Gazette, which announced his having been knighted and advanced to the rank of lieutenant-colonel.

Sir Alexander Burnes proceeded from Scinde on a political mission into Beloochistan, in which however he failed; and in April, 1839, he joined the army at Quettah. On the restoration of Shah Shoojah, in September, 1839, he was appointed political resident at Cabool, in which office he continued till he was murdered, Nov. 2, 1841, with his brother Lieutenant Charles Burnes and others, on the breaking out of the insurrection in that city; for the details of which, and the disastrous retreat of the British army, see Afghanistan, P. C. S., pp. 55, &c.

Sir Alexander Burnes was never married. His father and mother survived him, and he left three surviving brothers.

Besides his 'Travels into Bokhara,' of which we have given a sketch, after his death was published 'Cabool; being a Narrative of a Journey to and Residence in that City, in the years 1836, 7, and 8. By the late Lieut.-Col. Sir Alexander Burnes,' London, 8vo. He was also the author of some papers in the Journal of the Royal Geographical Society of London.

(*Asiatic Journal*, March, 1842; *Journal of the Royal Geographical Society*, 1834, Part 2.)

BURNETT, GILBERT THOMAS, was born in Marylebone, on the 15th of April, 1800. He was educated for the medical profession, and paid particular attention to botany. He commenced lecturing on botany at the Hunterian theatre in Windmill-street, and afterwards lectured at the St. George's School of Medicine. On the foundation of King's College he was appointed to the Chair of Botany, and in 1833 he became lecturer to the Society of Apothecaries, and delivered two courses at their gardens at Chelsea. In the same year he published his 'Outlines of Botany,' in 2 vols. 8vo. This work contained an outline of the author's lectures on botany in King's College. It displayed great research, and is a valuable depository of facts relating to the history and uses of plants. There is another feature also which has rendered it of great assistance to the student of botany: it contains a very extended introduction to the study of cryptogamic plants. The author however was too fond of mere verbal classification, and has overlaid the whole work with divisions and subdivisions that rather confuse than enable the student to discover the valuable matter which the work otherwise contains.

Mr. Burnett was latterly too much occupied with the bringing out this great work to devote himself to original research. That he was capable of this is however proved by his papers published from time to time in the 'Journal of Science and Art.' These papers are on various departments of natural history, comparative anatomy, and zoology, as well as botany. The most important are those devoted to physiological botany. In one of these he endeavoured to prove that what had been called the respiration of plants, viz. the taking in of carbonic acid, and the giving out of oxygen, was truly the digestive process of vegetables. He also endeavoured to prove that there was a true respiratory process carried on in plants; that they not only took in carbonic acid and gave out oxygen, but that they also took in oxygen and gave out carbonic acid. This theory has been adopted by many continental chemists and botanists, but it appears that the most rational exposition of the phenomena of plants giving out carbonic acid in the dark, is not that it results from a true respiratory process, but from the giving out of carbonic acid, which, being taken in by the roots, is not decomposed for the want of the light of the sun. He also contributed several papers on medical subjects to the 'Lancet' and 'Medical Gazette,' and was an active member of the Westminster Medical and the Medico-botanical Societies.

As a lecturer, Professor Burnett was remarkable for his fluent and graceful style, and his amiable manners won for him the respect and esteem of his pupils. He died in the summer of 1835, of pulmonary consumption. He continued his lectures till within a few days of his death. A bust executed by Behnes, and subscribed for by his pupils, has been erected to his memory at King's College.

BURNING. [Arson, P. C.]

BU'TEA, a genus of plants belonging to the natural order Leguminosæ, named after John, Earl of Bute, a great patron of botanists. It has a campanulate calyx, 5-toothed, the two superior teeth approximate and almost connected; the corolla with a lanceolate spreading vexillum; keel incurved, equal in length to wings and vexillum; the stamens diadelphous; the legume stipitate, compressed, flat, membranous, indehiscent, 1-seeded at the apex; the seed large, compressed. The species are natives of the East Indies. They are unarmed trees, with pinnately trifoliate leaves with racemes of deep scarlet flowers.

B. frondosa has pubescent branches; roundish, obtuse or emarginate leaflets, velvety beneath; the corolla four times the length of the calyx; the calycine teeth rather acute. It is a native of mountainous districts in Hindustan. A red juice flows from this tree, which when evaporated is found to consist principally of tannin, and is brought into the market under the name of East India Kino. The juice of the common flowers, which in this species are too inches long, gives to water a bright yellow colour similar to gamboge. This property is also possessed by the dried petals. 'The lac insects are frequently found upon the smaller branches of the tree, but whether the natural juices of its bark contribute to improve their red colouring matter has not been determined.' (G. Don.)

B. superba has glabrous branches; roundish ovate, obtuse leaflets, velvety beneath; the corolla four times the length of the calyx; calyx teeth acute. It grows on the mountains of Coromandel. It resembles the last species, but is larger in all its parts. It yields the same kind of juice. There are two other species described.

(G. Don, *Gardener's Dictionary*; Lindley, *Natural System*.)

BUTLER, SAMUEL, D.D., late Bishop of Lichfield, was born at Kenilworth, Warwickshire, 30th of January, 1774. His father was Mr. William Butler, a respectable inhabitant of the village. His grandfather had been for many years steward on the estates of Lord Hyde and Lord Leigh. He was educated at Rugby School, and in 1792 was entered at St. John's College, Cambridge. His University career was very successful: besides obtaining three of Sir William Browne's medals, two for the Latin ode and one for the Greek ode, he was elected in 1793 to the Craven University scholarship, and, after taking his bachelor's degree, he gained the first of the Chancellor's two gold medals that are annually given for classical scholarship; and both in 1797 and 1798 he carried off the Members' prize for the best Latin Essay by Bachelors of Arts. In 1797 he had been elected a Fellow of his College, and in 1798 he accepted the appointment of head master of Shrewsbury School. In 1802 he was presented by the Earl of Clarendon to the vicarage of Kenilworth; in 1807, by Bishop Cornwallis, to a prebendal stall in Lichfield Cathedral; and in 1822 he was made archdeacon of Derby. He had taken his degree of D.D. in 1811. Under Dr. Butler Shrewsbury School, the reputation of which had fallen very low, gradually rose to eminence, and he continued to preside over it till he was promoted, in 1836, to the see of Lichfield and Coventry, or, as it is now entitled, of Lichfield, the archdeaconry of Coventry having been annexed the same year to the diocese of Worcester. But from that time his health rapidly gave way, and his death took place at Eccleshall Castle, Staffordshire, the episcopal residence, on the 4th of December, 1839. He had married, in 1798, Harriet, fifth daughter of the Rev. Dr. Apthorp, vicar of Croydon and rector of St. Mary-le-Bow; and he left a son and two daughters.

Dr. Butler is stated to have been much beloved in private life; his public distinction was derived from his able conduct of his school and his steady profession of liberal or Whig politics. Of his literary works the most considerable is his edition of Aeschylus, which he was selected to superintend by the Syndics of the Cambridge University Press about the time when he removed to Shrewsbury, and the first of the four 4to. volumes of which appeared in 1809, the last in 1816. It is also printed in 8 vols. 8vo. This edition, in which the text is that of Stanley, has not much reputation. The first volume soon after its appearance was made the subject of an article in the 'Edinburgh Review,' which immediately drew from Butler 'A Letter to C. J. Blomfield, containing Remarks on the Edinburgh Review of the Cambridge Aeschylus,' 8vo. 1810. The article is in the Edinburgh Review, No. 29 (for October, 1809), pp. 152-163. A more elaborate criticism on the second volume appeared in the same work, No. 38 (for February, 1812), pp. 477-508. The writer of a very laudatory memoir of Dr. Butler in the 'Gentleman's Magazine' for February, 1840, to which we are indebted for the facts of his life, states that he had long cherished a design of re-editing Aeschylus, and had collected MSS. for that purpose. The new edition, it is added, 'would, no doubt, have been far superior to the former one.' Dr. Butler's best known work is his 'Sketch of Modern and Ancient Geography, for the use of Schools,' 8vo., which originally appeared at Shrewsbury in 1813. His laudatory biographer in the 'Gentleman's Magazine' describes this performance with singular candour in the following terms:—'Since frequently reprinted, having become a standard book on the subject, and produced large profits; but it is not a work of much value.' It certainly is not; and the two Atlases which the author afterwards published to be used along with it may be described in the same terms. Dr. Butler's other chief publications on classical literature were an 8vo. volume, which he produced in 1797, entitled 'M. Musuri Carmen in Platonem, Is. Casauboni in Jos. Scaligerum Ode; accedunt Poemata et Exercitationes utriusque Linguae;' and 'A Praxis on the Latin Prepositions,' 8vo. 1823 (afterwards three times reprinted). He wrote the Latin language rather fluently than well. He also translated Lucien Bonaparte's poem of 'Charlemagne,' in conjunction with the Rev. F. Hodgson; and he published sundry single sermons at divers times. Dr. Butler left a valuable collection of Aldine editions, and also of Greek and Latin MSS.

BUXBAUMIA, a genus of plants belonging to the natural order of Mosses. It was named in honour of J. C. Buxbaum, a German botanist, and author of a catalogue of plants of the environs of Halle, and who first detected this moss in Russia. Buxbaumia has an oblique gibbous capsule; a double peristome, the outer consisting of numerous filiform, erect, jointless teeth, the inner a plaited membranous cone; a minute mitriform calyptra. There is but one species of this singular genus, the *B. aphylla*. This plant is destitute of apparent leaves, and looks more like a fungus than a moss. The ascending axis of the plant is in fact reduced to a little conical bulb, which is clothed with minute scales, and these Mr. Robert Brown pointed out as its leaves. From the bulb arises a red tuberculated seta bearing the reproductive organs, which is about an inch high. It is a very rare plant. It was first discovered in Great Britain at Sproughton near Norwich It has also been found in three or four localities in Scotland.

(Smith's *English Flora*, vol. v.)

BUXTON, SIR THOMAS FOWELL, was born on the 1st of April, 1786, at Earl's Colne, in Essex, the residence of his father Thomas Fowell Buxton, who died while his children, three sons and two daughters, were young. Thomas Fowell, who was the eldest son, was sent by his mother, who was the daughter of Mr. Hanbury, of Coggeshall, in Essex, to the school of Dr. Charles Burney, at Greenwich, son of Charles Burney, Mus. Doc., and brother of Madame D'Arblay. He was afterwards intrusted to the private tuition of a clergyman in Ireland, and subsequently became an under-graduate of the University of Dublin. He left the university at the age of twenty-one, and on the 13th of May, 1807, married Hannah, the fifth daughter of the late John Gurney, of Earlham Hall, near Norwich, by whom, besides other children, he had a son, born in 1812, who has succeeded to the baronetcy.

When he was about twenty-six years of age, he made a speech at the Mansion-House, London, before a large meeting assembled to inquire into the best means of relieving the extreme distress of the population of Spitalfields. About the same time he distinguished himself by a speech at one of the earliest of the public meetings of the Norfolk and Norwich Auxiliary Bible Society. His attention was next directed to the state of prison discipline; he inspected many prisons, and before he was thirty had written and published an Inquiry into the subject, illustrated by descriptions of several gaols, and an account of the proceedings of the Ladies' Committee in Newgate, the most active of whom was Mrs. Elizabeth Fry, his sister-in-law.

In 1818 Mr. Buxton was elected member of parliament for the borough of Weymouth, after a severe contest; and in 1819 he took a prominent part in the debates in the House of Commons, on prison discipline, the amelioration of the criminal law, and the suppression of lotteries. About the same time he devoted his efforts towards the abolition of the barbarous practice of burning widows in India. He continued to represent the borough of Weymouth for nearly twenty years, during which period he was assiduous in the performance of his parliamentary duties (few members so frequently addressed the House), nor did he ever slacken or deviate in the assertion and working out of those benevolent principles with which he started in public life.

On the 15th of May, 1823, Mr. Buxton brought forward a resolution condemning slavery 'as repugnant to the principles of the British constitution and to Christianity.' Soon afterwards he supported the motion of Sir James Mackintosh for mitigating the rigour of the criminal law. In 1833, when Lord Stanley brought forward a motion for the abolition of slavery, he bore a prominent part in the discussions.

In 1837 he lost his election for Weymouth, and from that time refused to be again put in nomination for that or any other borough. In 1840 the crown conferred on him the dignity of a baronet. Though afflicted with ill-health, he did not cease his benevolent exertions, and was one of the chief promoters of the well-meant but disastrous expedition to the Niger in 1841. He died on the 19th of February, 1846, at his residence North-Repps Hall, near Aylsham, in Norfolk, at the age of fifty-nine.

Sir Thomas Fowell Buxton was a man of singularly commanding person; he was more than six feet four inches in height, and of a fine expression of countenance. As a speaker, he was somewhat heavy both in style and delivery, but the influence arising from his high character always secured him a respectful attention. He had no great reach of intellect or imagination, and little of the fervour of an orator, but in collecting facts his industry was untiring, and in exhibiting and commenting upon them, he was zealous to pertinacity, reiterating his attacks till his object was attained or found to be unattainable. He was a brewer, of the firm of Trueman, Hanbury, Buxton, & Co., and exceedingly rich. His charities were numerous, and, when the occasion seemed to him to require it, munificent.

(*Daily and Weekly Newspapers*, &c.)

BYRGIUS, JUSTUS, or JUST BYRGE, a mathematician and artist, chiefly distinguished by the reputation of having been the first person who invented or, at least, gave indications of numbers corresponding to logarithms. He was born in Switzerland, in the year 1552, and was long attached to the observatory which had been built at Hesse-Cassel by the Landgrave William IV.; at this place he made celestial observations, which were afterwards published by Snell; and he was occasionally employed in making mathematical and astronomical instruments. He is said to have invented an instrument similar to that which is now called proportional compasses; and to have constructed a pendulum clock in the year 1600, which is above fifty years before the application of a pendulum to an instrument for measuring time was made by Huyghens. He executed for the landgrave a celestial globe or orrery, which was afterwards purchased by the emperor Rudolph II., who appointed him his instrument-maker.

His brother-in-law Bramer states that on the death of the landgrave he went to reside at Prague; and that in 1632 he returned to Cassel, where he died in the following year. Dithmarsus, who designates himself a pupil of Byrgius, observes that the latter had studied neither Latin nor Greek; and Kepler describes him as an indolent and reserved man, who withheld his discoveries from the public.

Dithmarsus ascribes to his tutor the discovery of two rules for resolving spherical triangles; one, when the three sides, and the other, when two sides and the angle contained between them, are given; and he considers them as much more simple than any which had been used before that time. He states also that Byrgius had discovered a method of dividing any given angle into equal parts, or into parts having given relations to one another; and he adds that by such means he could compute with great facility a table of sines, either in natural or in *logistic* numbers. These last are supposed to be a species of logarithms, and as the work of Dithmarsus was published in 1588, or twenty-six years before the 'Canon' of Napier [NAPIER, P. C.], it is possible that Byrgius may have preceded the latter in the time of the discovery. This is directly asserted by Kepler, in the preface to the Rudolphine Tables, where it is also observed that the *Logistic indices* (the accents by which minutes, seconds, thirds, &c. of a degree are designated in sexagesimal arithmetic) led Byrgius to the discovery of logarithms similar to those of Napier. If this assertion be correct, it may be presumed that Byrgius formed, by the means obscurely indicated in the work of Dithmarsus, two series of numbers, one series in an increasing arithmetical progression, and the other in a decreasing geometrical progression; like the denominations above alluded to, and as in the original table of logarithms computed by Napier

From Montucla ('Histoire des Mathématiques,' tom. 2) we learn that there is a passage in a work on Perspective by the Bramer above mentioned, in which it is stated that Byrgius had published at Prague, in 1620, a table containing two series, one in arithmetical and the other in geometrical progression; it is added, that he entertained the idea of publishing several of his works, among which was a table of sines to every two seconds of the quadrant, and that the distress occasioned by the Thirty Years' War prevented the design from being put in execution. An imperfect copy of the tables first mentioned was in the possession of M. Kästner, and from this it was found that the logarithmic numbers began with zero, and increased constantly by 10, while the natural numbers began with 1, and formed an increasing geometrical progression. Bramer infers from the publication of this table, that his brother-in-law was in possession of logarithms long before Napier had made the discovery; but, as the 'Canon Mirificus' was published six years earlier than that table, this inference is unfounded. It may be admitted however from the circumstances mentioned by Dithmarsus, that twenty-six years before the publication of Napier's book, Byrgius had a knowledge of the properties of the numbers called logarithmic in facilitating arithmetical computations; but it does not appear that he was the first to form a table of them for the purpose.

It is remarkable that Kepler, who himself computed a table of logarithmic numbers, does not mention Byrgius till the year 1627, when he states that the latter had discovered logarithms similar to those of Napier. Previously to that time he always spoke of Napier as the inventor, and of his discovery as the most useful that had been made since numbers were known. If therefore Kepler, in Germany, had no knowledge of the discoveries of Byrgius from the work of Dithmarsus, it cannot be supposed that the latter had found its way to Scotland, or that its obscure indications guided Napier to the discovery which has immortalized his name.

BYRRHUS, a genus of Coleopterous insects, instituted by Linnæus, belonging to the family of *Byrrhidæ* as defined by Leach. The beetles composing it are more or less globose, very convex, and sericeous: the club of their antennæ is five-jointed, and is gradually thickened to the extremity. The elytra cover the body, and the animal can so contract its legs as to pack them in cavities adapted for their reception on the under side of the body. This it does when alarmed, simulating death. The larva of the common species, the *Byrrhus pilula*, popularly known as the Pill-beetle, is of an elongate form, narrow, with a large head, the dorsal plate of the first segment large, and the two terminal segments larger than the others. Seven British species of *Byrrhus* are enumerated by Mr. Stephens in his 'Systematic Catalogue of British Insects.' For an account of the family see Westwood's 'Introduction to Entomology.'

BYSSA'CEÆ, a tribe of Cryptogamic plants, raised by some botanists to the importance of a distinct order, whilst others refer it either to the Lichens or the Fungi, or distribute its genera amongst the various orders of Cryptogamia. Fries places this group of plants in the natural order of Lichens, with the following definition:—'Aerial, perennial, constantly growing, with a filamentous texture; consisting of solid fibres (either few, or several glued together, with a common bark), unchanged and permanent. Fructification homogeneous, growing externally and naked.' Many of the species of plants referred to this order are of a very doubtful nature, and particular states of decaying vegetable and animal matter have undoubtedly been described as plants, and placed amongst them. These forms of matter, whatever they may be, are not less interesting to the naturalist than if they came under his definition of a plant.

The genus *Rhizomorpha* [RHIZOMORPHA, P. C.] is referred by most botanists to Byssaceæ. Some authors have doubted their specific vegetable character. The various forms are found on decaying wood, and in mines, pits, and dark places. In the coal-mines of Dresden they form objects of great interest on account of their phosphorescence. Mr. Erdmann, quoted by Burnett in his 'Outlines of Botany,' gives the following account of this phenomenon, in one of the Dresden mines:—'I saw,' he says, 'the luminous plants here in wonderful beauty; the impression produced by the spectacle I shall never forget. It appeared, on descending into the mine, as if we were entering an enchanted castle. The abundance of these plants was so great, that the roof and walls and the pillars were entirely covered with them, and the beautiful light they cast around almost dazzled the eye. The light they give out is like faint moonshine, so that two persons near each other could readily distinguish their bodies. The lights appear to be most considerable when the temperature of the mines is comparatively high.' One of the species, *Rhizomorpha cinchonarum*, is found on the cinchona barks of commerce, and is a sure indication of their worthless state. Another species of Byssaceæ, *Himantia cinchonarum* of Feé, is an evidence of the subputrescent state of the barks on which it is found. *Racodium* is a genus referred by Fries to this group of plants. The *R. cellare* is a common plant in wine-cellars, where it forms a kind of tapestry on the walls and roofs, investing the casks and bottles with a tunic resembling in colour and appearance the skin of a mouse. *Hypochnus* is a genus found on the decaying bark of trees. When found on barks used for medicinal purposes, they should be rejected as unfit for use, as this plant indicates incipient decay.

The genera *Monilia* and *Aspergillus* are sometimes referred to Byssaceæ. The species of these genera, with many others, form what is known by the name of mould on various substances. [MOULDINESS, P. C.] *Monilia penicillata* is commonly found on plants in herbaria. The various forms of *Aspergillus* are found on all kinds of decaying substances. *A. glaucus* is the blue mould which forms on cheese, lard, bread, &c. It gives a value to cheese, and its colour is often imitated by fraudulent dealers by sticking brass pins into the cheese, the verdigris formed from the pins giving it the colour of mould.

Most of the species of the old genus *Byssus* are distributed amongst other genera. *B. Iolithus*, the violet-scented byssus, is found of a deep red colour on boarded buildings, old pales, and trunks of trees, on rocks in mountainous countries, and on walls. It is now called *Lepraria Iolithus*. It is not less remarkable for its violet scent than its red colour. [SNOW, RED, P. C.] There is another plant, *Chroolepus Iolithus*, which was included under the *Byssus Iolithus* of older writers. *Byssus cryptarum* forms the genus *Tophora* of recent writers. Several species of Tophora have been named. They do not however produce spores, and by some they are supposed to arise from the germination of the spores of ferns and mosses arrested in the rudimental state. The *Lepraria* are sometimes referred to Byssaceæ, but they seem to be the commencing point of the organization of true lichens. They have a thallus resembling a scurf which is formed of sporules. They are very common on decaying timber of all kinds.

The cells of the leaves of many plants during decay assume a variety of forms which have been described as cryptogamic plants under the genera *Phyllerium*, *Erineum*, *Grumaria*, *Taphria*, &c. Many of these so-called plants are meteoric productions; 'on one occasion they are said to have suddenly overrun all the leaves of pines on the side next the wind in the neighbourhood of Dresden; on another, on the 29th of August, 1830, to have in an instant spread over the sails and masts of a ship at Stockholm; and Fries is disposed to consider the cobweb-like matter that overruns the grass in the mornings of spring and autumn of this nature, and not of animal origin.' (Lindley.)

(Lindley, *Natural System*; Burnett, *Outlines*; Smith, *English Flora*.)

INDEX TO THE LETTER B.

VOLUME I.

Baber Island, page 161
Babirousssa, or Babyroussa [Suidæ, P. C.]
Bábrius, 161
Babylonia, 161
Bachelor, 161
Bacillária, 162
Baciocchi, Marie-Anne-Elisa Bonaparte, 162
Bactrian Coins, 162
Badalócchio, Sisto, 163
Baggesen, Jens, 163
Baglióne, Giovanni, 164
Baglioni (family), 164
Bagshot Sand, 165
Bail, 165
Baillie, Robert, 165
Baily, Francis, 166
Bala Limestone, 168
Baldíni, Báccio, 168
Baldung, Hans, 168
Balechou, Jean Jacques, 168
Bálen, Hendrik van, 169
Baléstra, António, 169
Balióstichus, 169
Banána [Musa, P. C.]
Bandanas, 169
Bandon, River [Cork, P. C.]
Bandon, or Bandon-Bridge, 169
Bankruptcy, 170
Banks, 172
Banks, Savings' [Savings' Banks, P. C. S.]
Banks, John, 174
Bans [Marriage, P. C.]
Barbárea, 174
Barckhausia, 175
Barclay, William, 175
Barclay, John, 175
Barclay, John, 176
Barium, Chloride of, 176
Barker, Benjamin, 176
Barker, Edmund Henry 176
Barker, Robert, 177
Barlow, Francis, 177
Barret, George, 177
Barry, Lodowick, 177
Bartan, or Bartin, River [Parthenius, P. C.]
Bártoli, Pietro Santo, 177
Bartsch, Adam von, 178
Bartsia, 178
Basaiti, Marco, 178
Base-Fee [Estate, P. C.; Recovery, P. C.; Tenant-in-Tail, P. C.]
Basilius [Fathers of the Church, P. C.]
Basilosauris, 178
Basin, 178
Basso di Cámera, 179
Bastardy, 179
Batavian Republio [Netherlands, P. C., p. 159]
Báthycles, 180
Batóni, Pompéo Girólamo, 181
Batráchida, Fossil, 181
Bátrachus, 181
Batteries, Electrical and Galvanic, 181
Battus, 183
Baumannshöhle, 183
Bayse [Garonne, P. C.]
Bazhenov, Vassili Ivanovitch, 183
Beaches, Raised, 183
Beale, Mary, 183
Beaumont, Sir George Howland, 184
Beccafúmi, Doménico, 184
Bechera, 184
Beckford, William, 184
Bedstead, 185
Bedstraw [Galium, P. C. S.]
Beechey, Sir William, 185
Begarelli, António, 186
Béham, Hans Sebald, 186
Belemnitélla, 186
Belemnites, 186
Bell, Dr. Andrew [Schools, Primary, P. C.]
Bell, George Joseph, 187
Bell, Sir Charles, 187
Bell-Casting, 188
Bell-Metal [Alloy, P. C.; Bell-Casting, P. C. S.]
Bella, Stéfano della, 189
Bellérophon, 189
Bellíni, Vincenzo, 189
Bellis, 189
Bellows [Blowing-Machines, P. C. S.]
Belonóstomus, 190
Belóptera, 190
Belosépia, 190
Beowulf [Saxon Language and Literature, p. 490]
Berberra, or Burburra, 190
Bereníceа, 190
Bergkalk, 190
Bergler, Joseph, 190
Bergmehl, 190
Bernadotte [Charles XIV., king of Sweden]
Bernier, François, 190
Bervic, Charles Clement Balvay, 191
Beryx, 191
Bevel, or Bevil, 192
Bewick, Thomas, 192
Bidens, 192
Bigbone Lick, 192
Bignónia, 192
Bilderdyk, Willem, 193
Bill Chamber, 193
Bill of Exchange, 193
Bill in Equity [Pleading, P. C.]
Bill in Parliament [Parliament, P. C.]
Billardiéra, 194
Biloculína [Foraminifera, Fossil, P. C. S.]
Binck, Jacob, 194
Binomial Equation [Equation, Binomial, P. C. S.]
Bird, John, 194
Bird, Edward, R.A., 194
Birde (or Byrde, or Bird), William, 195
Birkbeck, George, M.D., 195
Birkenhead, 196
Birmingham, 197
Birth [Infanticide, P. C.]
Bishop, Bishopric, 199
Bistorta [Polygonum Bistorta, P. C.]
Black Rod, Usher of the, 201
Blackberry [Rubus, P. C.]
Blake, William, 201
Blanchard, Jacques, 202
Bland, Rev. Robert, 202
Blanket [Woollen and Worsted Manufactures, P. C., p. 555]
Blastéma [Cytoblast, P. C. S.]
Blasting, 202
Blechnum, 203
Bletting, 203
Blíghia, 204
Blítum, 204
Blizard, Sir William, 204
Block Machinery, 205
Blois, Peter of [Peter of Blois, P. C.]
Blond, or Blon, Jacques Christophe le, 207
Blow, John, Mus. Doc., 207
Blowing-Machines, 207
Blumenbach, Johann Friedrich, 209
Blumenbáchium, 210
Blysmus, 210
Bobbin Net and Lace [Weaving, P. C., p. 179]
Bobbio, 210
Boerne, Ludwig, 210
Bogue, David, 211
Bohlen, Peter von, 211
Boieldieu, Adrien-François, 212
Boiler, 213
Bol, Ferdinand, 213
Bologna, John of, or Giovanni da, 213
Bolsover Stone, 213
Bolswert, Scheltius, 213
Bombax, 214
Bona Fides and Bona Fide, 214
Bona Notabilia [Administration, P. C.; Executor, P. C.]
Bonaparte, Letizia Ramolíno, 214
Bonaparte, Joseph, 214
Bonaparte, Lucien, 216
Bonaparte, Hortense Eugénie Beauharnois, 217
Bone, Henry, 218
Bonnington, Richard Parkes, 218
Bonomì, Joseph, 219
Bonsignóre, or Buonsignore, Ferdinando, 219
Bookbinding, 219
Book Trade, 221
Borágo, 224
Border Warrant, 224
Bordóne, Paris, 225
Boring Instruments, 225
Bornia, 226
Borough Courts of Record [Boroughs of England and Wales, P. C.]
Borrera, 226
Borreria, 226
Bos, Fossil, 226
Boston, Thomas, 226
Botany, Fossil, 227
Bothrodéndron [Ulodendron, P. C. S.]
Botrychium, 227

VOL. I.
Botta, Carlo Giuseppe, 227
Bottomry Bond [Bottomry, P. C.]
Bouchardon, Edme, 228
Boucher, François, 228
Boufflers, 229
Boulder Formation, 229
Boürne, Vincent, 229
Bovista, 229
Bowditch, Nathaniel, 230
Braccio Fortebracci, 230
Brachyphyllum, 232
Brachypódium, 232
Bradford Clay, 232
Brake, or Break, 232
Bramah, Joseph, 232
Bramah's Press [Hydraulics, P. C., p. 384]
Branchióstoma, 233
Brasses, Monumental, 235
Bray, Sir Reginald, 235
Bread, Beer, and Ale, Assize of [Assize, P. C.]
Breakwater [Plymouth, P. C.]
Breast Wheel [Hydraulics, P.C., p. 384]
Breccia [Ossiferous Breccia and Caverns, P. C. S.]

VOL. I.
Breviárium Alariciánum, 236
Brexiáceæ, 236
Bribery [Election Committees, P. C. S.]
Brick-Making by Machinery, 236
Bridges (Law), 237
Bridgewater Treatises, 238
Brieve, 239
Briggs, Henry Perronet, R. A., 239
Bril, Paul, 239
British India [India, P. C. S.]
British Husbandry [Husbandry, P. C.]
Briza, 239
Brizio, Francesco, 240
Brome, Richard, 240
Brome, Alexander, 240
Bromide of Potassium, 240
Bromley, William, 240
Bromus [Brome-Grass, P. C.]
Bronchótomy [Tracheotomy, P. C.]
Bröndsted, Peter Oluf, 240
Bronzíno, Angelo, 241
Brora Coal, 241
Brown, Thomas, 241
Brown, Lancelot, 241

VOL. I.
Brown, Dr. John, 242
Browne, William, 242
Brúcea, 242
Bruges, Roger van, 242
Brulliot, Franz, 243
Brunoniáceæ, 243
Brusa, Prusa, or Bursa, 243
Brusasorci [Ricci, Domenico, P. C. S.]
Brush, 244
Bryum, 245
Bucklandia, 246
Buddlea, 246
Bude Light, 246
Buffalmacco, 246
Buffonia, 246
Bufonites, 246
Building, 247
Building, Act for regulating, 250
Building Stone [Stone for Building, P. C. S.]
Bularchus, 252
Bullant, Jean, 252
Bumastes, 252
Búnium, 252
Bunter Sandstein, 252
Buonarruoti, Michel-Agnolo, 253

VOL. I.
Buoninsegna [Ducciodi Buoninsegna, P. C. S.]
Buoyancy, 253
Buoys and Life-Preservers, 253
Búpalus, 255
Bupleurum, 255
Buprestis, Fossil, 255
Burburra [Berberra, P. C. S.]
Burder, Rev. George, 255
Burdett, Sir Francis, 255
Burdie House, 256
Burgage Holding, 256
Burgkmair, Hans, 256
Burglary [Housebreaking, P. C. S.]
Burial [Interment, P. C.]
Burmánniæ, 256
Burnes, Sir Alexander, 257
Burnett, Gilbert Thomas, 258
Burning [Arson, P. C.]
Butea, 258
Butler, Samuel, D.D., 259
Buxbaumia, 259
Buxton, Sir Thomas Fowell, 259
Byrgius, Justus, or Just Byrge, 260
Byrrhus, 260
Byssáceæ, 260

Note.—Since the article BEWICK was printed off, two or three errors have been pointed out by one of his pupils. In line 5 of the article, for 'city' read 'town.' In col. 2, line 11, read thus: 'In 1797 Thomas published the *first volume* of his "History of British Birds;"' and add, at the end of the paragraph, 'The *second volume* was published in 1804.' In col. 2, line 18, for 'by his son Robert and other able pupils,' read 'by his pupils.' Robert was not an engraver on wood. In col. 2, line 22, for 'and his "British Fishes,"' read 'and vignettes for his "British Fishes," which work was never published.'

C.

CAB, or CABRIOLET. [Hackney-Coach, P. C. S.]

CA'CCIA, GUGLIELMO, commonly called MONCALVO, from Moncalvo near Casale, the place of his abode, was born at Montabone in 1568. He was one of the best fresco painters of the seventeenth century, and is one of the most celebrated of the Piedmontese painters. There are still several of his works in Milan, Pavia, Turin, Novara, Moncalvo, Casale, and other cities of that part of Italy. The church de' Conventuali alone, at Moncalvo, contains almost a gallery of Caccia's works in oil; they are very light in colour, but faint in effect, and in design frequently remind us strongly of the works of Andrea del Sarto, especially in his Holy Families and such pieces. He is reported to have studied with the Carracci, a fact which Lanzi considers very improbable, and he says that if Caccia studied in Bologna at all, it must have been from the works of L. Sabbatini, prior to the Carracci; but he accounts for his similarity of style with that master, from a picture by Soleri in Casale, from which he may have acquired it, as their styles are very similar. Bernardino Campi also painted in a very similar style. Caccia's best works in fresco are in the church of Sant' Antonio Abate at Milan, and in San Paolo at Novara. His masterpiece in oil is considered the Deposition from the Cross, in the church of San Gaudenzio at Novara: there are also two excellent altarpieces by him in the churches of Santa Croce and Santa Teresa at Turin; and two others in a chapel of San Domenico at Chieri. Some of his landscape backgrounds are in the style of Paul Bril: he died about 1625.

Caccia instructed two of his daughters in painting; Orsola Maddalena and Francesca, by whom there are many works in Moncalvo and the vicinity: the pictures of the elder, Orsola, are marked with a flower; those of Francesca with a bird. Orsola founded the Conservatorio delle Orseline (Ursulines) in Moncalvo: she died in 1678. Francesca also survived her father many years: she died aged fifty-seven.

(Orlandi, *Abecedario Pittorico*; Lanzi, *Storia Pittorica*, &c.)

CAGNO'LA, LUIGI, the most distinguished Italian architect of the present century, his fame having been extended through Europe by the finest monument of its kind in modern times, the magnificent Arco della Pace at Milan, was born in that city in 1762, of an antient patrician family, one of whose ancestors, Ariprando Cagnola, was consul of Milan in 1117. At the age of fourteen, Luigi was sent by his father, the Marchese Gaetano Cagnola, to the Clementine College at Rome, where he applied himself entirely to the study of architecture, in consequence of the impression made upon him by the ancient edifices of that capital. On being recalled home, he was sent to the university of Pavia in 1781, in order to study jurisprudence; but, although he was so far from neglecting his studies that he obtained honorary prizes, his passion for architecture was insuperable, and he resolved to devote himself exclusively to that art, notwithstanding that professional practice in it was deemed somewhat derogatory in one of his rank and station. In this determination he was confirmed by finding that a better taste in architecture was beginning to prevail at Milan, where it had been introduced by Piermarini [Piermarini, P. C. S.], Polacchi, and Cantoni [Cantoni, P. C. S.].

Cagnola at first accepted some official post under Count Wilczek, then governor of Milan, but did not continue in it very long, being compelled, by the ill-health of his father, to take upon himself the chief management of the family affairs. After that he filled for two years the office of *Viro Probo*, a sort of ædileship in the civic government of Milan. At length he ventured to put forth three different designs for the Porta Orientale, then about to be erected at Milan, and of which Piermarini had been appointed architect by the Archduke Ferdinand, at that time governor of the city. At the archduke's request Cagnola's designs were submitted to him; yet, though they were approved, that by Piermarini was adopted, as being more economical. He now engaged the services of a very clever perspective draftsman and water-colour artist, named Aureglio, and undertook a series of illustrations of the ancient baths of Maximian, near the church of San Lorenzo, published under the title of 'Antichità Lombardico-Milanesi;' and he was afterwards employed by the government (1812) to secure from further ruin the sixteen noble Corinthian marble columns which constitute the chief remains of that monument of antiquity. The death of his father, in 1799, devolved upon Cagnola an important share in public affairs, when, besides being one of the state council, he was attached to the army-commissariat in the Austrian service, which office he discharged with prudence as well as ability. On the change of the government by the establishment of the Cisalpine Republic, he withdrew from Milan, and spent about two years at Verona and Venice, where he found sufficient and congenial occupation in studying the architectural treasures of those cities. Soon after his return, he erected in 1802 a noble villa for the brothers Zurla, at Cremi, near Vajano, which while in progress was nearly destroyed by an earthquake that did great damage throughout the district; but he repaired the mischief done to the works with so much skill and promptitude as thereby to acquire increased fame. It was about the same period that he designed the magnificent *catafalchi* for the funeral obsequies of Archbishop Viconti, the Patriarch Gamberi, and Count Anguissola, published in folio, 1802. On the marriage of the Viceroy Eugène Beauharnois with the Princess Amelia of Bavaria in 1806, he was called upon to erect another grand temporary structure, which, like the preceding ones, would now be known only by engravings, had it not proved the prelude to his most celebrated achievement in his art; for such was the admiration excited by the arch constructed of wood on that occasion, that it was determined to perpetuate it in marble. Accordingly, the first stone of the Porta del Sempione, or, as it is now called, the Arco della Pace, was laid October 14, 1807. The political changes which afterwards took place threatened to put a stop to the work altogether, when it was not advanced beyond the piers of the arches. Almost the idea of its being ever completed had been abandoned, when, on his visit to Milan, the late emperor (Francis I. of Austria) ordered the works to be resumed; and from that time they were prosecuted without interruption, so that Cagnola saw the whole structure terminated, or very nearly so, before his death, exclusively of some of the decorative sculpture and bronze figures. With the single exception of the Arc de l'Etoile at Paris, the Arco della Pace is by far the largest as well as most magnificent structure of the kind in modern times, and in its general mass it is equal to, even if it does not somewhat exceed, the largest of the antient—the Arch of Constantine; it being 78 feet English wide, as many high, and about 27 feet deep.

Another public monument by him at Milan, which is greatly admired, is the Porta di Marengo, otherwise called Porta Ticinense, an Ionic propylæum, whose two fronts consist of a distyle in antis, consequently of three open intercolumns, and the two sides or ends are filled in with an open arch. Nothing can be more simple or even severe in character than this structure, for it is one of the very few things in Italian architecture which decidedly approximates to the taste of Grecian antiquity; but not even the desire of novelty could induce Cagnola, any more than the rest of his countrymen, to shake off his allegiance to Vitruvius and Palladio. Compared with Athenian examples his Ionic capitals look meagre and insignificant, and seem at all events to require a necking, which, by adding to the mass of the capitals, would have reduced the lankiness of the shafts.

The Campanile at Urgnano in the Bergamasque territory, begun in 1824 and finished in 1829, exhibits more of design and composition than the preceding. It is a circular tower of three orders, Doric, Ionic, and Corinthian, upon a square rusticated basement, each order consisting of eight half-columns, and between those of the Corinthian order are as many open arches. Above this last rises an additional order of Caryatid figures supporting a hemispherical dome: the entire height from the ground is 58 metres, or 190 English feet. The elevation of this Campanile is engraved in the 'Ape delle Belle Arte,' Rome, 1835. Among other works executed by Cagnola are the chapel of Santa Marcellina in the church of S. Ambrogio, at Milan; the church at Concorrezzo; the façade of that at Vivallo; and the church at Ghisalba in the Bergamasque. This last, which was not completed till after his death, in 1835, is his noblest work of the kind, and is a rotunda of the Corinthian order, with a portico of fourteen columns, but whether octastyle in front, or how the remaining columns are disposed, is not specified. The interior has sixteen columns of the same order. Besides those which were carried into execution, Cagnola produced a great number of designs and *projects*, in several of which he gave such free scope to his invention and *grandezza* of ideas, as to render their adoption hopeless: such, for instance, was that for an Hospitium on the summit of Mount Cenis, with no fewer than one hundred and ten columns, eleven English feet in diameter—to which may be added his designs for a senate-house and a magnificent triumphal bridge. In fact, he derived no inconsiderable share of his celebrity from his designs of that class; wherefore it is greatly to be regretted that he neither edited them himself, nor directed by his will that both they and those of all the buildings he executed should be given to the world in the form of a splendid architectural publication—a record of his labours that would have made them universally known. However, he indulged his taste without regard to cost in improving or nearly rebuilding his villa at Inverigo near Milan, which occupied him during the last years of his life, and which he directed to be completed by his widow. One noble interior feature of this palatial villa is a magnificent central rotunda erected on what was originally an inner court.

Cagnola died of apoplexy, August 14th, 1833, at the age of seventy-one. There is a portrait of him in Förster's 'Bauzeitung' for 1838, with an accompanying memoir, to which we are indebted for some of the particulars in this article. Among those of Cagnola's pupils who have since distinguished themselves are Peverelli, Bianchi (architect of the grand church of San Francesco di Paula at Naples), Vergani, Gillardi, and Dordone.

CAKILE, a genus of plants belonging to the natural order Cruciferæ, to the suborder Lomentaceæ and the tribe Cakilineæ. In addition to the accumbent cotyledons of the tribe, it has an angular pouch composed of two 1-seeded indehiscent joints, the upper joint deciduous with an erect seed, the lower one persistent, seedless, or with a pendent seed. The species are smooth, fleshy, glaucous, annual branched herbs, with pinnatifid or toothed leaves. Racemes of flowers opposite the leaves, and terminal with filiform bractless pedicels.

C. maritima, Purple Sea-rocket, has the joints of the pouch 2-edged, the upper one with two teeth at the base, the leaves fleshy, pinnatifid, somewhat toothed. The flowers are of a purplish colour. It is a native of Europe, along the sea-coast from Sweden and Lapland to Gibraltar: it is also found on both sides of the Mediterranean. It is a native of Great Britain, on the sea-coast. This plant had at one time a reputation as a cathartic, but it is not employed at the present day. There are three other species of Cakile named: *C. Ægyptiaca*, *C. Americana*, *C. equalis*. They are all pretty annuals, and may be easily cultivated. The seeds may be sown in spring or autumn, and they should be treated as other hardy annuals.

(Babington, *Manual*; Don, *Gard. Dict.*)

CALA'DIUM, a genus of plants belonging to the natural order Aroideæ, and to the tribe Caladieæ. The flowers are monœcious, and the calyx and corolla are absent; the male flowers have many-celled peltate anthers, disposed in a spike at the end of the spadix; the female flowers have the ovaries inserted at the base of the spadix, no style; the fruit is a 1-celled berry with many seeds. A great number of species of this genus have been described. They are frequently cultivated in this country for the sake of their spotted stems and neat green leaves, which are rarely disfigured by any of the accidents which affect other stove-plants. They have the same general appearance as the species of Arum, and also resemble them in physical and chemical properties.

C. Seguinum, Dumb-cane, is a caulescent suberect plant with oblong cuspidate leaves, and the spadix shorter than the oblong spathe. This plant is a native of South America and the West Indies. It grows to a height of five or six feet. It secretes an acrid poison, so that when any part of the plant is chewed the tongue swells and the power of speech is lost. It is on this account called Dumb-cane. Sir William Hooker, in his 'Exotic Flora,' relates the case of a gardener who incautiously bit a piece of Dumb-cane: 'his tongue swelled to such a degree that he could not move it; he became utterly incapable of speaking, and was confined to the house for some days in the most excruciating torments.' The juice is stated to impart an indelible stain to linen. Notwithstanding its poisonous nature, P. Browne says that, in common with the Arum ovatum, its stalk is used to bring sugar to a good grain when it is too viscid, and cannot be made to granulate with lime alone. In the districts where it grows the natives use a decoction of the stem as a bath and fomentation in dropsy, and the rootstock is used in obstinate constipation and in long-standing gout. The negroes also use it as an anti-aphrodisiac.

C. sagittifolium, Brazil Cabbage, is stemless, with sagittate acuminate leaves, the spadix shorter than the spathe, which is ovate-cucullate. This plant is a native of the West Indies, and is called by the French Chou-de-Bresil, and by the Germans Essbare-Arum. In appearance it resembles Arum colocaria, and is used for the same purposes. Both the leaves and rootstock of this plant are eaten. The leaves are boiled and eaten as coleworts; the rootstock is not considered so great a delicacy as the leaves. Of all the eatable Aroideæ, this appears to be the most extensively cultivated. It is found in the East and West Indies, in China, Japan, New Zealand, and the South Sea Islands. When raw the rootstock contains a certain amount of the poisonous secretion of the family, and, like the potato, has an acrid unpleasant flavour which entirely disappears in cooking. The leaves are very soft and glaucous, from being covered with a fine silky hair, and in many places are used instead of plates and dishes.

C. esculentum resembles the last: its leaves are peltate-cordate, and its spathe ovate-lanceolate. It is also a native of South America, and is cultivated on account of the starch contained in its rootstock. It possesses similar properties to the last.

C. arborescens is a poisonous species, though not so virulent as the Dumb-cane. Merat says that it was formerly used for wetting the mouths of negroes as a punishment for slight misdemeanors.

(Loudon, *Cyclopædia of Plants*; Lindley, *Natural System*; Burnett, *Outlines of Botany*; Bischoff, *Medicinisch-Pharmaceutische Botanik.*)

CALAMINTHA, a genus of plants belonging to the natural order Lamiaceæ, and the tribe Satureineæ. It has the apices of the stamens connivent under the upper lip of the corolla; the anther-cells at length divergent, connective subtriangular; the upper lip of the corolla straight, nearly flat, the lower patent trifid; the calyx 2-lipped and 10-13-nerved, throat hairy; the flowers whorled, axillary or spiked. This genus was constituted by Moench, and contains several species which were placed under *Thymus* and *Clinopodium* by Smith, in *Melissa* by Bentham, and one in *Acinos* by Hooker. Koch in his 'Flora Germanica' follows Moench, and also Babington in his 'Manual of British Botany.' There are four species of this genus, common and well-known plants in Great Britain.

C. Nepeta, Lesser Calamint, Cat-mint, Balm or Field-Balm, has leaves ovate, obtuse, serrated, pale beneath, shortly stalked, calyx subcampanulate, obscurely 2-lipped, teeth all nearly the same shape, the upper ones slightly shorter; nuts roundish, almost smooth; cymes dichotomous, many-flowered. This is not a common plant, and is found on dry banks. It has a strong aromatic smell not unlike that of penny-royal, and a pungent taste. Cats are said to be fond of the smell, and hence its name cat-mint. An infusion of the leaves is recommended as a tonic and stimulant in flatulence and colic. This and the other species possess the volatile oil which is found in the whole order, and hence they all have a more or less powerful medicinal action.

C. officinalis, Mountain Balm, Common Calamint (*Thymus Calamintha*, Smith; *Melissa Calamintha*, Bentham), has broadly ovate, rather acute, slightly serrated leaves, green on both sides, seated on longish stalks; the calyx tubular, ventricose in front, distinctly 2-lipped, teeth of the upper lip triangular, of the lower twice as long and subulate; nuts roundish, covered with impressed dots; cymes scarcely dichotomous, few-flowered.

C. Acinos, Basil Balm, or Basil Thyme (*Acinos vulgaris*, Persoon; *Acinos thymoides*, Moench), has ovate, subserrate, acute leaves with revolute margins; tubular gibbous calyx distinctly 2-lipped, the upper lip with short triangular teeth, the lower one with subulate teeth, all converging in fruit. It is found in dry gravelly places, and in corn-fields throughout Europe.

C. Clinopodium, Wild Basil, Bed-foot (*Clinopodium vulgare*, Smith), has ovate obtuse leaves, rounded below, slightly crenate; whorls equal, many-flowered; bracts setaceous; as long as the calyx. Common in dry bushy places, in Europe; it is also found in America, but has probably been introduced there.

(Babington, *Manual*; Bentham, *Labiatarum Genera & Species.*)

CALAMIS, a very celebrated Greek sculptor, of the fifth century before Christ. Neither his native place nor the exact period of his career is known; he was however contemporary with Phidias, but probably his senior in years, as according to Cicero and Quintilian, who probably expressed the general opinion, notwithstanding the general excellence of his works, there was a hardness in his style. He worked in various styles, in marble, in bronze, and ivory, and as an engraver in gold. He was also very famous for his horses, in which, Pliny says, he was without a rival.

Many works by Calamis are mentioned in antient writers, Greek and Latin; but one in particular claims attention. This is the Apollo of the Servilian gardens at Rome, mentioned by Pliny, and by some supposed to be the Apollo Belvedere of the Vatican at Rome. This supposition however completely sets aside the criticisms of Cicero and Quintilian upon the style of Calamis, for this work, so far from being hard, would be effeminately delicate for any male character below a divinity.

Calamis made two other statues of Apollo: the Apollo *Alexikakos* (Deliverer from Evil), which Pausanias saw at Athens; and the colossal Apollo, made for the city of Apollonia in Illyricum, and which, according to Strabo, was brought to Rome by Lucullus, and placed in the Capitol. Junius and Harduin supposed that Pliny and Pausanias speak of the same work; but it is not at all probable that a work which was in Rome in Pliny's time would be in Athens in the time of Pausanias. This inconsistency has been pointed out before; but many have been misled by the opinion, and it seems to have suggested the idea which Visconti and Flaxman have adopted, that the Apollo Belvedere and the Apollo *Alexikakos* of Calamis are the same, or at least that the former is a marble copy of the bronze original by Calamis. Sillig supposes that the statue mentioned by Pausanias must have been of bronze, because it was placed in the open air; this does not follow however, as many of the antient Greek marbles were placed in the open air. It was dedicated in honour of Apollo after the delivery of Athens from the plague, in Ol. 87. 4 (429 B.C.), during the Peloponnesian war. It is the latest work by Calamis mentioned, and must have been made at least three or four years after the death of Phidias. His earliest work which is noticed is a pair of bronze horses mounted by boys, for the triumphal car of Onatas, placed by Deinomenes, the son of Hiero, at Olympia, in Ol. 78. 2 (467 B.C.), in commemoration of Hiero's victory at the Olympic games, twelve years after the battle of Marathon.

Lucian also, in his description of Panthea, has recourse to the aid of Calamis. He takes some of Panthea's charms from a statue of Sosandra by Calamis, which he mentions also in his 'Hetæreæn Colloquies' as a paragon of beauty. Many other works by Calamis are mentioned by antient writers; as an Æsculapius at Corinth, a Victory at Elis, a Bacchus and a Mercury at Tanagra, a Venus at Athens, Jupiter Ammon at Thebes, Hermione at Delphi, &c.

(Pliny, *Hist. Nat.* xxxiii. 12; xxxiv. 8; xxxvi. 4; Pausanias, i. 3; Lucian, *Imag.* 6, *Dial. Meretr.* iii.; Cicero, *Brutus*, 18; Quintilian, *Inst. Orator.*, xii. 10; Strabo, vii. 491; Junius, *Catal. Artificum*; Sillig, *Catal. Artificum*; Thiersch, *Epochen der Bildenden Kunst*, &c.)

CALAMITES, one of the most frequent and characteristic genera of fossil plants. It is found abundantly, but not exclusively, in the carboniferous system of strata, and generally in the sandstones and shales which alternate with coal. Calamites Suckovii occurs in most European and American coal-fields. Calamites arenaceus occurs in the bunter sandstein. We have found traces of a calamites in the red marl series of Worcestershire.

CALAMITES. [COAL-PLANTS, P. C.]

CALAMO'PORA, the generic title applied by Goldfuss to many Palæozoic corals, for some of which Lamarck employed the name of Favosites.

CALCAIRE GROSSIER, the coarse calcareous building-stone of Paris, which, geologically speaking, is coeval with the blue clay of the basin of London, and contains many identical shells. These constitute the types of the Eocene tertiary series of Mr. Lyell.

CA'LCEOLA, an extinct genus of Brachiopoda, which occurs in the Palæozoic strata, and especially in the middle group. Calceola sandalina occurs in this position in the Eifel and in South Devon.

CALCULATING-MACHINES. Before computers had attained great proficiency in performing arithmetical operations by the pen, machines by which the results of such operations could be obtained by inspection were in almost constant use: the Roman abacus, which continued to be employed in the south of Europe till the end of the fifteenth century, and, in England, to a later period, consisted of counters moveable in parallel grooves or on parallel wires, and having the different denominations units, tens, hundreds, &c., according to the grooves in which they were placed. Thus a counter in the first groove represented 1, while a counter in a groove corresponding to it represented 5; and a counter in each of these expressed together 6. A counter in the second groove denoted 10, while one in a groove corresponding to it denoted 50, and one in each expressed together 60; and so on. The Romans had also machines of the like kind which were applicable to duodecimal arithmetic. The form and use of an abacus similar to the Schwan-pan of the Chinese is described under ABACUS, P. C. An account of the prismatic rods invented by Napier for the performance of arithmetical operations is given under NAPIER'S BONES, P. C.; the nature and use of the logarithmic scales, under SLIDING RULE, P. C.; and under SAUNDERSON, P. C., is a short account of the machine invented by that mathematician for enabling the blind to make computations.

The celebrated Pascal constructed, it is said, when only 19 years of age, a machine for executing the ordinary operations of arithmetic; and as it has a resemblance, though faint, to the machine invented by Mr. Babbage, it may be proper to give a brief description of it in this place.

It was an assemblage of wheels and cylinders; and on the convex surfaces of the latter were the numbers with which the operations were to be performed: these operations consisted chiefly in the addition and subtraction of sums of money having the denominations of livres, sous, and deniers, for which may be substituted pounds, shillings, and pence; and to those denominations the numbers were adapted. Extending round the convex surface of the first cylinder on the right hand of the machine, and one above the other, were the two series,

0, 11, 10, 9, 8, 7, 6, 5, 4, 3, 2, 1
11, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10;

the first of which served for the subtraction and the other for the addition of pence; the cylinder being turned in the same direction for both operations. Upon the surface of the next cylinder on the left were the two series,

0, 19, 18, 17, 16 1
19, 0, 1, 2, 3 . . . . . . 18:

serving for the like operations on shillings: and on the left of this last were several cylinders, about each of which were the two series—

0, 9, 8, 7, 6, 5, 4, 3, 2, 1
9, 0, 1, 2, 3, 4, 5, 6, 7, 8;

and these were used for operations with pounds, or with any numbers in the decimal scale.

Attached to the axles of the first cylinder was a wheel having on its circumference 12 teeth, on that of the second, one having 20 teeth, and on the axle of each of the other cylinders was a wheel having 10 teeth; and before an operation commenced, the zeros of the numbers in the first or second series above, on all the wheels, were brought by hand to the front of the machine.

As an example of the method of using the machine, let it be required to add together the following sums of money:—

£8 9*s*. 8*d*.
4 15 6

By means of a pointer the wheel connected with the first cylinder on the right is to be turned till the eighth tooth, and under it the number 8 on that cylinder, are brought to the front; in like manner the number 9 on the second cylinder and 8 on the third are brought to the front: thus the series of numbers in the fronts of all the cylinders exhibits the first of the above sums of money. Then, by means of the pointer, the first wheel and cylinder on the right hand are to be turned till the sixth tooth (after the eighth) comes to the front, when the cylinder having, from its first position, performed on its axle one revolution and $\frac{2}{12}$ of another, the number 2, representing 12+2, or 1*s*. 2*d*., appears in front. Now, by the construction of the wheel-work, one complete revolution of the first wheel and cylinder on the right hand causes the wheel and cylinder on its left to turn one-twentieth part of a revolution; by which means, in this example, the number 9 being already in front of the latter cylinder, the number 10 is now there: thus the one shilling obtained by the addition is, as it were, *carried*. The second wheel and cylinder being now turned by means of the pointer till the fifteenth tooth, after the tenth, is brought to the front, the number in front of the cylinder below is 5, representing 20+5, the cylinder having made $1 + \frac{5}{20}$ revolutions from its first position; there is thus obtained 1*l.* 5*s.* One revolution of the second wheel and cylinder causes the next, towards the left, to make one-tenth of a revolution; and thus the 1*l.* is *carried*, so that the number in front of the third cylinder is now 9 instead of 8. This third wheel and cylinder are next turned by means of the pointer till the fourth tooth, after the ninth, is brought to the front, when there appears on the cylinder below it the number 3, representing 10+3; and the next cylinder on the left, in front of which was previously zero, has now 1, which may thus be said to have been *carried*.

It is easy to be perceived that, if several sums of money were to be added together, each wheel should be continually turned so as to bring to the front a number of teeth expressed by the number in the line next below that which had been previously added; and that no attention need be paid to the numbers thus, successively, brought to the front of the machine till the last, or lowest, line has been added.

The subtractions are performed exactly in the same manner as the additions, by means of the numbers in the upper series on the cylinders.

Where many sums of money are to be added together, some time may be saved by the use of such a machine; but the processes for subtraction, multiplication, and division would be more tedious, and perhaps more liable to error than those which are performed by the pen. A description of the machine may be seen in the *Encyclopédie Méthodique, Mathématiques*, art. 'Arithmétique.'

Subsequently to the time of Pascal, Leibnitz invented a machine by which arithmetical computations could be made: no account of it appears to have been published; and perhaps all that is known of it is that, by wheel-work, the operations of multiplication and division could be performed without the successive additions or subtractions which would be required if Pascal's machine were used.

The machine invented by Mr. Babbage, should it be carried on to the extent proposed, would constitute one of the most superb monuments of human ingenuity: it is intended not only to perform arithmetical operations with absolute certainty, but also to transfer the results immediately to copper-plates, from which any number of copies may be printed without a possibility of error. The principles on which this machine is constructed and the manner of using it are now to be stated; and in so doing all possible brevity shall be used.

In any series of numbers arranged in line or column, if the difference between the first and second, between the second and third, and so on, be taken, there will be formed a line or column of what are called first differences: if the difference between the first and second, between the second and third, and so on, of these last numbers be taken, there will be formed a line or column of what are called second differences. Proceeding in like manner to form third, fourth, &c. orders of differences, there will at length be found a series of differences which are either constant, or to a great extent are very nearly so. Thus, taking the series of numbers in the column N below, the several orders of differences will be as in the succeeding columns; the numbers in the sixth column being constant:

N	$\Delta^{i.}$	$\Delta^{ii.}$	$\Delta^{iii.}$	$\Delta^{iv.}$	$\Delta^{v.}$
243					
	781				
1024		1320			
	2101		1230		
3125		2550		600	
	4651		1830		120
7776		4380		720	
	9031		2550		
16807		6930			
	15961				
32768					
&c.	&c.	&c.	&c.	&c.	&c.

Now it is evident that, having any one of the numbers in the first column, and the numbers corresponding to it in the several columns of differences; all the succeeding numbers of the series may be found by mere additions. It may happen however that while the numbers in the original series increase, the numbers in some of the columns of difference may decrease; and then, in forming the terms of the series, subtractions might take place: in such a case, the arithmetical complements of the numbers to be subtracted being taken, the operations may still be performed by additions only.

The machine accomplishes these additions by the movements of a number of cylinders having on the convex surface of each the series of numbers 1, 2, 3, 4, 5, 7, 8, 9, 0; and the operations are thus distributed: by the first, the additions are made; and by the second, there is introduced the 1 which should be carried to the *ten's* place every time that the sum of two numbers is greater than 10.

Let it be imagined that there are several vertical axles, on each of which are several cylinders one above another; and that these axles with their cylinders are capable of being turned by wheelwork, so that any one of the ten figures may be made to stand on the face of the machine, and immediately under a fixed index. Let it be further imagined that, when the moving power (the hand of the operator applied to a winch) has made one quarter of a revolution, the first, third, fifth, &c. axles may turn, causing the cylinders on them to make parts of a revolution or allowing them to remain at rest as the case may be, while all the cylinders on the second, fourth, &c. axles remain at rest. Again, when the moving power has made the second quarter of a revolution, let it be imagined that certain, only, of the cylinders on the first, third, fifth, &c. axles make one-tenth of a revolution, so that, whatever figure be under the index of each of these moving cylinders, the next figure, in increasing order, may be brought under that index; the cylinders on the second, fourth, &c. axles still remaining at rest. Let it next be imagined that, when the moving power describes the third quarter of a revolution, the cylinders on the second, fourth, &c. axles describe parts of a revolution or remain at rest, the cylinders on the other axles being unmoved: and lastly, when the moving power has described the fourth quarter of a revolution, let certain cylinders only on the second, fourth, &c. axles make one-tenth of a revolution, the other cylinders remaining at rest. Then it may be understood that by the first and third of these motions, numbers are added together; while, by the second and fourth, 1 is carried to each figure which ought to be increased in consequence of a sum of two figures being greater than 10.

As an example, let it be required to obtain the numbers of the series in the first column above, beginning with 3125.

Let the figures composing the number be under the indices in front of the cylinders on the first vertical axis, towards the left hand; and the figures composing the several orders of differences in front of the cylinders on the other axis, towards the right, as in this second table.

N	$\Delta^{i.}$	$\Delta^{ii.}$	$\Delta^{iii.}$	$\Delta^{iv.}$	Δ^{v}
3	4	2	1	0	0
1	6	5	8	6	1
2	5	5	3	0	2
5	1	0	0	0	0

Then the moving power being turned one quarter of a revolution, each cylinder in the first, third, and fifth vertical columns will be turned through as many tenths of a revolution as are expressed by the number in front of the cylinder immediately on its right hand: thus the cylinder having 3 in front (at the top of the first vertical column) will move through four-tenths of a revolution, and the number 7 will be brought under its index in front. The cylinder having 1 in front (in the first vertical column) will be turned through six-tenths of a revolution, which will bring 7 under its index in front; and so on.

The numbers in front of the whole machine will now stand thus:—

N	$\Delta_{i.}$	$\Delta^{ii.}$	$\Delta^{iii.}$	$\Delta^{iv.}$	$\Delta^{v.}$
7	4	3	1	0	0
7	6	3	8	7	1
7	5	8	3	2	2
6	1	0	0	0	0

By the addition (in the preceding table) of 5 in the third column to 8 in the fourth, there should be produced 13, whereas 3 only appears under the index of the cylinder (in the third column of the present table), therefore 1 must be *carried*. The operation of carrying is performed by the action of the moving power in the second quadrant of its revolution; and, in the present example, this does nothing more than turn the cylinder marked 3 (in the first line, third column) through one-tenth of a revolution, which brings 4 to the front of that cylinder. The reader may now imagine the 3 to be effaced, and the number 4 introduced in its place.

Now the moving power turning through the third quarter of a revolution, the cylinders on the second and fourth axles are made to turn through as many tenths of a revolution as are expressed by the figures on the cylinders immediately on their right hand: thus the cylinder marked 4 in the second column of the last table will turn through four-tenths, and this movement will bring to its front the number 8: the cylinder marked 6 will be turned through three-tenths of a revolution, which will bring to its front the figure 9, and so on. The numbers in front of the machine will now stand thus:—

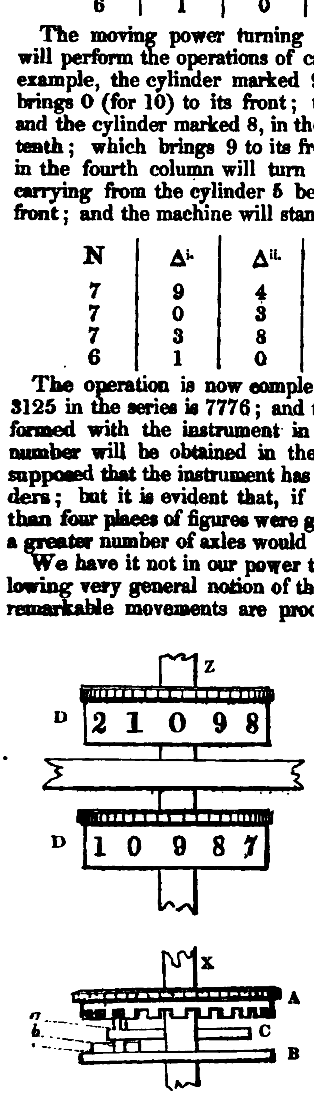
N	Δi.	Δii.	Δiii.	Δiv.	Δv.
7	8	4	1	0	0
7	9	3	5	7	1
7	3	8	5	2	2
6	1	0	0	0	0

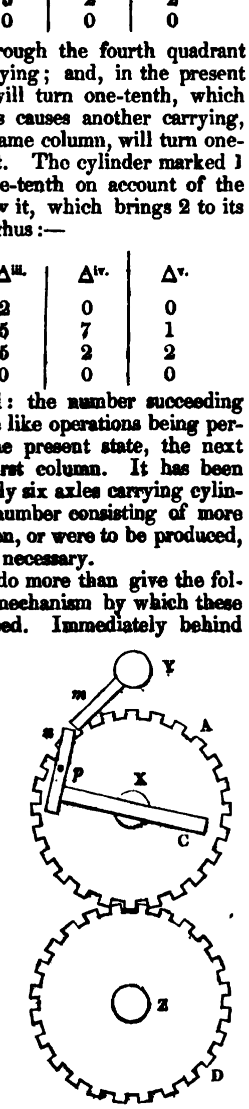
The moving power turning through the fourth quadrant will perform the operations of carrying; and, in the present example, the cylinder marked 9 will turn one-tenth, which brings 0 (for 10) to its front; this causes another carrying, and the cylinder marked 8, in the same column, will turn one-tenth; which brings 9 to its front. The cylinder marked 1 in the fourth column will turn one-tenth on account of the carrying from the cylinder 5 below it, which brings 2 to its front; and the machine will stand thus:—

N	Δi.	Δii.	Δiii.	Δiv.	Δv.
7	9	4	2	0	0
7	0	3	5	7	1
7	3	8	5	2	2
6	1	0	0	0	0

The operation is now completed: the number succeeding 3125 in the series is 7776; and the like operations being performed with the instrument in the present state, the next number will be obtained in the first column. It has been supposed that the instrument has only six axles carrying cylinders; but it is evident that, if a number consisting of more than four places of figures were given, or were to be produced, a greater number of axles would be necessary.

We have it not in our power to do more than give the following very general notion of the mechanism by which these remarkable movements are produced. Immediately behind each column of the cylinders D carrying the figures, and in a vertical plane perpendicular to the front of the machine, is a vertical axle X which carries, opposite to each cylinder, two horizontal wheels A and B, and between them a moveable bolt C, also in a horizontal position: these two wheels are capable of being connected with or disconnected from the axle, so that they may or may not turn with the latter. The upper wheel A is furnished with teeth, standing out horizontally from the rim, and these work in the like teeth formed about the cylinder D carrying the figures, so that the wheel A, when it turns with its axle, may be said to drive the cylinder. It is also furnished with teeth which are perpendicular to its lower surface in the manner of an inverted crown wheel. The bolt C, which is under this wheel, and passes through the axle, is capable of being moved a short distance horizontally; it is provided, near its extremity, with a pin or tooth *a* standing perpendicularly above its upper surface, and with a pin *b* perpendicularly below its inferior surface. And the lower wheel B carries a wedge or inclined plane *c*.





Behind the wheels on the axle X is another axle Y, which is also in a vertical position: this carries a projecting bar or finger *m* which revolves horizontally when the axle is made to turn by the action of the moving power. During its revolution it meets, at a proper place, one extremity of a lever, *n* which is capable of turning on a pivot at *p*: that extremity being displaced, the extremity of the opposite arm presses against the end of the bolt C in the axis X and causes the upper pin *a* to enter between two teeth of the crown-wheel A. This wheel is thus fixed to its axle so as to be compelled to turn with the bolt; and the horizontal teeth of the wheel, consequently, cause the cylinder D carrying the figures to turn on its proper axis Z. Such is the nature of the mechanism that, while the moving power describes the first and the third quadrants of its revolution, the cylinder D might make a complete revolution; but, in general, the cylinder is to make only as many tenths of a revolution as are expressed by the figure in front of the next cylinder on its right hand; and therefore the bolt is to be withdrawn from the crown-wheel when such part of a revolution has been performed. This is accomplished by the pin *b*, which, moving along the wedge or inclined plane *c*, draws the bolt back so that the pin *a* above is removed from between the teeth of the crown-wheel; the latter is thus disengaged from its axle and ceases to revolve: at the same time the cylinder D, with which it is connected by the horizontal teeth, ceases also to revolve. The cylinder remains then at rest till it is moved at a subsequent step in the process. If the cylinder is not to turn while the moving power describes the first and third quadrants, an apparatus provided for the purpose removes out of its place the lever which should press against the end of the bolt.

For every vertical axis carrying cylinders in front of the machine, there is an axle carrying wheels and bolts, and an axle carrying the fingers which lock the bolts: and behind every cylinder is its proper apparatus, consisting of wheels, bolt, and finger.

The process of *carrying*, which takes place when the moving power is describing the second and fourth quadrants of its revolution, is accomplished thus:—a bar or finger revolves on the axle of the lowest cylinder D, for example, in the first vertical column on the left; and, at a proper time, comes against the extremity of a claw which then engages itself between the teeth of a ratchet-wheel connected with the next cylinder above it: both the wheel and cylinder are thus made to turn, but the length and position of the claw are such that the cylinder can only make one-tenth of a revolution, and thus bring to the front a figure greater by unity than that which was there before. When a cylinder has made the movement just indicated, a projecting pin, called a thumb, on the axle of the lower cylinder, touches a trigger which raises, out of a notch in the claw, a hook which retained the latter: a spiral spring then draws back the claw and allows it to fall between the next teeth of the ratchet-wheel without creating any movement in the cylinder; and the apparatus is thus prepared for the next carrying operation which is to take place.

A very ingenious contrivance is also provided in order to produce an equalization of the action through the machine during an operation: this consists in having the *fingers* by which the bolts and claws are moved placed spirally on the several axles, so that they do not act at once but successively in the time that the moving power describes one quadrant of its revolution: and the fingers which cause the bolts to enter between the teeth of the crown-wheels are disposed so that the shooting of a bolt may take place immediately after the action of the fingers which move the claws employed in the carrying process, by which means a *carrying* is allowed to take place when the previous process of carrying has already caused a cylinder, in moving one-tenth of a revolution, to bring 0 (for 10) to the front.

The most remarkable circumstance in this machine is the provision which may be made in it for avoiding errors arising from inaccuracies in the original construction, or from accidental derangements; but as the means of obtaining this end have not yet, we believe, been put in execution, nothing can be said concerning them.

It is proposed by the inventor to apply to the machine an apparatus by which the numbers obtained from the cylinders in the left-hand column may be immediately transferred, by the operation of *punching*, to plates of copper, in order that the results given by the machine might be printed without a possibility of error. A curvilinear bar of metal is to act on an arm of a lever so as to raise it to ten different heights corresponding to the ten figures on the surface of a cylinder; and the opposite arm of the lever is to move an arch carrying ten punches having on them the characters 1, 2, 3, &c. in relief. The plate of copper being below, a bent lever is to press the punch upon the plate, and produce the impression of the figure. The different figures in front of the first column of cylinders may thus be successively transferred to the copper-plate; and the arch and plate being shifted, the set of figures brought in front of the cylinders in the same column, at the next operation with the machine, may be transferred in like manner.

Whatever be the cause that the construction of this superb machine is suspended, the circumstance cannot fail to be a subject of great regret. The portion which has been already executed is now in the library of King's College, London; and we are informed that it is capable of producing tables of the powers and roots of numbers not extending beyond eight places of figures.

A great improvement on the machine above described is contemplated by the inventor; who, with reference to the purposes to which the improved machine can be applied, designates it an Analytical Engine. In Taylor's 'Scientific Memoirs' (vol. iii. art. xxix.) there is given, by M. Menabrea of Turin, a sketch of the properties of the engine; and in the 'Notes' by the Translator of the article there is the following summary of the operations which can be performed by it:—

It will perform the several operations of simple arithmetic on any numbers whatever. It can combine the quantities algebraically or arithmetically in an unlimited variety of relations. It can use algebraic signs according to their proper laws, and develop the consequences of those laws. It can arbitrarily substitute any formula for any other, effacing the first from the columns on which it is represented and making the second appear in its stead. And lastly, it can effect processes of differentiation and integration on functions in which the operations take place by successive steps. It is further stated that the engine is particularly fitted for the operations of the combinatory analysis, for computing the numbers of Bernoulli, &c.

CALDER'ARI, OTTO'NE, a nobleman of Vicenza (where he was born in 1730), to whom that city is indebted for many important additions to its previous architectural attractions, for edifices rivalling those by Palladio himself. In fact, he is fairly entitled to be called the Palladio of the eighteenth century, and that not so much on account of his being a decided imitator of that master, as for adopting all the best qualities of his style and peculiar characteristics of manner, without having his defects. Nevertheless, while Palladio has been almost universally and no less indiscriminately extolled, Calderari has been treated with most unaccountable neglect. Woods makes no mention in his 'Letters of an Architect' of Calderari or any of his buildings either at Vicenza or elsewhere, although he is rather particular in his notices of those by Palladio in that city; neither does Wightwick in his 'Sketches by a Travelling Architect' (in 'Library of Fine Arts'), nor Eustace, nor any other architectural tourist. In his 'Encyclopædia of Architecture' Gwilt preserves the same complete silence, neither inserting his name in the list of architects, nor the large and beautifully executed folio work of his 'Designs' in that of architectural publications. The only testimony to the merits of Calderari which we have met with in any English publication, excepting Cresy's translation of Milizia's 'Lives,' is in a paper in the Quarterly Review, No. 32, on the 'Palladian Architecture of Italy,' where it is said, 'Ottone Calderari particularly distinguished himself by his simplicity and elegance, and his knowledge of the true principles on which the beauty of Grecian (Greco-Italian) architecture depends. The Loschi and Bessaro palaces at Vicenza, and the Seminario at Verona, are noble specimens of his skill'—and likewise of his taste.

Instead of apologising for remarks that will at all events not diminish the interest of this notice, we have to regret that scarcely anything amounting to biography can be collected to append to it. No materials are furnished by Diedo, the editor of his 'Designs,' in the 'Elogio' prefixed to that work, where he styles him 'Il Immortale Calderari.' His enthusiasm for architecture is said to have been first excited by viewing the Basilica of Vicenza by moonlight, which made so powerful an impression upon him that he thenceforth devoted himself to the study, and became, like Burlington, more than a mere 'dabbling amateur' in it, since his renown eclipsed that of many of his professional contemporaries. One of his earliest recorded works was the casino erected by him near Vicenza, in 1772, for the Count Anti-Sola, which has a very extended front towards the gardens, with terraces uniting the house to the wings. In 1773 he built the small Palazzo Bonini at Vicenza, whose façade has two orders, Doric and Ionic (of five intercolumns), surmounted by an attic, and so decidedly an imitation of Palladio that it says more for the count's fidelity to that master than for his own invention. The Palazzo Cordellina (1776) at Vicenza, which is esteemed by his editors his 'capo d'opera,' differs very little from the preceding in the style of its façade, which presents the same orders. The Villa Porto at Vivaro, five miles from Vicenza, erected in 1778, is a happier specimen of his talent, and the Doric colonnades between the body and wings, backed by a screen wall with openings in it, produce much scenic effect. In 1782 he built the Palazzo Loschi at Vicenza, a Corinthian order and attic on a rusticated basement; in 1785 the Casino Todaro, and also the Palazzi Quinto and Salvi, in the same city. Nor was Vicenza alone the scene of his architectural labours, for he designed the beautiful atrium of the Seminario at Verona, and the Villa Capra, at Marano, and the Casa Cocastelli in the Mantuan territory.

Count Calderari belonged to the principal academies and societies in Europe, and was elected by the French Institute expressly as being 'foremost among the Italian architects of that day;' nor can it be denied that he is entitled to the admiration of those who hold Palladio to be a pattern of excellence. He died at Vicenza, October 26, 1803, and his éloge was pronounced by Diedo, secretary to the Academy of Fine Arts, Venice, and the chief editor of his 'Opere di Architettura,' &c. 2 vols. folio, 1808-17. Though there is no portrait of him prefixed to that work, there is one in Gamba's 'Galleria de' Letterati,' &c., Venice, 1824.

CALENDERING is a general name applied to the processes of smoothing, dressing, and glazing webs or textile fabrics of cotton and linen, either to prepare them for the operations of the calico-printer, or to impart the last finish to the goods before they are folded and packed for the market.

The common smoothing-iron affords the simplest illustration of the process of calendering, and the mangle, which is so frequently employed as a substitute for the smoothing-iron, presents another, the operation of which is identical with that of some of the earlier calenders, or calendering machines. In the common mangle, as in the old calenders constructed on the same principle, the cloths to be smoothed are rolled upon smooth wooden rollers, and laid between two hard flat surfaces, the lower one of which is immoveable, while the upper, which is formed by the bottom of a large heavy box, is capable of being moved backwards and forwards in the direction of its length, thereby causing the cloth-covered rollers to roll backwards and forwards until every part of the cloth wrapped upon them has received sufficient compression. In a common mangle the alternate motion of the pressing-box, which is usually loaded with stones, is produced by turning a winch-handle, which alternately winds and unwinds ropes extending from the ends of the box to a drum or cylinder fixed over it. To obviate the inconvenience occasioned by the frequent changes in the direction of the motion required, various ingenious devices have been resorted to, by which the alternating motion of the loaded box is produced by a continued motion of the winch-handle in one direction. Being larger and heavier than common mangles, the old calenders made on the same principle were often worked by a horse-wheel, or some other moving power. The process of calendering was greatly improved by the invention of a machine in which the pressure is produced between cylinders, instead of between cylinders and flat surfaces, and in which, consequently, the alternating motion is got rid of, and, also, it is easier to give a uniform and equal pressure. According to the writer of the article 'Calender' in the 'Encyclopædia-Britannica,' the cylindrical calendering engine was introduced into this country from Flanders and Holland by the Huguenots who were driven to England by persecution. The rollers or cylinders were formerly made of wood; but, as it was found impossible to overcome the tendency of that material to warp and crack, they are now usually made either of paper or of cast-iron. The paper cylinders, which form the most remarkable feature of a modern calender, are formed in the following manner. The axis is a strong square bar of wrought-iron, and the body of the cylinder consists of a great number of circular pieces of stout pasteboard, each of which has a square hole in the centre to receive the axis, and six smaller round holes at equal distances from each other, near the periphery. A strong cast-iron plate, of a circular form, but rather smaller than the pieces of pasteboard, and perforated in like manner, is first put upon the axis, and then a sufficient number of pieces of pasteboard to form, when compressed, a cylinder of the required length. Another cast-iron plate is then added, and long cylindrical bolts of wrought-iron, each of which has a head at one end, and a screw cut upon the other, are put into the six holes near the rim, and passed completely through the mass of pieces of pasteboard and the end plates of cast-iron. Nuts being put upon the ends of these bolts, the whole is screwed up as tight as possible, after which the cylinder is exposed to a strong heat for several days in a stove or heated chamber. By this process the pasteboard is considerably shrunk, and while it remains hot the nuts are repeatedly tightened up as much as possible. When allowed to cool the pasteboard is inclined to expand again, while the iron bolts contract, so that the mass of paper of which the cylinder is composed becomes almost inconceivably hard and dense. It is finished by very careful turning in a lathe, by which the surface of the cylinder is rendered perfectly true, and receives, in consequence of its extreme compactness, a very high polish. Iron cylinders, which are used in conjunction with paper cylinders in the same machine, are made hollow, and, for cases in which the application of heat is required, are constructed either to receive red-hot rollers or heaters, or to admit steam through a stuffing-box in the axis at one end, and discharge it at the opposite extremity.

The calenders now commonly employed for smoothing cotton and linen goods, contain four or five rollers mounted above one another in a strong frame-work of cast-iron, which, from its ability to bear the application of heat without warping, is very preferable to wood; and, if the object be simply to smooth the fabrics, the motion of the rollers, which can be made to bear against one another with any required degree of pressure by means of weighted levers, is so adjusted that, though their relative diameters may vary, their surfaces travel with equal velocity, so that no rubbing contact is produced. For some goods, however, especially those intended for use in household furniture, and in certain articles of dress, a glazed or polished surface, as well as mere smoothness or evenness, is required. Such goods were formerly glazed by hand upon an inclined table, with a rounded piece of polished flint attached to an apparatus which enabled the operator to preserve the cloth at a proper degree of tension, and to rub the flint backwards and forwards with considerable force over the surface, a small portion at a time. This process is now far more expeditiously performed with a calender of the ordinary construction, with the addition of a series of toothed wheels which cause the rollers to move with different velocities, so that the surface of one will rub or slide upon the surface of that adjacent to it. By the ordinary process of calendering, and still more by the use of the glazing calender, the round threads of which the web is composed are flattened, so that, by the diminution of the interstices, the fabric is made to appear closer than when it leaves the loom. Lawns, muslins, and other very light transparent fabrics are calendered with a very slight pressure, in a machine often worked by hand, which has the effect of smoothing the goods without altering the cylindrical form of the threads.

When the operation of the calender is intended to finish goods for the market, it is immediately followed by folding and packing. Dr. Ure describes in the 'Dictionary of Arts,' article 'Calender,' a very complete calendering apparatus in use among the calico-printers of Alsace, to which a self-acting folder may be attached at pleasure; and in the article 'Calender,' in the 'Encyclopædia Britannica,' are given some curious details respecting the mode of folding various kinds of goods. After folding, the goods are subject to immense pressure in a hydrostatic press, by the aid of which they are frequently made up into bales with such compactness as to occupy one-third less space then they could do if packed by hand in boxes. The calendering of goods in the process of manufacture is closely connected with the operations of the bleacher and calico-printer, but the calendering of finished goods is usually performed by the packer.

CALE'NDULA, a genus of plants belonging to the natural order Compositæ, the suborder Corymbiferæ, the tribe Cynareæ, the subtribe Calendulaceæ, the division Calenduleæ. It has an involucre of two rows with equal scales; the flowers of the ray ligulate, pistilliferous, fertile; the style divided at top into two stigmata; the flowers of the disk hermaphrodite, barren, the style undivided; the achenia unequal, curved, toothed, or muricated.

C. arvensis, Field Marigold, has the achenia cymbiform, muricated, incurved, the outer ones lanceolate, subulate, muricated on the back. This plant is common on the continent of Europe, and is found in immense numbers in some of the vineyards of the Rhine.

C. officinalis, Common Marigold, has cymbiform achenia, all of them incurved, and muricated. This is the *Souci du Jardin* of the French, *Gold-blume* of the Germans, and *Furrancio* of the Italians. Although common enough now in the gardens of Great Britain, and frequently found wild, it is not a native of these islands, and has been introduced from the south of Europe. This plant is a great favourite in gardens, and continues to blossom till the approach of winter. It is often grown in churchyards in this country, and in cemeteries on the Continent, but this practice does not appear to be connected with any superstition. There are several varieties of this plant found in gardens, as the orange-coloured, the lemon-coloured, and the double. It formerly had numerous virtues attributed to it, but independent of the bitterness of the tribe to which it belongs, and a rather more powerful volatile oil than is found in other species of the order, it possesses no active properties. The flowers are used in some parts of the country to give a yellow colour to cheese. In the Clock of Flora of Linnæus, it is said to open its flowers at nine in the morning and to close them at three in the afternoon. *C. pluvialis* has been named from its flowers closing at the approach of rain. The petals of these plants are sometimes employed to adulterate saffron.

(Loudon, *Encyclopædia of Plants*; Koch, *Flora Germanica*.)

CALLCOTT, JOHN WALL, one of the brightest ornaments, in every sense of the expression, of the British school of music, was born in 1766, at Kensington, where his father carried on the business of a builder. At the age of seven he was entered as day-boarder in a neighbouring school, where he made such progress that he commenced reading the Greek Testament in his twelfth year, when family affairs occasioned his removal, from which period, great and various as were his acquirements, he was self-educated, a circumstance to which, probably, the vigour of his unshackled mind may be attributed. Music, at first his amusement, accidentally became his profession, instead of surgery, for which he was preparing to qualify himself, when the sight of a severe operation so powerfully acted on nerves of remarkable sensibility, that he at once abandoned all hope of succeeding in the healing art, and devoted himself to that of harmony, the study of which he prosecuted without any master; though by a constant attendance at the Chapel Royal, at Westminster Abbey, and many concerts, together with the friendly hints, given in frequent conversation with Doctors Cooke and Arnold, he, no doubt, profited very largely.

He commenced his professional career in the subordinate capacity of deputy-organist of St. George the Martyr, Queen Square; and at about the same time made his first attempt in the composition of that truly national music, the Glee. In 1785, when only nineteen years of age, he appeared as a candidate for the prizes annually given by the Catch Club, and obtained three out of the four gold medals. Among the successful pieces was that masterly composition, 'Oh! sovereign of the willing soul.' Thus encouraged, he followed up with ardour and industry the course so auspiciously begun, and in the following ten years, twenty medals of the same most distinguished and laudable society were awarded to him. We must, however, add, that some of his best productions were either not candidates for prizes, or unduly appreciated by the dispensers of those musical honours.

In 1785, at the early age of nineteen, Mr. Callcott was admitted bachelor-in-music by the University of Oxford. In 1787 he assisted in forming the Glee-Club. In 1790 he took advantage of the arrival of Haydn in this country, and derived considerable knowledge in the higher branch of instrumental composition from that illustrious musician. He advanced to the degree of doctor-in-music at Oxford, in 1790; his exercise was a Latin motet, selected from Isaiah, beginning 'Propter Sion non tacebo.' His 'Musical Grammar' appeared in 1805. About the year 1806, he undertook to deliver lectures on music at the Royal Institution, a task 'most of all others suited to his studies and gratifying to his ambition: but the very anxiety he felt to execute the duty in a manner worthy of himself, rendered his hopes futile, and his efforts unavailing. His mind, long overstrained, now sank at once under the burthens he had so unsparingly laid on it, and he became incompetent to the fulfilment of any of his engagements.' After a seclusion of five years, he rallied for a time, and by avoiding all severe study or exciting occupation, afforded hopes to his friends that his mental powers were permanently restored. This gleam, however, lasted but three years, when he was once more assailed by the most woful of human maladies, and never recovered. He died in May, 1821.

The productions of this original and ingenious composer are too numerous, and indeed too well known, to be particularized here: the choicest of them were, in 1824, collected and published in two handsome volumes, by his son-in-law, Mr. Horsley. The work is enhanced in value by a portrait of the composer, engraved from a painting by his brother (afterwards Sir Augustus Callcott, R.A.), a remarkably strong likeness, in which the ingenuousness and benignity of his disposition, and the strength and quickness of his intellect, are very happily depicted.

Dr. Callcott left a widow, eight daughters, and two sons. One of the latter has already attained considerable distinction in his father's art.

(Horsley's *Memoir of Dr. C.*; and *Harmonicon*, ix. 53.)

CALLCOTT, SIR AUGUSTUS WALL. This very distinguished landscape painter, frequently styled the English Claude, was born at Kensington in 1779, and died in the same place in the close of the year 1844, aged sixty-five. He was the brother of the distinguished composer, Dr. Callcott, and he himself in early life officiated for several years in the choir of Westminster Abbey under Dr. Cooke. He however preferred painting to music, and for some time pursued both studies together, until the success of a portrait which he painted under the tuition of Hoppner, in 1799, and which he exhibited, led him to the final choice of painting as his profession. Very little experience, however, showed him that portrait was not suited to his taste, and in 1803 he devoted himself exclusively to the study of landscape painting. Richard Wilson had adopted a similar course, but notwithstanding his great ability, with very different success.

Callcott was elected an associate of the Royal Academy in 1807, and a member in 1810. For his diploma-picture, he presented a beautiful painting called 'Morning.' In 1837 he was knighted by the Queen; and at the death of Mr. Seguier in 1844, he was appointed his successor as Conservator of the Royal pictures, an office which he held for a very short time, and of no great emolument, yet honourable, and sufficiently valuable to be of very great importance to the venerable painter, who was so enfeebled by long illness, that in the last few years of his life he was unable to undergo the ordinary exertions of his profession. He was buried on the 30th of November in Kensal Green Cemetery, where his wife, Lady Callcott, had been buried two years previously.

Lady Callcott was the widow of Captain Graham, R.N., and was married to Sir Augustus in 1827. She was born in 1788: her maiden name was Mary Dundas. She was the daughter of Captain Dundas, and was married early in life to Captain Graham, with whom she went to India in 1809. She remained in India two years, and visited during that period many of the most remarkable places in that country, and published an account of her travels after her return home. She published at a later period two works relating to Italy, where she dwelt for some time,—'Three Months in the Environs of Rome,' and 'Memoirs of Poussin.' In 1821 she embarked with her husband for South America, but Captain Graham died during the voyage, and was buried at Valparaiso.

After her second marriage she paid another visit to Italy, in the company of Sir Augustus, and turned her attention particularly to art. In 1836 she published her last literary work, under the title—'Essays towards the History of Painting,' which, notwithstanding an unfortunate corruption of names, partly due to the old translation of Pliny by Philemon Holland, and a few other inaccuracies, is a very creditable performance, and considering that it is the only popular work on ancient painting that has hitherto appeared in English, it is a useful contribution to the library of the young student in art.

It is not intended, in this notice, to give a list of Callcott's pictures, nor even a view of his labours. He was for many years a steady and large contributor to the exhibitions of the Royal Academy. His landscapes were generally of small dimensions, and all very similar in style; but most of them are extensive as views and extremely quiet, and strictly belong to the beautiful as a class. He was less extensive in his distances than Claude, being more defined, and, certainly to the true lovers of nature, more pleasing; in his fore-grounds he was more correct and natural than Claude, except in the foliage, especially of large trees: in colour he was perfectly true and natural. His works are perhaps more frequently original characteristic pictures of certain scenery, as 'Italy,' 'Morning,' 'Evening,' &c., than mere views of particular localities. Many of his pictures also have their titles from the occupation of a few figures introduced into them, as 'Returning from Market,' 'Waiting for the Passage-boat,' 'The Ferry,' &c.: he painted also some marine pieces. In 1833 he had in the exhibition a beautiful picture called 'Harvest in the Highlands,' in which the figures were painted by E. Landseer, R.A. In 1837 he departed from his usual style and exhibited a picture of 'Raffaelle and the Fornarina,' which attracted general admiration, and was selected by the directors of the London Art-Union to be engraved by L. Stocks for circulation among the subscribers for the year 1843. The success of this piece seems to have induced the painter to attempt a work on a much larger scale in the same style. He exhibited in 1840 a picture of 'Milton dictating to his Daughters,' in which the figures were about the size of life; the attempt was however a failure; the composition was extremely meagre and commonplace, and the figures, especially one of the daughters, were ill-drawn. With the very high reputation he deservedly enjoyed as a landscape painter, and the little experience he had had in figure painting, it was, to say the least, injudicious to attempt such a work, and rash to exhibit it. However, as a landscape painter, Callcott is worthy of all praise, and he has earned a reputation which will ensure his name a place among the greatest painters in that department of the art. He was, from the account of those who knew him, not less estimable as a man, than he was meritorious as an artist.

(*Art-Union Journal*, 1843-1845; *Catalogues of the Exhibitions of the Royal Academy*; Waagen, *Kunstwerke und Künstler in England.*)

CALLI'MACHUS (Καλλίμαχος), a celebrated Greek sculptor of uncertain age, but probably of about the time of Phidias. He was apparently an Athenian, though some claim him for Corinth, because he is recorded by Vitruvius as the inventor of the Corinthian capital. Callimachus is, on the other hand, supposed to have been of Athens, from a report noticed by Vitruvius, and in part by Pliny, and Pausanias, that the Athenians used to call him Catatexitechnos (Κατατηξίτεχνος, according to the emendation of Sillig, which appears just), signifying one who weakens or effeminates an art, in allusion to the excessive finish by which he greatly injured the effect and value of his works. Pliny calls him the calumniator of himself, and says that he never knew when to leave off finishing his works; the same fault was found with Protogenes.

If Callimachus invented the Corinthian capital, this circumstance enables us, as Winckelmann has observed, in some degree to fix his time. It must have been before the 95th Olympiad, about 400 B.C., for Scopas then erected a temple of Minerva, according to Pausanias, with columns of the Corinthian order at Tegea; and he cannot have been much earlier than that date, as his style was so elaborate and finished. Dionysius of Halicarnassus compares the works of Callimachus and Calamis with the orations of Lysias, on account of their finish and neatness. Callimachus is also said to have first used the drill in working marble, a fact doubted by several modern critics, who suggest that he may have improved the drill in use, but cannot have been the first to use it in working marble, as it has evidently been used in the hair of some of the most antient statues, which, from the other evidence concerning Callimachus, must have been executed long before his time.

There is a bas-relief in the capitol at Rome, with Καλλιμαχος εποιει engraved upon it, which represents a dance of three bacchantes and a fawn; and some have supposed this to be the same work which Pliny notices as a dance of Spartan virgins by Callimachus. Winckelmann however supposes the inscription to be a forgery, or that there must have been some other Callimachus, who lived later than the subject of this notice. The characters of the inscription are, according to him, too recent; the subjects also are not the same, and the work itself is too insignificant to have been singled out by Pliny or his authority as a production worthy of record. According to Pausanias Callimachus was not an artist of the highest merit.

(Pliny, *Hist. Nat.* xxxiv. 8. 19; Vitruvius, iv. 1; Pausanias, i. 26; Winckelmann, *Werke*, vol. v.; Sillig, *Catalogus Artificum*; Thiersch, *Epochen der Bildenden Kunst*, &c.)

CALLIPERS. [CALIBRE, P. C.]

CALLI'STRATUS, a Roman jurist, who was writing under the joint reign of Severus and Antoninus (1. tit. 19, s. 3; 49. tit. 14, s. 3), by whom are meant Septimius Severus and his son Antoninus Caracalla. Severus died A.D. 211. Lampridius (*Alexander Severus*, 68), mentions a Callistratus as one of the Council of the Emperor Alexander Severus; and this may be the Callistratus who was writing under Severus and Antoninus.

Callistratus is one of the Jurists from whose writings Justinian's Digest was compiled [JUSTINIAN'S LEGISLATION, P. C.]: the works of Callistratus from which the excerpts in the Digest are taken, were—six books De Cognitionibus; six books of the Edictum Monitorium; four books on the Jus Fisci; three books of Institutiones; two books of Quaestiones. It appears from Institutiones being mentioned as one of the works of Callistratus, that he was one of those Roman jurists who wrote institutional treatises, such as Gaius.

CALLI'TRICHE, a genus of plants, the type of the natural order Callitrichaceæ. The flowers are without calyx or corolla, with two bracts at their base; one stamen; two ovaries, each 2-lobed and imperfectly 2-celled; the styles 2, subulate; the fruit dry, separating into 4 indehiscent carpels. Kützing has figured a deciduous calyx belonging to this genus. Five species have been described. Four of these are natives of Great Britain. They are water-plants with smooth leaves, and are known by the name of Water-starworts. *C. verna* is common in stagnant waters and slow streams. *C. platycarpa* is found on mud or in shallow water; seldom, and then apparently by accident, in deep water. *C. pedunculata* is found in marshes; and Babington has described a variety, *C. p. sessilis*, which is found in lakes. *C. autumnalis* is found in streams, but rare.

(Babington, *Manual of British Botany.*)

CA'LLITRIS. [THUJA, P. C.]

CALLU'NA (from καλλύνω, to make beautiful), a genus of plants belonging to the natural order Ericaceæ. It has a 4-parted, membranous coloured calyx, longer than the 4-cleft campanulate corolla, surrounded by four green bracts; 8 stamens, with dilated filaments; the capsule 4-celled; the dissepiments adhering to the axis; the valves opening at the dissepiments, and separate from them. There is only one species of this genus, the common heath (*C. vulgaris*). It is a low-tufted shrub with small, sessile, closely imbricated, keeled leaves, arranged in four rows, each leaf having two small spurs at the base, and nearly or quite smooth. The colour of the flowers varies from a deep red to a white, and numerous varieties have been named. This plant is common on every heath in Great Britain. The varieties are ornamental when planted in the garden. They should be grown in a peat soil, and may be propagated by layers or cuttings under a bell-glass.

(Babington, *Manual of British Botany.*)

CALOGIERA, ANGELO, born at Padua in 1699, of a family originally from Corfu, studied at Venice, and entered at an early age the monastery of St. Michele, near Murano, which belonged to the order of the Camaldulenses. After having taken his vows, he was sent to Ravenna to teach theology, and there finding a rich library at his disposal, and a well-informed and well-disposed librarian, he acquired a large store of varied literary knowledge. At Ravenna he made acquaintance with the learned Querini, afterwards cardinal. Calogiera, after some years, returned to his monastery of St. Michele, where he spent the greater part of his remaining life in his favourite literary studies. He was induced to compile an annual selection from the numerous papers which were read in the various scientific and philological academies scattered about Italy, and which, for want of a common journal, remained buried and forgotten in their respective archives. Calogiera undertook the task, in which he was assisted by Pier Caterino Zeno, Facciolati, Vallisnieri, Muratori, Manni, and other learned contemporaries. He began to publish in 1728, at Venice, the 'Raccolta d'Opuscoli Scientifici e Filologici,' which continued to appear periodically till 1757, when the series closed by its fifty-first volume, which contains an index of the whole collection. He resumed it, however, in 1754, under the title of 'Nuova Raccolta d'Opuscoli Scientifici è Filologici,' which he carried on to the time of his death, in 1768, after which it was continued by his co-religionist Father Mandelli till 1784, when the fortieth and last volume of this second series appeared. The two series constitute an ample store of Italian learning during the 18th century. Amidst many papers which have only a local and temporary interest, there are many others which are truly valuable, and which could not be found anywhere else. Calogiera wrote also a kind of literary journal entitled 'Memorie per servire alla Storia Letteraria;' he wrote with Apostolo Zeno in the journal 'La Minerva,' and he also contributed to a new edition of the 'Biblioteca volante' of Cinelli. Calogiera was appointed in 1730 Revisore or book Censor for the Venetian State. He left a voluminous correspondence, which is inedited.

(Lombardi, *Storia della letteratura Italiana nel Secolo XVIII.*)

CALOPHYLLUM (from καλός, beautiful, and φύλλον leaf), a genus of plants belonging to the natural order Guttiferæ It has a bractless calyx consisting of from 2-4 unequal coloured sepals; 4 petals (sometimes 2), opposite the sepals; indefinite stamens, free or connected at the base, filaments short, anthers inserted by their base, 2-celled, bursting longitudinally; the style twisted, crowned by a large capitate stigma, which is usually lobed; fruit drupaceous, globose or egg-shaped, 1-celled, 1-seeded; the seeds large. The species are trees, the leaves of which have numerous transverse parallel veins, which give them a very beautiful appearance.

C. Inophyllum has oblong or obovate obtuse leaves, usually emarginate, round branches, loosely racemose flowers, racemes axillary, 1-flowered, usually opposite peduncles. This tree is a native of the East Indies, and often attains a height of 90 or 100 feet. It has large handsome leaves like those of a water-lily, snow-white fragrant flowers, and a fruit about the size of a walnut. When the trunk is wounded, it exudes a yellow viscid juice, which frequently hardens to the consistence of a gum. It is a common plant in Malabar, where it yields fruit twice a year, in March and September, and frequently attains the age of three hundred years. The nuts afford a fixed oil, which is expressed, and used for burning in lamps, for making ointment, &c. This tree is cultivated in Java for the sake of its shade and the fragrance of its flowers. The bark and the exudation are used for medicinal purposes.

C. Calaba, Calaba-tree, has obovate or oblong, obtuse or emarginate leaves; hermaphrodite or male flowers; lateral, very short racemes. This plant is a tree 60 feet in height, and is a native of the Caribbee Islands. It has white sweet-scented flowers, and a green fruit something like the cornelian cherry, which contains a white solid kernel. An oil is expressed from the seed for domestic uses and for burning in lamps. The timber is used for various purposes, especially for staves and cask-headings. Lindley says, 'that the true East Indian Tacamahaca is produced by Calophyllum Calaba.' There are however several gums brought into the market under the name of Tacamahaca, of which formerly more was used than at the present day. The *Tacamahaca seu Resina Tacamahaca* of the old Pharmacopœias appears to have been the produce of the *Elaphrium tomentosum* and *E. excelsum*, plants belonging to the natural order Amyrideæ. It is described as a resin of a brown yellow colour, spotted with white, easily broken into pieces, which have a shining fracture, easily melting in the fire, and having a pleasant scent. Cullen says that it was not employed in his day 'as an internal medicine, and as an external I cannot perceive its virtues.' It was used for making plasters as a counter-irritant, for which there are forms in the continental Pharmacopœias at the present day. There is however another form of Tacamahaca brought to Europe, called Tacamahaca in shells. It has got this name from being collected in little gourd-shells. This is the true East Indian Tacamahaca, which is collected from *C. Inophyllum* in the East India islands, and from *C. Tacamahaca* in Madagascar and the Mauritius.

(Bischoff, *Medicinisch-pharmaceutische Botanik;* Loudon, *Encyclopædia;* Don, *Gard. Dict.;* Lindley, *Nat. System.*)

CALOTYPE. [PHOTOGRAPHY, P. C. S.]

CALVERT, DENIS, sometimes called FIAMMINGO, a distinguished painter in his time, especially in landscape, was born at Antwerp about 1555. He settled early in Bologna, and studied there, first with Fontana, and afterwards with Sabbatini, with whom he visited Rome and assisted in some works there. Sabbatini had more influence upon the style of Calvert than Fontana, who however taught him the value of perspective, in which Fontana excelled. After a stay of some time in Parma, Calvert returned to Bologna and opened a school there, which became very celebrated and was numerously attended; he is said to have taught 137 painters. His school was unrivalled in Bologna until the establishment of the famous school of the Carracci, which in a few years completely superseded it. Some of the greatest scholars however of the Carracci had been students in the school of Calvert, as

Domenichino, Guido, and Albani, three of the most famous of the Bolognese painters.

Calvert died at Bologna in 1619. He is spoken of with great respect by Malvasia and other Italian historians of art. There is nothing peculiarly Flemish in his style; his pictures, of which there are still several in Bologna, are generally well coloured, and strictly in an Italian style of design: in landscape he was superior to any of his Bolognese contemporaries. His masterpieces are a St. Michael in the church of San Petronio, and a Purgatory alle Grazie.

(Malvasia, *Felsina Pittrice*; Lanzi, *Storia Pittorica*, &c.)

CALYCOPHYLLUM (from κάλυξ, calyx, and φύλλον, leaf), a genus of plants belonging to the natural order Cinchonaceæ. It has the limb of the calyx truncate or bluntly 5-toothed, one of the teeth expanded into a petiolate coloured membranous leaf; the corolla campanulate or funnel-shaped with a 5-plaited limb; five stamens, the filaments rising from the throat free, the length of the corolla; the anthers oval, exserted; the style ending in 2 reflexed stigmas; the capsule dehiscing at the apex, oblong, 2-celled, many seeded; the seeds fixed to the linear placenta, imbricate, oblong, girded by a very narrow membranous wing. The species are small smooth trees, with opposite glabrous leaves, short stipules, and flowers disposed in axillary and terminal dichotomous corymbs.

One of the most remarkable species of this genus has been lately described by Sir Robert Schomburgk as a native of British Guiana. There are several genera closely allied to Calycophyllum, as *Mussænda Pinkneya*, &c., in which one of the teeth expands into a petioled and coloured leaf of a membranaceous texture. In the species discovered in Guiana the bract-like expansion of the calyx, has a rose colour, and as the flowers are very numerous the whole tree assumes the colour of the rose. In describing the discovery of this plant, Sir Robert says, 'Let imagination convey you to the great garden of nature in Guiana, clothed in tropical exuberance; and among those productions of a congenial sun and fertile soil, figure to yourself trees from forty to fifty feet high presenting a mass of leaves the colour of our favourite flower, from a deep pink to the lightest rose, and perhaps your fancy will assist you to form some idea of the picture I beheld at one of the valleys of the river Rapunnuni, where a high mountain on the river's left bank turns its bed boldly to the east. The banks of the stream and the steep side of the hill were alike covered with trees clothed with rose-coloured leaves; and only on a near approach could the shining green leaves and the spikes of flowers of a velvety blue be discovered."

This plant is called by its discoverer after Lord Stanley, *Calycophyllum Stanleyanum*. The wood of the tree is very hard. It is very bitter to the taste, and, like the rest of the order, is probably febrifugal.

(Hooker; *London Journal of Botany*, 1844.)

CALY'MENE, the generic title, in Brongniart's classification of Trilobites, for the species of Crustacea allied to the well known Dudley fossil Calymene Blumenbachii. [TRILOBITES, P. C.]

CALYSTE'GIA (from καλύξ, 'calyx,' and στέγω, 'to cover'), a genus of plants composed of species formerly included under Convolvulus. It is distinguished by two large bracts which enclose the flower. It has a 5-parted calyx, a campanulate 5-plicate corolla, one style, a 2-lobed stigma, globose or terete lobes, a 2-celled ovarium with 2 ovules; the capsule only 1-celled from the shortness of the dissepiment. The species are lactescent, glabrous, twining or prostrate herbs, with solitary 1-flowered peduncles.

C. sepium, Great Bindweed, has sagittate or cordate, very acute leaves; lobes truncate, entire, cordate, keeled; acute bracts longer than the calyx, but one half shorter than the corolla; the peduncles square, sepals acute. This is the Convolvulus sepium of older botanists. The genus Calystegia is not adopted by Koch, Babington, and other botanists. It is a native of Europe in hedges, and is found in Great Britain very common. It possesses apparently the properties of the genus Convolvulus. Haller and Withering state that the expressed juice of the root may be used as a substitute for scammony. It is sometimes called German Scammony. In doses of 20 or 30 grains it has been recommended as a hydragogue cathartic in dropsies, by Mason Good.

C. Soldanella, Sea Bindweed, has trailing, glabrous, rather fleshy leaves, reniform, entire, or a little angular; peduncles angular, angles, winged; bracts large, ovate, blunt, mucronate, generally shorter than the calyx. It is a native of many parts of Europe on the sea-coast, and also some parts of Asia. The young stalks are sometimes eaten pickled. The juice of the mature plant is however a cathartic.

Several other species of this genus are described. Like the Convolvuli, they are elegant plants in blossom, and are of the most easy culture. They may be propagated by pieces of the root or by seeds. The C. Soldanella should now and then be watered with salt water.

(Don, *Gardener's Dictionary*.)

CAMBIA'SO, LUCA, sometimes called LUCHETTO DA GENOVA, a very celebrated Italian painter in fresco and in oil, was born at Moneglia near Genoa, on St. Luke's day, in 1527. He was instructed by his father Giovanni, a painter of considerable merit, and distinguished himself even when a boy, and though he is not known to have visited Rome in his youth, his best works have many of the qualities of the great Roman masters. After a long and honourable career at Genoa, where he was without a rival, he went, in 1583, to Spain with his son Orazio, and L. Tavarone, one of his pupils, to assist him in some works which Philip II. had commissioned him to execute in the Escurial. Cambiaso was invited to Spain by Philip II. to supply the place of his old friend and fellow-labourer G. B. Castello of Bergamo, who died in Madrid in 1579. Cambiaso and Castello executed several paintings together in Genoa.

Cambiaso executed several works in the Escurial, the largest of which was an immense fresco of Paradise, containing a vast number of figures, arranged as the monks desired on the ceiling of the choir of the church of San Lorenzo. He received 12,000 ducats for this picture, yet it occupied him only fifteen months; it was however in the opinion of Mengs much inferior to his best works in Genoa: the composition is formal and bad, but for this the monks must be held responsible. The oil painting of John the Baptist preaching in the Wilderness, also in the Escurial, is the best of his Spanish works: he died at the Escurial in 1585, and Philip greatly regretted his loss. He was called Cangiaso by the Spaniards. He was a painter of surprising facility and power; Armenini compared him with Tintoretto. He painted however latterly with great negligence, a circumstance which some attribute to a disappointment in love. The story is this: his wife died, and Cambiaso invited her sister to keep house for him and take care of his children; he however soon became desperately in love with her, and as he could not marry her by the law of the Roman church, he set out for Rome to pray the Pope Gregory XIII. for an indulgence. He took two pictures with him as presents for his holiness, which were accepted, but his prayer was decisively rejected, and he was ordered to remove the lady from his house. This refusal had a great effect upon him, and rendered him indifferent in his works, which he henceforth executed merely for money. When he was in Spain however he again encouraged the hope of inducing the pope to grant his prayer, through the intercession of Philip II., but when he alluded to the subject to some of Philip's confidential advisers, he was told by them that the bare mention of the matter to the king would ensure his immediate disgrace, which so depressed him that it induced a despondency which paralyzed his intellect, and in a few weeks brought on his death, in his fifty-eighth year.

Cambiaso's masterpiece is considered the Martyrdom of St. George in the church of San Giorgio at Genoa. The Rape of the Sabines, in Terralba near Genoa, is also a magnificent and celebrated work. His portrait by himself is in the Florentine gallery: several of his works have been engraved.

(Soprani, *Vite de' Pittori*, &c.; Cean Bermudez, *Diccionario Historico*, &c.)

CAMBRIAN ROCKS. Professor Sedgwick has at length established, in North Wales, beyond a doubt, the important fact, that beneath the slates and flags of Denbighshire, which belong to the upper Silurian strata, occur in the Berwyn Mountains and in the vicinity of Bala other strata containing lower Silurian fossils, to the extent of several thousand feet in thickness. In South Wales the progress of the Geological Survey, under De la Beche, has established the fact of very considerable thicknesses of partially fossiliferous rocks beneath the Llandeilo (or lowest Silurian) strata of Murchison. By these labours we perceive that the Palæozoic forms of organization descend, in Wales, many thousand feet below the lowest recognised Silurian strata, and we are therefore enabled to present the subjoined view of the nomenclatures separately proposed by Sedgwick and Murchison, in connection with the terms used in this work:

LOWER PALÆOZOIC STRATA. [P. C.]		Upper Silurian. (Murch.)	Ludlow rocks. Wenlock rocks.
	Cambrian Strata. (Sedgw.)	Lower Silurian. (Murch.)	Caradoc rocks. Llandeilo rocks.
		Groups yet to be named.	—————— ——————

HYPOZOIC STRATA OF CUMBERLAND AND SCOTLAND.

Thus it appears that the Cambrian strata are not exactly equivalents of the lower Silurians, but include a great range of other strata below those originally defined by Mr. Murchison. Viewed however without reference to nomenclature, the Cambrian and lower Silurian rocks form one grand type, and may perhaps deserve to be ranked as one great 'Protozoic' system.

CAMELI'NA, a genus of plants belonging to the natural order Cruciferæ, to the suborder Latiseptæ, and the tribe Camelineæ. It has a subovate pouch, the valves ventricose, with a linear prolongation at the end, which is confluent with the persistent style.

C. sativa, Gold of Pleasure, has pear-shaped pouches, intermediate stem, leaves lanceolate, sagittate at the base, entire or denticulate. It has small yellow flowers. Its name is a burlesque on the humble appearance of the plant. Babington admits it into his British Flora, but it is undoubtedly a foreign plant, which has been introduced with the seed of flax. It is found abundantly in the corn and flax fields of the Continent, from whence the seed is brought to this country.

C. dentata, is another species frequently found in Great Britain, in company with the last, and introduced in the same way.

CAMPANELLA, TOMMA'SO, born near the town of Stilo in Calabria, in 1568, entered the Dominican order and became distinguished for his learning. He applied himself chiefly to metaphysics, and followed his countryman Telesio, who died in 1588 at Cosenza, in his opposition to what was then taught in the schools under the name of Aristotelian philosophy. Campanella published his first work at Naples, in 1591, entitled 'Philosophia Sensibus demonstrata adversus eos qui proprio arbitratu, non autem sensata duce natura, philosophati sunt, cum vera Defensione Bernardi Telesii.' Philosophy was at that time a very dangerous ground for discussion, as was experienced, among others, by Bruno and Vanini, both natives of the kingdom of Naples, who were burnt alive for their opinions, one at Rome and the other in France. [Bruno Giordano, P. C.] The schoolmen, and the monks especially, raised such a storm against Campanella, that he left his native country. He was accused of sorcery, of being an adept of Raymond Lullus, and of some cabalistic Rabbins. Campanella went to Tuscany, where the Grand Duke Ferdinand de' Medici received him with great kindness, and offered him a professorship at Pisa, which he declined. From thence Campanella proceeded to Padua, where he gave private instruction to several young patricians of Venice. About this period he wrote several works, among others a project of a Christian monarchy with a treatise on Church government, addressed to the pope, in which he suggested how, with mere spiritual weapons, he might bring all Christians within the pale of the Church. Campanella appears in this and others of his works as an admirer of unity, both in Church and State; he advocated a universal spiritual monarchy as well as a temporal one, both acting in unison for a common purpose. He also wrote a disquisition in Italian, at the request of a senator of Venice, on the question, whether the foreign ambassadors at Venice should be allowed to harangue the Senate in their respective languages. After some years, Campanella left Padua for Rome, but his papers were seized on the road, and it seems that they found their way to the archives of the Inquisition at Rome; but the author remained unmolested for the present. From Rome Campanella returned to his native country, where he lived for some time at Stilo, enjoying considerable celebrity for his learning, until serious political events came to disturb the land. A vast conspiracy is stated to have been hatched in Calabria, in which several hundred monks and other clergymen, some bishops, and many barons, were said to be implicated, against the Spanish viceregal government, which was one of the worst in Europe. The peasantry were ripe for revolt, being ground down by taxes, and still more by the cruel manner in which they were levied. Philip II. of Spain, who had wielded so long with a strong hand the power of the Spanish crown, was dead, and his successor had not inherited his abilities or his firmness. The Count de Lemos was sent Viceroy to Naples by Philip III., and a fresh tax on 'fuochi' (hearths), or families, was imposed. Dissatisfaction became loud all over the country. In August, 1599, two citizens of Catanzaro revealed the plan of a conspiracy, in which Campanella and his brother friar, Dionisio Ponzio of Nicastro, were leaders. It was said that their object was to proclaim a republic, and that they relied upon the Turks for assistance, and had carried on a correspondence with Cicala Pasha, a Turkish Admiral, but himself a Calabrian renegade, who was then scouring the neighbouring sea with his squadron. Such a plan may have been conceived by some person, but that a man of so much information and judgment as Campanella displays in his works, a monk, and an advocate for a universal Christian monarchy, could think of establishing a republic in Calabria by means of Turkish assistance and against the power of the Spanish monarchy, is incredible, and the sequel tends to disprove the charge. The probability is, that he was imprudent in his language, that he expressed himself indignantly against the oppressions of the viceregal government, and that his historical information supplied him with comparisons unfavourable to it. Campanella and Dionisio Ponzio were arrested, together with many more, and sent to Naples, where several of the conspirators, having confessed under torture, were executed. Campanella remained in a dungeon for years; he was put to the torture seven times; five times his trial was begun afresh, but he confessed nothing, or had nothing to confess, and after several years his confinement was mitigated, and he was allowed to see his friends. Charges of heresy were mixed up with political charges against him; he was even accused of being the author of the book 'De Tribus Impostoribus,' which Campanella observes had been published thirty years before he was born. The historian Giannone asserts that Campanella was really a leader of the great conspiracy, which he says was concocted chiefly by monks; but Giannone, like most Neapolitan jurists, was prejudiced against monks and churchmen in general, and he believed the insinuations of the viceregal lawyers. He says that he had seen a copy of the proceedings against Campanella and his fellow-conspirators, but we know what the forms of trial for treason were in those times, and at Naples. Botta, in his continuation to Guicciardini, has followed Giannone implicitly. A search has been lately made in the archives of Naples for the papers relative to Campanella's imprisonment and trial, but nothing has been found. Most of the documents existing of the viceregal judicial administration are of a later date than Campanella's trial; the previous records of the sixteenth and beginning of the seventeenth century are missing. Antonio Serra, a Calabrian, and one of the earliest writers on political economy, was one of the individuals imprisoned on the same occasion as Campanella, and he also was tortured and kept in prison for years. [Political Economy, P. C.] Campanella enjoyed at one time a glimpse of favour from the viceroy Duke of Ossuna, who loved to converse with him on politics; but when Ossuna was recalled and arrested, on the charge of having intended to assume supreme power at Naples, Campanella became the object of fresh suspicions, and his captivity was made more rigorous. At last, in 1626, he was released from his prison at the pressing request of Pope Urban VIII., who, probably in order to obtain his release, urged that as the prisoner had been charged with heresy and was moreover an ecclesiastic, he ought to appear before the tribunal of the Inquisition. Campanella was therefore sent to Rome, and lodged in the buildings of the Holy Office, where however he was a prisoner at large, and was treated with considerate attention. After three years more, making in all thirty years of confinement, he was allowed his full freedom. He remained for several years at Rome, enjoying the favour of the pope, of many of the cardinals, and other distinguished persons. He published two works in favour of the Papal See and Court: 'Monarchia Messiæ, ubi, per philosophiam divinam et humanam demonstrantur Jura summi Pontificis super universum Orbem, Jesi, in the Papal State, 1633; and 'Discorsi della Libertà e della Felice Suggezione allo Stato Ecclesiastico,' Ibid. The object of the last work was to show that the people subject to the Papal See were among the happiest in Italy, which was then probably true. These two works having occasioned remonstrances and complaints on the part of the Spanish and other courts, were suppressed, and copies of them are very scarce. He also wrote at Rome a 'Liber de Titulis,' on hierarchical precedence and titles of honour.

Campanella had become very intimate at Rome with the Duke de Noailles, ambassador of Louis XIII., and this intimacy, added to the old suspicions of the agents of Spain, made them cry aloud against the protection granted by the pope to a turbulent friar, whom they compared to Luther. Campanella stood evidently in danger, even in the midst of Rome; so great was then the dread of the Spanish power in Italy, that the pope's protection was deemed insufficient. Noailles proposed to Campanella to take refuge in France, and he sent him off in his own carriage, disguised as one of his attendants, and with letters of recommendation to the minister Cardinal Richelieu. Campanella arrived safely at Marseille, in October, 1634; he saw at Aix the learned Peiresc, who treated him most kindly and provided him with necessaries for the remainder of his journey. At Paris he had a very favourable reception from Richelieu, who conversed with him confidentially on the affairs of Italy, and introduced him to Louis XIII., who granted him a pension. Campanella, worn out by his sufferings, retired to the convent of his order, the afterwards famous Convent of the Jacobins in the Rue St. Honoré, where he died, in 1639.

The works of Campanella are very numerous. The Dominican bibliographers Echard and Quetif, 'Scriptor. Ord. Prædic.,' give a long catalogue of his inedited works. Among those that have been published, the following are deserving of notice:—1, 'Prodromus Philosophiæ Instaurandæ, seu de Natura Rerum, cum Præfatione ad Philosophos Germaniæ,' Frankfort, 1617. The preface is by Tobias Adami, a learned German, who became acquainted with Campanella in his confinement at Naples. Campanella intrusted him with several of his MSS. 2, 'De Sensu Rerum et Magia Libri IV., ubi demonstratur Mundum esse Dei vivam statuam beneque cognoscentem; omnes illius partes sensu donatas esse, quatenus ipsarum conservationi sufficit; et fere omnium naturæ arcanorum reperiuntur rationes,' Frankfort, 1620. This work was composed, as well as several others, by Campanella during his Neapolitan captivity, and was published in Germany by Adami, but the author published a second edition of it at Paris in 1636, which he dedicated to Cardinal Richelieu. Father Mersenne wrote to refute the book as heretical, and Athanasius of Constantinople wrote against it his 'Anti-Campanella,' Paris, 1655. 3, 'Realis Philosophiæ Epilogisticæ Partes IV., cum Tobiæ Adami Annotationibus; accedit Appendix politicus sub hoc Titulo: Civitas Solis, seu Idea Reipublicæ Philosophicæ,' Frankfort, 1620. The 'Civitas Solis' has been often reprinted separately, and translated into various languages. 4, 'Apologia pro Galileo, ubi disquiritur utrum ratio philosophandi quam Galileus celebrat faveat Scripturis sacris an adversetur,' Frankfort, 1662. 5, 'Astrologicorum Libri VI.,' Lyon, 1629. A second edition was published at Frankfort in 1630, with the addition of a seventh book, 'De Fato Siderali vitando.' Campanella had faith in astrology. 6, 'Atheismus Triumphatus, seu contra Antichristianismum,' Rome, 1631; and a second edition, with additions, Paris, 1636. 7, 'De Prædestinatione, Electione, Reprobatione, et auxiliis Divinæ Gratiæ, Cento Thomisticus,' Paris, 1636. The author discusses some of the opinions of Thomas Aquinas, and supports those of Origenes. 8, Universalis Philosophiæ, seu Metaphysicarum Rerum Libri XVIII.,' Paris, 1638. 9, 'Philosophiæ Rationalis Partes Quinque.' 10, 'De Gentilismo non retinendo Quæstio unica,' Paris, 1636. The question proposed is, whether it is lawful to contradict Aristotle. The following works of Campanella were published after the death of the author. 11, 'De Libris propriis et recta Ratione Studendi,' Paris, 1642, in which the author speaks of himself, his studies, and his works. It was edited by Naudé, who knew Campanella, and who speaks of him and his imprisonment in his 'Considérations Politiques sur les Coups d'Etats.' 12, 'De Monarchia Hispanica Discursus,' Amsterdam, 1640. This, perhaps the most remarkable work of Campanella, was written by him during his confinement at Naples. It is an able sketch of the political world of that time, and with reference to the Spanish monarchy, which was then the preponderating power, it showed how that preponderance could be maintained and increased. The author has been compared to Machiavelli, but there is this difference between them, that although Campanella is not very scrupulous as to sincerity and faith in political transactions, yet he reprobates cruelty and persecution, and prefers milder and more humane means. In fact his age was different from that of Machiavelli, and such barefaced atrocities as those of Borgia would not have been tolerated. In many respects the advice which Campanella gives to the King of Spain, especially concerning the internal administration, is very sound. This work made great noise at the time; it was reprinted several times, and was translated into English, and published during Cromwell's Protectorate: 'A Discourse touching the Spanish Monarchy, wherein we have a political glasse representing each particular country, province, kingdom, and empire of the world, with ways of government by which they are kept in obedience, written by Thomas Campanella, and newly translated into English according to the third edition of his book in Latin;' London, 1654, with a preface by the translator, giving a notice of Campanella's adventures. The work was reprinted after the Restoration, under this title: 'Thomas Campanella, an Italian Friar, and second Machiavel, his Advice to the King of Spain for attaining the Universal Monarchy of the World, particularly concerning England, Scotland, and Ireland, how to raise division between King and Parliament, to alter the government from a Kingdom to a Commonwealth, also for reducing Holland and other seafaring countries, &c., with a preface by William Prynne of Lincoln's Inn.' The following extract will serve to give some idea of the tenor of the work, which was written towards the end of Elizabeth's reign:—'My opinion is that the King of Spain should do well to employ under hand some certain merchants of Florence that are wise and subtle persons, and that traffick at Antwerp, who (because they are not so much hated by the English as the Spaniards are) should treat with some such of the English as are some way or other descended from some of the former kings of England, and should promise each of them severally (no one of them knowing any thing of what is said to the others) all the possible aid that can be from Spain, for the restoring of them to their inheritances. . . . . Let him also send privately to King James of Scotland, and promise him that he will assist him to the utmost of his power in his getting possession of the kingdom of England, upon this condition, that he shall either restore there again the Catholic religion, or at least that he shall not annoy or any way disturb the Spanish fleets from the West Indies. Again, on the other side, let him under-hand labour with the English peers, and other chiefest of the Parliament, and egge them on to endeavour to reduce England into the form of a republic. The English bishops are also to be exasperated and put into fears of the advent of King James and his Scots. . . . . The chiefs of the Irish nobility are also to be dealt with, so that as soon as they hear of Queen Elizabeth's death, they should new-model Ireland, either into the form of a republic, or else make it into a kingdom of itself, throwing off all obedience to England, withal promising aids to each of them in particular, and that so much the rather, because in that kingdom or island the Catholics, and especially the friars that are of the order of St. Francis, are very greatly esteemed and beloved. There is also much greater agreement and correspondence between the Spaniards and the Irish than betwixt them and the English, whether it be by reason of the similitude of their manners, or also by reason of the clime, and the nearness of these two countries one to the other. There are also in Ireland many vagabond persons, and such as have fled their countries, being men that are most impatient of government, and yet are good Catholics, and such as may be able to do good service in this kind, as hath been shown already. But this sort of men is not very rare to be found, either in England or Scotland also.' (*Spanish Monarchy*, chap. 25.)

Professor Morland has found in the King's Library at Paris several MSS. of Campanella, among others an invective against the Jesuits: 'Istruzione ai Principi della maniera con la quale si governano i Padri Gesuiti, à persuadere il Pontefice Paolo V. e tutti i Principi Cristiani à distruggere la Compagnia.' There is in the same library a discourse of his against the Lutherans and Calvinists. In the Imperial Library at Vienna there is an Italian dialogue of Campanella, on the means of convincing of error all the heretics and sectarians of his time.

In the latter years of his life at Paris, Campanella being asked whether Gaston d'Orleans, brother of Louis XIII., should ever reign, as the queen, Anne of Austria, was childless, he gave a sibylline reply: 'Imperium non gustabit in æternum.' Soon after, Queen Anne proved pregnant, and the child was Louis XIV. Campanella lived long enough to compose a Latin eclogue on the birth of the infant, which was his last composition.

Ernest Solomon Cipriani wrote a biography of Campanella, Amsterdam, 1705. Brucker and Buhle, in their Histories of Philosophy, give an abstract of Campanella's philosophy. Some short Italian poems of Campanella have been lately published at Lugano, by Orelli. Adami published some of his Latin poems.

(Baldacchini, *Vita e Filosofia di T. Campanella*, Naples, 1840, with several inedited letters of Campanella; Tiraboschi, *Storia della Letteratura Italiana;* and the Works quoted in the course of this article).

CAMPA'NULA (diminutive of Campana, on account of the form of its flowers), a genus of plants the type of the natural order Campanulaceæ. It has a 5-cleft calyx, the corolla mostly bell-shaped, with five broad and shallow segments, the anthers free, the filaments dilated at the base, the stigma 3-5-fid, the capsule not elongated, 3-5-celled, and opening by lateral pores outside the segment of the calyx. This genus is one of the largest in the vegetable kingdom, although from time to time the number of its species has been reduced by the formation of new generic types. George Don, in the 'Gardener's Dictionary,' gives descriptions of 153 species, and many more have been added since the publication of that work. Of these eight are described by Babington as British species. The species of Smith were more numerous, but Babington recognises Heister's genus *Specularia* for the old *C. hybrida* (*Prismatocarpus hybridus* of L'Heritier) and its allies, and Schrader's genus *Wahlenbergia* for the *C. hederacea*. The older names of the genus Campanula are *Trachelium* and *Cervicaria*, names which were given to it on account of the supposed efficacy of many of the species in the cure of disorders of the neck and trachea. Hence also the common name Throatwort. All the species are herbaceous, with mostly perennial roots, and the radical leaves differing in form from those of the stem. They are natives of the northern hemisphere.

C. edulis, Chobs, Okab, is a hispid plant with a thick root, erect 1-flowered stems, ovate-lanceolate, crenate leaves, lobes of the calyx linear-lanceolate, equal in length to the corolla, which is hispid. It is a native of Arabia Felix. Its root is thick and sapid, and contains a considerable quantity of starch. It is on this account frequently eaten by children, as the roots of many other species.

C. glomerata, Clustered Bell-flower, has the leaves minutely crenate-serrate, the lowermost stalked, ovate-lanceolate, generally cordate at the base, the upper leaves half-clasping, sessile, ovate, acute; the flowers sessile in terminal and axillary clusters. This is a native of Europe, especially in mountainous districts. In Great Britain it is found in dry pastures on limestone. It is the *Trachelium minus* and *Cervicaria minor* of Lobel and Dodonæus. It is often cultivated in our gardens, and a great number of wild varieties have been described by Alphonse De Candolle.

C. Trachelium, Nettle-leaved Bell-flower, has the leaves coarsely doubly serrate, hispid, the lower one cordate with long stalks, upper nearly sessile, ovate or lanceolate, acuminate; flowers racemose, peduncles 2-3-flowered; segments of the calyx triangular-lanceolate, entire, erect; the stem erect, angular. This is a European species. It is found in the south of England, and has large blue bell-shaped flowers. A decoction of this herb was formerly used in disorders of the throat, but the properties of the genus are medicinally inert.

C. rotundifolia, Hare-bell, Blue-bells, Milkwort, has the radical leaves cordate or reniform, shorter than their stalks, stem-leaves linear, the lower ones lanceolate; flowers one or more racemose, corolla turbinate, campanulate. It has pretty blue flowers, and is a favourite throughout Europe. In France it is called *Clochette;* in Germany, *Weisen-Busch*, and *Grass-glas*. The juice of the flowers makes a very good blue ink, and when mixed with alum a green one. The roots of this species also may be eaten.

C. pyramidalis is a glabrous plant with leaves glandular, toothed, the lower ones petiolate, ovate-oblong, somewhat cordate, the stem-leaves sessile, ovate-lanceolate; the flowers numerous, pyramidally racemose, the lobes of the calyx acuminate, spreading, the capsule spherical, deeply furrowed. It is indigenous on rocks and walls in Carinthia, Carniola, and Dalmatia. From its having been a great favourite in the gardens of Europe, it has now become naturalized in many places where it was not originally a native. It has not often been found wild in Great Britain, though it is commonly cultivated for the sake of its tall raceme of beautiful blue flowers. It is in great demand in Holland, where it is employed to ornament halls and staircases, and to place before fire-places in summer, for which purpose it is planted in large pots and trained in a fan-manner so as to hide a large surface. In the shade it remains in bloom two or three months. 'The art of producing a very large plant is to begin with pots of a small size, and shift frequently during two years, till at last the plant occupies a pot of a foot or more in diameter. Rich light soil should be used, but no animal manures or recent dung, as these are very injurious. Cuttings of the roots flower the second and seedlings the third year. *C. carpatica* and *C. grandiflora* may be treated in the same manner.' (Loudon.)

C. Rapunculus, Rampion, has leaves crenate, the radical leaves oblong-elliptical narrowed into a petiole, the stem-leaves linear-lanceolate, sessile, the raceme few-flowered, the segments of the calyx lanceolate. It is a native of Marocco and Barbary, also of the south of Europe, and extends as far north as Norfolk in England. It has a fusiform thick white root, which looks like a little turnip; hence the specific name, *rapunculus*, being the diminutive of rapa, or radish. In Germany it is called *Rapunzel*, in France *Raiponce*, in Italy *Raperonzola;* the English *Rampion* appears to be the same word. It is much cultivated in France and Italy, and sometimes in Britain, for the sake of the roots, which are 'boiled tender and eaten hot with sauce, or cold with vinegar and pepper.' (Loudon.) In its cultivation the seed should be sown in the spring on deep light soils, in drills; and in the autumn of the year the plants will be ready for use. The *C. persiciflora*, a doubtful native of Britain, and the *C. rapunculoides*, an indigenous plant, may be used for the same purposes as *C. Rapunculus*.

C. liliifolia (*Adenophora liliifolia*, Ledebore) has alternate leaves, the radical ones petiolate, ovate-roundish, cordate, toothed, the corolla campanulate, the style exserted. It is a native of Siberia, and of the east of Europe. Like many others of the genus, it has an edible root, which is sometimes divided into several turnip-formed tubes. The flowers are numerous and sweet-scented. It is interesting from the fact that the leaves, before blossoming, are crowded together on the summit of the stem, so as to form a green rose-like body. But as the axis elongates, the leaves become afterwards scattered on the prolonged stem. The roots are eaten in China both raw and cooked.

The other British species of this genus, not described, are *C. latifolia*, great Bell-flower, common in the North; *C. rapunculoides*, very rare; and *C. patula*, frequent in hedges and thickets. For some of the older species see SPECULARIA, P. C. S., and WAHLENBERGIA, P. C. S.

Most of the species of *Campanula* are worth cultivating, on account of their beautiful blue flower. They thrive well in common garden earth, and may be increased by seeds sown in the open border in spring. The perennial species may also be propagated by division of the root. Those species which are indigenous in warmer climates require a little protection during the winter and spring months. The smaller kinds are adapted for rock-work as well as for collections of alpine plants.

(Loudon, *Encyclopædia of Plants;* Koch, *Flora Germanica;* Babington, *Manual of British Botany;* Burnett, *Outlines;* Don, *Gardener's Dictionary.*)

CAMPBELL, REV. JOHN, was born at Edinburgh in March, 1766, and apprenticed to a goldsmith and jeweller in his native city. About 1789, at which time he was actively engaged in measures for the extension of Sunday-schools and itinerant preaching in the neglected districts near Edinburgh, he began to dedicate himself to the Christian ministry. He subsequently visited London, to take charge of twenty-four young natives of Africa, who were brought from Sierra Leone to be instructed in Christianity, with a view to its introduction into their native land; and during this visit he preached at a dissenting chapel at Kingsland, the pulpit of which he was subsequently requested permanently to occupy. He was ordained in 1804, and retained his pastoral charge until his death, on the 4th of April, 1840, at the age of seventy-four. During his long connexion with religious movements in Scotland and England, Campbell took an active part in the formation of the British and Foreign Bible Society, and several other important religious associations; and in 1812 he undertook a journey to the stations of the London Missionary Society in South Africa, from which he returned in 1814, and of which, in the following year, he published an account in an octavo volume. In 1818 he revisited Africa, on the same errand, and found some interesting changes produced by the civilization introduced by the missionaries. The journal of this second visit, from which Campbell returned in 1821, appeared in 1822, in two octavo volumes. He published several other works, chiefly for the instruction of youth, and he was the founder and for eighteen years the editor of the 'Youth's Magazine,' a religious periodical which has long done good service in the work of popular instruction. In 1823 he established one of the first, if not absolutely the first, of the now long list of attractive magazines for children, being a penny monthly periodical entitled the 'Teacher's Offering.' Among his other works for the young were an abridgment of his 'Travels in South Africa,' published by the Religious Tract Society, 'Walks of Usefulness,' 'Worlds Displayed,' and 'African Light thrown on a Selection of Scripture Texts,' to the second edition of which, published at Edinburgh in 1842, a memoir is prefixed, from which, and from a biographical notice in the 'Evangelical Magazine,' for June, 1840, the preceding statements are chiefly derived.

CAMPBELL, THOMAS, was born July 27, 1777, at Glasgow, where his father, who was the youngest son of a Highland laird, Campbell of Kernan, and had then attained the age of sixty-seven, had spent his life as a merchant, but was now out of business. Thomas was the youngest of a family of ten sons and daughters. At the university of his native city, where he was educated, he appears to have distinguished himself rather by his occasional exercises than by his general industry and proficiency. It is related that a translation (into verse, we suppose) of the 'Clouds' of Aristophanes, for which he obtained a prize in the Greek class, was pronounced by the professor, the late learned and eccentric Professor Young, to be the best exercise ever given in by any student of the university. Others of his performances of this date were, several poetical translations from Sophocles, Tyrtaeus, and other Greek writers, some of which are printed among his works. He had left the university some years, and had been for a short space resident in Edinburgh, when he published there, in April, 1799, his 'Pleasures of Hope,' which brought him at once into notice. Few first poems indeed have ever made so great a sensation; and it has continued to retain its popularity, so that Campbell's poetical reputation with most readers will rest principally upon this juvenile work. It is, to be sure, in subject, form, and extent, the work of greatest pretension that he has left us. Yet, with all its imposing declamatory splendour, and the true poetic glow that animates it, it betrays, both in execution and in substance, the raw and unknit mind of youth, and it will probably not be the production on which its author's more enduring fame will stand. It was a poem of extraordinary promise however for a first production, evincing perhaps as much boldness and originality as any other young writer has shown in our more recent literature. Certainly at least it could not be considered as a mere clever imitation of any reigning model or other previous poetry; taken all in all, in its faults as well as in its beauties, its manner and spirit were its own. It is said that the profits he derived from the sale of the 'Pleasures of Hope' enabled Campbell to visit the Continent, which he did in the latter part of the year 1800. He saw part of Germany, and having proceeded to Bavaria, then the seat of war, had a view from a safe distance of the battle of Hohenlinden, fought in December of that year. He was stopped in attempting to pass into Italy, and returned to England by the way of Hamburg. A seventh edition of his 'Pleasures of Hope' appeared in 1802, 'with other poems,' among which were his noble verses on the battle of Hohenlinden; his spirited and stirring song, 'Ye Mariners of England,' written at Hamburg on the prospect of war with Denmark; his 'Exile of Erin,' also written there; and his 'Lochiel's Warning,' which had been written at Edinburgh since his return. After being nearly two years in Edinburgh, he came to London in 1803; and having in the autumn of that year married his cousin, Miss Matilda Sinclair, he appears to have commenced in earnest the pursuit of literature as a profession. Among the works which he produced in the course of the next five or six years, was a compilation, published anonymously at Edinburgh in 1807, in three volumes, 8vo., entitled 'Annals of Great Britain, from the Accession of George III. to the Peace of Amiens.' He also contributed several articles to the Edinburgh Encyclopædia, begun in 1808, under the superintendence of Dr. (now Sir David) Brewster. Meanwhile, in 1806, he had received from the Fox ministry a pension of 200*l.* a-year, which he enjoyed while he lived.

With the exception of a few occasional short pieces, he published no more poetry till his 'Gertrude of Wyoming' appeared in 1809, accompanied in the first edition by 'Lord Ullin's Daughter' and his 'Battle of the Baltic,' perhaps his finest lyric;[*] and in a subsequent edition by his beautiful and passionate tale of 'O'Connor's Child.' 'Gertrude of Wyoming' is written upon the whole in a much purer style than the 'Pleasures of Hope'—though still not without occasional forms of expression having more sound than sense, such for example as the 'transport and security entwine' which Byron has ridiculed. With all his truth and delicacy of taste in the matter of diction, Campbell seldom altogether escapes these hollow conventionalities of phraseology, at least in his quieter passages. The best executed portions of his 'Gertrude of Wyoming,' as of all his poems, are those in which he is carried along by passion, and has less time to waste on words. For many years after this he published nothing except a few occasional short pieces. In 1818 he made a second visit to Germany, and the following year after his return appeared his 'Specimens of the British Poets,' in 7 volumes, 8vo. (reprinted in 1841, in one volume, 8vo., with additional notes by Mr. P. Cunningham). The 'Essay on English Poetry' by which this work is introduced is written in many passages with great beauty and classic eloquence. The year after its publication the author delivered a course of lectures on English Poetry, at the Surrey Institution, where Hazlitt had lectured on the same subject two years before. In 1820 also Campbell undertook the editorship of the New Monthly Magazine, which he retained till 1830. In 1824 he published his 'Theodric, a domestic tale:' it wants the force and fire of some of his other poetry, but is perhaps the sweetest of all his poems. He never wrote anything more touching than the letter of Constance towards the close of this poem. For some years after this he was much occupied by the interest he took in the emancipation of Greece and of Poland, and also in the project of the London University, now University College (which he always claimed the credit of originating). But whatever share Campbell had in originating the idea of a university in London, the execution of the work is due to others. [UNIVERSITY COLLEGE, P. C.] In 1827 he was elected Rector of the University of Glasgow, and he was re-elected to the office in the two following years. He lost his wife, by whom he had one son, who survives him, in 1830; in 1831 he established the Metropolitan Magazine upon relinquishing or losing the editorship of the New Monthly, but retained its management in his own hands only for a short time; and in 1832 he paid a visit to Algiers, an account of which he published in the Metropolitan Magazine in a series of papers, afterwards, in 1837, collected and reprinted in two volumes, 8vo. under the title of 'Letters from the South.' The other publications of his last years, none of which brought him much reputation, were a 'Life of Mrs. Siddons,' 2 vols. 8vo. 1834; a 'Life of Petrarch,' 2 vols. 8vo. 1841; 'Life and Times of Frederick the Great' (of this he professed to be only the editor), 4 vols. 8vo. 1841, and 1843; and the 'Pilgrim of Glencoe,' a poem, 8vo. 1842. In the summer of 1843 he retired to Boulogne; and he died there on the 15th of June, 1844. His body was brought over to England, and interred on the 3rd of July in Westminster Abbey, near the centre of Poet's Corner, close to the tomb of Addison.

(*Gentleman's Magazine* for August, 1844; Chambers's *Cyclopædia of English Literature*, vol. ii. pp. 369, 370; and Campbell's various Works.)

CAMPI, the name of a celebrated family of painters of Cremona. The eldest and master of the others was Giulio Campi; the others were Antonio, Vincenzio, and Bernardino Campi: the first three were the sons of Galeazzo Campi, who died in 1536, the last apparently their cousin. Antonio and Vincenzio were both living in 1591, in which year the latter died: Antonio was painter and architect.

Giulio, according to Lanzi, was the Ludovico, and Bernardino the Annibale, comparing them with the Carracci as a school. Giulio was born about 1500, and died in 1572. He was the scholar of Giulio Romano at Mantua, and contributed greatly to the dissemination of the principles of the Roman school throughout Lombardy, where his works, as well as those of all the Campi, are very numerous. In many instances he has combined the vigour of design of Giulio Romano with the colour of Titian, but his works are in various styles.

Bernardino Campi was born in 1522, and died about 1590. Though instructed by Giulio, he adopted a different style from his cousin, and is generally allowed to have surpassed him. They were both very similar in colour, but in design Bernardino was more chaste than Giulio and less robust. He was also an excellent portrait painter. He was originally a goldsmith, and was induced to adopt painting from seeing two tapestries worked from designs by Raphael, whose simplicity of style he always adhered to. Some of the greatest works in Cremona and Mantua were painted by Bernardino: his masterpieces are the frescoes of the cupola and other works in San Sigismondo at Cremona, which for paintings is one of the richest churches in Italy. Bernardino painted the cupola in seven months. A Nativity in the church of San Domenico is also considered a masterpiece of art, and would do honour to the greatest painters.

---

[*] On the attack on Copenhagen by Nelson in 1801. We have not been able to discover whether this poem appeared now for the first time. The writer (Jeffrey) of the article on 'Gertrude of Wyoming' in the Edinburgh Review (for April 1809), says 'The Battle of the Baltic, though we think it has been printed before, is much less known' (than Lochiel and Hohenlinden).

(Laist, *Notizie Istoriche de' Pittori, &c. Cremonesi*; Lanzi, *Storia Pittorica*, &c.)

CAMPO BASSO. [SANNIO, P. C.]

CANADA. By the treaty signed at Washington, August 9, 1842, the boundary between Canada and the United States has been permanently defined on the east, and on the west as far as the Rocky Mountains. The eastern boundary commences at a point called the Monument, at the source of the river St. Croix, thence north following a line marked in 1816 and 1817 to its intersection with the river St. John and to the middle of the channel of the river; thence to the mouth of the river St. Francis, along its channel and the lakes through which it flows, to the outlet of Lake Pohenagamook, thence south-westerly in a straight line to a point on the north-west branch of the river St. John—which point is to be 10 miles distant from the main branch of the St. John, but if the said point is found to be less than 7 miles from the nearest crest of the highlands which divide the rivers flowing into the St. Lawrence and the St. John, then the said point is to recede down the said north-west branch of the St. John to a point 7 miles from the crest—thence, in a straight line, to where the paraliel of 46° 25′ N. lat. intersects the south-west branch of the St. John; thence southerly to its source at Metjarmette Portage and along the highlands which divide the rivers falling into the St. Lawrence from those falling into the Atlantic to Hall's stream, and down the middle of it, until the line intersects the old line of boundary surveyed previously to the year 1774 at the 45th degree of N. lat., and thence west along this line to the St. Lawrence.

The western boundary is altered at the entrance to Lake Superior so as to transfer to the United States the island of St. George, or Sugar Island. The line is then carried through Lake Superior north of Ile Royale, then south-west to Pigeon river, along it and Lakes Saisaginega, Cypress, Bois Blanc, La Croix, Little Vermillion, Namecan, and La Pluie to Chaudière Falls, thence to the north-western point of the Lake of the Woods (49° 22′ 55″ N. lat. and 95° 14′ 38″ W. long.), thence due south to its intersection with the 49th parallel of lat. and along that parallel to the Rocky Mountains.

These lines were defined to settle differences which had arisen on the construction of the treaty made between Great Britain and the United States in the year 1783. Previous to this treaty the extent of Canada to the west was much more considerable than at present—extending as far south as the source of the Mississippi (47° 10′ N. lat.), and from the source of this river west to the Rocky Mountains. According to the French official map, made in 1757, and used in the negotiations of 1762, it included all the country not then defined as part of the province of Louisiana.

Since the article in the P. C. was written some magnificent works connected with the navigation of the St. Lawrence have been undertaken. The first of these is the enlargement of the Welland Canal, uniting Lakes Erie and Ontario on the north of the Niagara river. The new locks are 26½ feet wide, 8½ feet in depth, and 145 feet long. The canal itself is 45 feet wide at the bottom, and 10 feet deep. The estimated cost of the improvements is 405,900*l.*, and they are expected to be completed in the present year (1845). The canals uniting Lake Ontario with the great ports of the province are the Cornwall, the Beauharnois, and Lachine. These canals give 10 feet depth of water, with a width of 80 feet at the bottom, and the locks are 45 feet wide, 200 feet long, and give 9 feet depth of water. The Cornwall canal is 11½ miles long with a fall of 48 feet, and avoids the most violent rapids of the St. Lawrence. The Beauharnois canal is not yet complete. It is situated on the south side of the river; the length is about 12 miles, and the estimate of its cost is 248,976*l.* It unites the Lakes St. Francis and St. Louis, the navigation between which is checked by the cascades, and will, in connection with the Cornwall canal, enable boats to avoid the necessity which now exists of going along the Rideau canal—a work which will lose much of its usefulness for commercial purposes. The enlargement of the Lachine canal, at an estimated cost of 208,636*l.*, is expected to be completed in 1846. It ought originally to have been carried from Lachine, on the north side of Lake St. Louis, to the most eastern part of the city of Montreal, and to have entered the St. Lawrence below the island of St. Helene. It would thus have afforded winter docks for vessels at Montreal, and have saved the trade the expenses of steamers to bring vessels up the rapids at the north-east end of St. Helene's island.

The Chambly canal, which unites the lake of Champlain with the Richelieu river, and by this river with the St. Lawrence, is completed.

The tenure of land in the Seignoral districts of Lower Canada, that is, with two exceptions, of lands granted by the crown of France, is remarkable, and as a system of colonization deserves notice. A tract of land, varying in extent —but sometimes large, as in the case of the seignory of Beauharnois, which is six square leagues—was granted to a seignor, or lord of a manor, to re-grant to others at a certain fixed rent (*cens*). The seignor held of the crown upon the accustomed rents and dues, according to the custom of Paris: he had a local legal jurisdiction, which is now abolished; he performed homage on a mutation of possession; he was to reside by the express condition of some grants (*tenir feu et lieu*); certain timber was to be reserved for public purposes; he was to make roads; and he had the privilege of trading with the Indians. On alienation by the seignor, the fifth part of the purchase-money (*quint*) was paid to the crown. He was bound to make grants of the waste lands to applicants at the accustomed rent, and he was forbidden to sell such land to them. He had the right to enforce mill-service (*droit de banalité*), or the grinding of corn at his mill; and the right of pre-emption (*droit de retrait*) of lands offered for sale by persons within the seignory.

Any settler, not already possessed of land, was entitled to demand of right, from the seignor, a grant of waste land, usually of about 90 acres, at the accustomed rent, commonly a *sol* or penny an acre—a rent of the nature of our chief rent in free and common socage manors; the grantee was personally to occupy his land under the penalty of its re-union to the domain; he was to clear the land; to make and repair roads; to preserve certain timber for the crown; to give notice of minerals; and on alienation one-twelfth of the purchase-money (*lods et ventes*) was to be paid to the seignor.

The system had many advantages. The settler had no more land than his means enabled him to cultivate; what he received he was to cultivate; he was to reside; he was not required to apply any part of his previously accumulated gains in the purchase of his land, and the whole of his capital was free to be employed in agriculture. As his family increased, his children were enabled to apply for new grants, and to extend the settlement of the country.

Upon the establishment of the English authority in Canada, the enforcement of the law against the tenants continued, but was neglected by the crown against the seignors. The mill-service has been abused by conditions of grants that no mill of any kind shall be erected by the tenant—a condition beyond the authority of the seignor to impose, and as a general condition perhaps void, as being opposed to public policy. The right of pre-emption, which was formerly perhaps beneficial in checking excessive land speculation, has been used to gratify personal animosity. The accustomed rent has been increased, as though it was a farm rent, and this has also been done to evade the penalty of forfeiture imposed on the seignor in case he sold the land for a fixed sum—a proceeding which induced the commissioners who lately reported on the subject, to observe that 'they could recognise no difference between demanding for a concession a sum of money in the nature of a price, and the stipulation of that price in the shape of a rent-charge'—'in both instances there would be a violation by the seignor of the original conditions of his grant.'

The abuses of the system have occasioned many complaints in the province, connected also with a strong feeling in favour of the commutation of the fines payable on alienation. But instead of submitting the subject to the Provincial Legislature, which was perfectly competent to deal with it, the government passed the imperial act of the 6 Geo. IV. c. 59, called 'the Canada Tenures Act,' which has placed matters in a worse state than before. Instead of enforcing on the seignors the duty to make grants, which many refused to do;

placing the rent in a uniform state, and checking the abuses of the seignors; this act enables the seignors to pay the fifth (*quint*) to the crown, and on so doing the tenure of the land is commuted into free and common socage; the waste lands, which they only held on trust for public purposes, become private property; and the tenants, whose grievances were alleged to justify this measure, are left more completely at the mercy of the seignors than before, and no conditions are imposed on the seignors to afford to them any relief. 'It has been asserted,' say the Commissioners, 'by persons from various sections of the district of Montreal, that the feudal exactions and the neglect of the government to enforce the antient laws of the Province in relation to the tenure, conduced in no small degree to the outbreaks in 1837 and 1838.' Had the system been amended and enforced, it would have been found to have been infinitely preferable to making large grants to land-companies—for even under its imperfect working, the French settlements of Lower Canada present a remarkable spectacle of successful colonization, though checked by circumstances which have seriously interfered with the activity and energy of the population.

There are 223 seignories in Lower Canada. They are almost inclosed by the townships, or lands held in free and common socage. It would probably have been most prudent to have granted all lands in Lower Canada on the tenure of *franc alleu*, not unlike our socage tenure. All persons would then have had a common interest in the amendment of the law, and the marked distinction between French and English tenures, which has a most mischievous political effect, would have been avoided; while the extension of the French population to the American frontier, whose attachment to the English government is greater than to any republican institutions, would have created a community of interest between them and all other settlers in Lower Canada favourable to the English government.

In Upper Canada the land is held upon the tenure of free and common socage. The system of land-holding is defective in not being connected with a general land-tax on all waste lands not in the possession of the crown. The surveyors' note books and surveys ought also to be as generally accessible as similar documents are in the United States, to every person desirous to obtain information of any land proposed to be sold by the government. (*Report of the Commissioners on the Seignoral Tenure of Lower Canada.* 1844.)

The sketch of the political history of Canada was brought down in the P. C. to the year 1836, when Sir F. Head, who had been appointed lieutenant-governor of Upper Canada in December, 1835, was in the province; and Lord Gosford was governor of British North America. At that time there were associated with the latter, as commissioners, to inquire into the affairs of the province, Sir C. Grey, a retired Indian judge, and Sir G. Gipps, an officer of engineers. The events since this period have produced a great change in the government of the province. The amicable feelings which at first prevailed between the assembly of Lower Canada and Lord Gosford were interrupted by the unexpected disclosure made, during the sitting of parliament, by Sir F. Head, of the instructions given by the British government to Lord Gosford, which were considered to indicate a want of good faith in the mission with which he was charged. The supplies were consequently refused. But in the same session the House of Assembly sat 109 days—117 bills were introduced; 58 were passed; 34 were passed by the Assembly and rejected by the Legislative Council; 15 were passed and returned with amendments by the council; 10 were introduced into the assembly and not passed; 5 were received from the council and not passed, and one was reserved for the sanction of the home government;—62 reports were made by standing committees, and 104 reports were made by special committees. Of these measures not one has been specified as injurious to British interests. The refusal of supplies, the demand for a reform of the Legislative Council, the opposition to a wasteful grant of public lands, and the endeavour to secure the responsibility of the members of the administration to the house, were the acts for which the assembly has been condemned. The house was composed of 88 members, of whom the government had only the support of about 8; and this was the original fault of the system. A representative government existed, and the country was governed as a Crown colony, the members of the administration having rarely been taken from the house and never from the party composing the majority.

It is important to remark, that on August 20, 1836, the Hon. Mr. Baldwin, in a letter to Lord Stanley, proposed the establishment in Canada, of a provincial cabinet, 'composed of persons possessed of public confidence, and whose opinions and policy should be in harmony with that of the representative body.' He stated that in Upper Canada, from 1824 to 1836, the provincial administration had been in a minority for eight years and in three parliaments. The radical evil in the administration of the two provinces was the same.

On the publication in England of the report of the commissioners sent to Lower Canada, Lord J. Russell introduced in parliament ten resolutions. The 1st stated that supplies amounting to 142,160*l.* had been refused in Lower Canada between the years 1832 and 1837; 2nd, that in October, 1836, the governor had applied to the assembly for the arrears and for funds necessary to carry on the civil government of the province; 3rd, that the House of Assembly, on the 3rd of October, 1836, had refused the supplies and required an elective legislative council; the repeal of the North American Land Company Act; and the free exercise of its control over all branches of the executive government; 4th, that in the 'existing state' of Lower Canada, it was unadvisable to make the council elective, but that measures should be adopted to secure to it a greater degree of public confidence; 5th, that while it was expedient to improve the composition of the executive council in Lower Canada, it was unadvisable to subject it to the responsibility demanded by the House of Assembly; 6th, that the title of land holden by the North American Land Company ought to be maintained inviolate; 7th, that it was expedient, when lands in Lower Canada shall be discharged from feudal dues and services, to repeal the 'Canada Tenures Act;' 8th, that for discharging arrears, the receiver-general of the province should be empowered to issue the amount from the revenues in his hands; 9th, that the hereditary, territorial, and casual revenues of the province should be placed at the disposal of the legislature when a civil list shall have been granted; 10th, that the legislatures of Lower and Upper Canada should be respectively authorized to make provision for the joint regulation and adjustment of questions relating to trade and commerce.

These resolutions were carried by a large majority, and virtually deprived the Assembly of the only control which existed in the province over the acts of the administration. Great discontent was produced when they were announced in Canada; public meetings were held, violent resolutions were passed, but not a single step was taken by the government to secure peace or to prevent the occurrence of violence. The legislature of Lower Canada was again convoked on the 18th of August, 1837, when the resolutions passed in the British parliament were communicated; but the assembly adhered to its demands, the propriety of which it considered the resolutions themselves to have confirmed, and a prorogation took place. Matters were brought to an issue by the arrest of two popular leaders, who were rescued. Warrants were issued for the arrest of others; the peasantry in the districts of Chambly and of Grand Brulé rose in arms, and were defeated by the military. The issue was not doubtful, but the horrors of a civil war were witnessed. At St. Eustache, Sir J. Colborne had no influence over the militia who accompanied him, and houses were burnt and people pillaged after they had submitted, and in opposition to his orders. About the same time an insurrection occurred in Upper Canada, where considerable exasperation prevailed against the government. It was also suppressed. The military force in both sections of the province being small, and the absence of previous precautions having weakened the authority of the administration, martial law was proclaimed.

Lord Gosford was recalled from Lower Canada, and Sir J. Colborne became Administrator. Sir F. Head was recalled from Upper Canada, and was succeeded by Sir G. Arthur. On January 16, 1838, the Earl of Durham was appointed governor of Canada and high commissioner for the adjustment of Canadian affairs. On the 10th of February the Act of the 1 Vict. c. 9, was passed, suspending the legislature of Lower Canada, and empowering the appointment of a special council. Lord Durham arrived in Canada May 27, and on June 28, 1838, passed an ordinance, by which it was enacted that if twenty-six persons, among whom was the ex-speaker of the assembly, Mr. Papineau, should any of them ever again come into the province, they should suffer death 'if convicted of being found at large or coming into the province.' Other persons were also transported to Bermuda, a place beyond the jurisdiction of the government of Canada. This ordinance was disallowed by the Crown, and, in consequence of umbrage taken by Lord Durham at this step, and the Act to indemnify him, he threw up his office and returned to England without leave. A report was however made by him on the affairs of Canada, in which it was advised that the two provinces should be united, and that the responsibility of members of the executive to the House of Assembly should be recognised by connecting the administration with the majority of the house. Another disturbance in Canada shortly afterwards occurred, and the constitution of Lower Canada was further suspended by another act of parliament. On the 23rd of July, 1840, the Act of the 3 & 4 Vict. c. 35, for the re-union of the provinces, was passed. It authorises the appointment of a legislative council by the Crown of not fewer than twenty members; and enacts, that the two provinces shall return an equal number of representatives to the House of Assembly (at present 42 each); that the city of Toronto shall return two members, and the towns of Kingston, Brockville, Hamilton, Cornwall, Niagara, London, and Bytown, in North Canada, one each; that the cities of Quebec and Montreal shall return each two members, and the towns of Three Rivers and Sherbrook, one each; that the members of the House of Assembly shall be elected for four years; that all writs, proclamations, journals, &c. of the council and assembly shall be in the English language only; that the entire duties and revenues of the province shall form one consolidated fund, and the sum of 75,000*l.* is specifically appropriated for the civil government of the province. The act was brought into operation during the administration of Mr. Poulett Thomson, who was created Lord Sydenham. Many of his measures have been severely condemned, but his true merit was, that he acted with the majority of the assembly, though that majority for the time was secured by some unpardonable proceedings at the elections; and that, for the first time, the House of Assembly was directly connected with the actual government of the country, and with its administration. The House of Assembly also passed, with his assent, the responsible government resolutions, for the permanent establishment of this system. When the land companies desired to interfere in the direction of the public works, Lord Sydenham replied, that 'the local government and the legislature were more intimately acquainted with and interested in the works in question than any set of gentlemen in London,' and he acted as if convinced that the province must be governed through the aid of the representative body and local opinion.

On the death of Lord Sydenham, Sir C. Bagot was appointed to succeed him. He associated to his administration some of the leading French Canadians, who had been unwisely excluded from office. This step had the happiest result, and party seemed banished from the province. He is said to have given his ministry too much power, but no act has been cited to sustain the statement, and he governed in a spirit of truth, honour, justice, and legality. Sir C. Bagot was attacked by a fatal illness, and was superseded by Sir C. Metcalfe, the present governor, in 1843. The ministers then in office have since resigned, and the first parliament of the United Province was dissolved in consequence. They claimed to be consulted on all public appointments, as responsible to the Assembly for the conduct of public business. It does not appear that any appointment which they proposed to make was objectionable. An assertion of an uncontrolled prerogative on this question of patronage has been made by the governor, and it is identically the same with that which was contested in this country during Lord Bute's administration. The new ministry, which is chiefly composed of members of the old official party, appears to have very nearly equal members, in the new parliament, with the parliamentary or responsible government party; but their real position is at present undetermined in consequence of many petitions on contested elections remaining to be heard.

It is inexplicable that the Colonial Office should have hesitated to act with cordiality and openness with the responsible members of the local administration. They are jointly interested in the government of the province, and the dispensation of public patronage by the local administration is both a necessary sign of confidence and an element of political strength. A weak executive can possess little power for any beneficial purposes.

The last parliament restored the ancient boundaries of the cities of Quebec and Montreal, which had been limited by Lord Sydenham, and it petitioned the Crown against the civil list of the Union Act. The new parliament has already petitioned the Crown against the clause of the Union Act restricting the use of the French language.

The total expenses paid by this country on account of the army, navy, ordnance, and commissariat in Canada in 1837. was 189,048*l.* The total excess of expenditure, above this amount, from the year 1837 to 1843, in consequence of the insurrection, has been 4,909,017*l.* The expenditure for these services in 1843 was 806,007*l.*

The population of the counties of Lower Canada in 1831 and 1843 was as follows:—

Counties.	1831.	1843.
Saguenay	8,385	13,445
Montmorency . . .	8.089	8,434
Quebec	36,173	45,676
Portneuf	13,656	15,922
Champlain . . .	6,991	10,404
St. Maurice . . .	16,906	20,591
Bertier	20,225	26,705
Leinster	22,122	25,307
Terrebone . . .	16,623	20,646
Two Mountains . .	20,905	26,835
Ottawa	4,786	11,340
Montreal	43,773	64,306
Vaudreuil . . .	13,111	16,616
Beauharnois . . .	16,859	28,580
Huntingdon . . .	29,916	36,204
Rouville	18,185	21,198
Chambly	15,483	17,171
Vercheres. . . .	12,819	12,968
Richelieu	16,146	20,983
St. Hyacinthe . . .	13,365	21,734
Shefford	5,087	9,996
Missisquoi . . .	8,801	10,865
Stanstead	10,306	11,846
Sherbrooke . . .	7,103	13,302
Drummond . . .	3,566	9,374
Jamaska	9,496	11,645
Nicolet	12,509	16,280
Lotbiniere . . .	9,191	13,617
Megantic	2,283	6,730
Dorchester . . .	23,816	84,826
Bellechase . . .	13,529	14,549
L'Islet	13,508	16,990
Ramouraska . . .	14,557	17,465
Rimouski	10,061	17,577
Gaspé	5,003	7,458
Bonaventure . . .	8,109	8,230

Total, 1831, 511,912; 1843, 678,590, or increase 166,671.

The county of Leinster includes those of L'Assomption and Lachenaie; that of Huntingdon, those of L'Acadie and Laprairie; that of Dorchester, those of Dorchester and Beauce; and that of Montmorency, those of Montmorency and Orleans, which counties were distinct in 1831.

The population of the city of Montreal in 1843 was 40,137.

The population of Upper Canada in 1841 was as follows:—

Ottawa . .	9,324	Toronto (city) .	14,249
Eastern . .	30,279	Niagara . .	34,521
Johnstown . .	35,952	Gore . . .	42,577
Bathurst . .	27,635	Wellington . .	13,851
Prince Edward .	14,661	Brock . . .	15,621
Midland . .	32,208	Talbot . . .	9,626
Victoria . .	13,161	London . .	32,257
Newcastle . .	41,952	Western . .	23,026
Home . . .	64,401		

Total in 1841, 455,301; in 1831, 321,903; increase, 133,398.

Total population of the whole province 1,133,891. The population of the town of Kingston in 1841 was 6292; Hamilton, 3413; and of Cornwall, 1407.

The total number of emigrants who arrived in the province, at Quebec, from 1832 to 1841 both inclusive, was 227,608, most of whom must have gone elsewhere.

The number of emigrants who arrived at Quebec in the following years was:—

Where from.	1836.	1837.	1838.	1839.	1840.
England and Wales	12,188	5,580	990	1589	4,567
Ireland . .	12,590	14,538	1456	5113	16,291
Scotland . .	2,224	1,509	547	485	1,144
Nova Scotia, &c. .	720	274	273	255	232
	27,722	21,901	3266	7439	22,234

In 1841, 28,086; in 1842, 44,374; in 1843, 21,727; and in 1844, 20,142. Total in 9 years, 196,891. The number of emigrants from the United Kingdom who arrived at ports of the United States in part of the above period was:—

1836	53,075	1840	41,500
1837	34,000	1841	45,017
1838	13,059	1842	63,852
1839	24,376	1843	28,335

Total, 309,214.

The arrival of shipping at Quebec in the following years was:—

	Ships.	Tons.
1842	863	307,448
1843	1185	429,741
1844	1214	458,971

The public provision for education in Upper Canada is very limited, and in no part of North America is education so little regarded. That part of the public lands which ought to have been appropriated to educational purposes has been otherwise applied. In Lower Canada Lord Goderich, by a dispatch of July 7, 1831, consented to yield to the claim of the assembly, and to place the revenues of the estates of the Jesuits at the disposal of the provincial legislature, for the support of education in Lower Canada. The chief part of these estates consists of five seignories at Quebec, one at Montreal, and two at Three Rivers. Their revenue in 1841 was 4566*l.*, and a sum of 29,592*l.* on the same account was, in 1844, in the provincial chest, without interest. The funds have been, at various times, grossly misapplied, though probably there is nothing which the Lower Canadians more anxiously hope for than their application to the noble purposes to which they were originally devoted, in a manner that shall give distinction and honour to Lower Canada. The old college of the Jesuits, part of the estates at Quebec, is at present occupied as barracks.

In 1842, in Lower Canada, 44,703 acres of land were sold, at an average of 3*s.* 2*d.* per acre for crown lands, and 4*s.* 6*d.* per acre for clergy reserves, both being waste lands, and the revenue of the one forming part of the public income, and that of the other being specially appropriated. In Upper Canada 23,621 acres were sold, at an average of 9*s.* an acre for crown lands, and 11*s.* 3*d.* for clergy reserves. In Upper Canada the practice of extensive leasing has been introduced in order to favour colonization, but the experience of a similar attempt in the early settlement of the old colonies of America, and the great amount of arrears in all cases of leasing crown lands in Canada, prove its inexpediency, and the political evils it may occasion. The rents of leased clergy reserves in 1842 in Upper Canada were 4996*l.*; but of this sum only 1108*l.* had been collected. 'Experience,' Sir C. Bagot stated, 'had proved the inefficiency of past efforts to collect them, and that irritation and ill-will were sure to follow the adoption of extreme legal measures by the government.'

In 1841 there passed the Welland and Lachine canals these quantities of goods:

	Welland.	Lachine.
Of the Forest	66,923	46,614
Agriculture	77,659	89,989
Merchandise and manufactures .	4,540	20,351
Miscellaneous . . .	23,841	13,640
Tons .	172,964	172,564

The miscellaneous articles consisted of salt, plaster, coals, bricks, stone, &c.; but a very considerable quantity of timber passes to Montreal and Quebec without entering the Lachine canal.

The tolls received on the Welland canal were, in 1835, 5807*l.*; 1841, 22,210*l.*; 1843, 24,906*l.* The tolls on the Lachine canal were, 1827, 3051*l.*; 1833, 7154*l.*; 1842, 14,131*l.*; 1843, 16,159*l.* On the Chambly canal in 1843, 7322*l.* On the Burlington Bay canal in 1842, 1918*l.*

The gross amount of customs' duties received in 1843-44 was 241,572*l.*, and the amounts received at the following places will show the chief places of trade; Quebec, 55,843*l.*; Montreal, 102,482*l.*; Toronto, 17,603*l.*; Kingston, 9278*l.*; Hamilton, 12,191*l.*; St. John's, 22,350*l.*

Previous to the Union, the province of Lower Canada had only a small debt of about 30,000*l.* In Upper Canada, in 1839, Sir G. Arthur stated the debt to be 1,162,187*l.*—the interest 65,000*l*; the permanent expenses of the government, 55,000*l.*; and the revenue 78,000*l.*, leaving a deficiency of 42,000*l.* In January, 1844, the debt incurred previous to the Union amounted to 1,559,431*l.*, and the new debt to 781,125*l.*; total 2,340,556*l.* The net revenue of the province at the same date was 320,987*l.*, which, with a previous balance of 79,347*l.*, gave the total receipts for the year at 400,335*l.*, and a balance over expenditure of 115,505*l.*

By a late alteration of duties, foreign wheat imported into Canada is taxed under a provincial act at 3*s.* per quarter, and wheat and flour exported from Canada may be imported into Great Britain at a duty of 1*s.* per quarter.

(*Parliamentary Papers from* 1836 *to* 1845.)

CANARIA, or Gran Canaria, is an island of the Canary group, to which it has given its name. It is situated between 27° 45′ and 28° 15′ N. lat., and between 15° 25′ and 15° 45′ W. long. It is nearly circular, and about twenty-four miles in diameter, or seventy-five in circumference. This island, like the other Canaries, is of volcanic origin, consisting of trachyte, basalt, and more recent volcanic productions. The surface is extremely uneven, and the rocks rise in general with a steep acclivity. The most elevated point is near the southern coast, and is called Pico del Pozo de las Nievas The German naturalist Von Buch determined its elevation above the sea by the barometer, and found it to be 6226 English feet; but Lieutenant Arlett found it to be 6648 feet. Nearly in the centre of the island is the Roque de Saucillo, according to Von Buch 5656 feet, and according to Lieutenant Arlett 6070 feet, above the sea-level. The valleys between these volcanic masses are not of great width, but very fertile, which is always the case where the soil is formed by decomposition of volcanic matter. In climate the Canaria resembles the island of Teneriffe. Canaria has more anchorages than any other of the Canaries. The bank on which it rests generally extends to a greater distance from the shore. During the summer, when there is a constant north-east wind, the high land, by obstructing its course, occasions calms to prevail off the south-west end of the island to the distance of eight or nine miles from the land, where the divided currents again unite. The same cause however gives rise to a westerly current close in shore, which the coasting vessels turn to account. The productions of this island do not differ from those of Teneriffe [P. C., vol. xxiv. p. 204], except that there are no camels on Canaria. The capital, Las Palmas, is built on a bay of moderate extent, which has tolerable anchorage. It is the largest town in the Canaries, having a population of 18,000 individuals. It is well built, and has a cathedral, hospital, and college, with convents of monks and nuns. It is well supplied with water, having fountains in all the streets or principal squares. The market is well supplied with every kind of provisions, especially of fruit. It carries on a considerable commerce with England and America, and sends a few small vessels to the fishery on the western shores of the Sahara. Canaria was taken by the Spaniards in 1483, and has since remained in their possession.

(Glas, *History and Conquest of the Canary Islands*; Von Buch, *Physikaliske Beschreibung der Canarischen Inseln*; *Die Canarischen Inseln nach ihrem gegenwärtigen Zustande*, von Mac Gregor; and Arlett's *Survey of the Canary Islands*, in *London Geogr. Journal*, vol. vi.)

CANCELLIERI, FRANCESCO, born at Rome in 1751, after studying in the Roman college under the Jesuit professors Cunich, Cordara, and Zaccaria, became secretary to the senator Rezzonico, and afterwards librarian to the learned Cardinal Antonelli, Prefect of the Propaganda. In 1773 he edited a newly discovered fragment of the 91st book of Livy, with a preface. On the occasion of the new sacristy added by Pius VI. to the Basilica of the Vatican, Cancellieri undertook a work of historical and liturgical erudition on the antient office of Secretary of that Basilica, 'De Secretariis Basilicæ Vaticanæ,' 4 vols. 4to., Rome, 1788, which contains an ample store of information concerning the Basilica, its early history, its vaults, its library, its former monastery, the circuses of Caligula and Nero, with illustrations of numerous monuments and documents. This work was received with great applause by the learned, and the author was placed among the first writers on church antiquities. He afterwards published a 'Descrizione del Carcere Tulliano,' a notice on the statues of Pasquino and Marforio, as well as various treatises on the ceremonies which are performed in St. Peter's church and in the pontifical chapel of the Vatican on great festival days; he explained the origin and meaning of the various ceremonies, most of which appear to the uninformed spectator as unmeaning pageants and mummeries; but are really not so: 'Descrizione dei tre Pontificali che si celebrano nella Basilica Vaticana per le Feste di Natale, di Pasqua, e di S. Pietro;' 'Descrizione delle Funzioni che si celebrano nella Cappella Pontificia per la Settimana santa;' 'Notizie intorno la Novena. Vigilia, Notte, e Festa di Natale;' 'Descrizione delle Cappelle Pontificie e Cardinalizie di tutto l'Anno;' 'Storia dei solenn. Possessi de' sommi Pontefici da Leone III. à Pio VII.;' 'Memorie storiche delle sacre Feste dei SS. Apostoli Pietro e Paolo, e della loro solenne Ricognizione nella Basilica Lateranense fatta da Pio VII.;' 'Descrizione della doppia Illuminazione della Cupola di S. Pietro a Lanternoni e Fiaccole, e della Girandola della Mole Adriana.' Most of these treatises have been translated into French.

When the French revolutionists drove away Pius VI. from Rome, in February, 1798, Cancellieri was separated from his patron Cardinal Antonelli, who was arrested and sent to Civitavecchia. Some years after, when Pius VII. took possession of Rome, Cancellieri was appointed director of the printing-press of the Propaganda. In 1804 he accompanied Cardinal Antonelli to Paris, on the occasion of Napoleon's coronation. He kept a diary of that journey, from which many entertaining extracts are found in Baraldi's Life of Cancellieri. When the French invaded Rome a second time, in 1808, Cardinal Antonelli was banished to Sinigaglia, where he died in 1811. At the restoration of Pius VII. Cancellieri was reinstated in his office. He continued to write works of antiquarian erudition until 1826, when he died at Rome. The year before, he had at his own expense raised a handsome cenotaph with a biographical inscription to his patron Cardinal Antonelli, in the Basilica of the Lateran, below which he desired by will to have himself buried. He published an account of this monument: 'Cenotaphium Leonardi Antonelli,' Pesaro, 1825. Pietro Visconti wrote the eulogy of Cancellieri for the Tiberine Academy. The Marquis Villarosa wrote on the same subject, 'Ultimi Uffizii alla Memoria dell' Abate Francesco Cancellieri,' Naples, 1827. Among the printed works of Cancellieri, which exceed 160 in number, the following, besides those already mentioned, are deserving of notice: 1, 'Il Mercato, il Lago dell' Acqua Vergine, il Palazzo Panfiliano nel Circo Agonale,' &c., 4to., Rome, 1811. This is an erudite description of a most interesting district of the city of Rome. 2, 'Dissertazione intorno agli Uomini dotati di gran Memoria, e a quelli divenuti Smemorati,' 1815; 3, 'Descrizione dell' Uso di rappresentare la Befana nell' Epifania.' This refers to one of the popular customs of Rome. 4, 'Notizie sopra l' Origine e l' Uso dell' Anello pescatorio e degli altri Anelli ecclesiastici,' 1823; 5, Memorie della Vita ed Opere del Pittore Errante,' 1824; 6, 'Notizie delle Stagioni e de' Siti diversi in cui sono stati tenuti i Conclavi nella Città di Roma,' 1823; 7, 'Lettera sopra l' Origine delle Parole Dominus e Domnus, e del Titolo di Don,' Rome, 1808; 8, 'Dissertazioni epistolari sopra Cristoforo Colombo e Giovanni Gerson,' 1809; 9, 'Elogio del Cardinale Stefano Borgia,' 1809; 10, 'Elenchus Librorum qui omnigenis Formis impressi prodierunt e Propaganda,' 1817. Many of his minor works have appeared in the 'Effemeridi Letterarie,' 'Notizie del Giorno,' 'Giornale Arcadico,' and other journals. There is a list of his inedited works, amounting to eighty.

(Tipaldo, *Biografia degli Italiani Illustri.*)

CANDLES AND LAMPS. [LIGHTS, ARTIFICIAL, P. C. S.]

CANDOLLE, DE. [DE CANDOLLE, P. C. S.]

CANKER-BRAND. [UREDO, P. C.]

CANNA, a genus of plants belonging to the natural order Marantaceæ. It has spathaceous flowers, simple anthers attached to the edge of a petal-like filament, an inferior ovary, thick club-shaped erect free style, a linear obtuse stigma. There are several species of this genus, all of which are known by the name of Indian Shot. They are inhabitants of South America and of the East Indies.

C. Indica has the inner limb of the corolla trifid, the segments lanceolate, acuminate, straight. This species, with *C. patens* and *C. coccinea*, are common plants within the tropics on all the continents. In America and Brazil they are known by the common name of wild plantains. Their leaves are large and tough, and are mostly chosen for forming envelopes for articles of commerce. Hence the French call these plants *Balisiers*. The seeds of most of the species are round, black, shining, hard, heavy, and about the sixteenth of an inch in diameter, resembling shot, for which they are sometimes used as a substitute.

C. edulis has smooth leaves and stems coloured at the base, the roots tuberous and large, the middle segment of the corolla very short. This is one of the species of the order the rootstock of which is used for making arrowroot. Nearly all the species contain starch in the rootstock, which renders them fit to be used as food after being cooked. The starch is separated by tearing the rootstock in pieces, and submitting it to the action of water. The water with the starch suspended is poured off from the ligneous portion of the rootstock, and the starch is afterwards allowed to subside. Clusius says that the *C. lutea* grows in the open air in Spain and Portugal, and that the inhabitants of those countries use the seeds for making rosaries.

Many of the species will bear the open air in the summer in this country. They require a light rich soil, and may be increased by dividing the roots or by sowing the seed. They should be planted out in a warm border early in the summer.

(Loudon, *Encyclopædia of Plants.*)

CA'NO, ALONSO, a very celebrated Spanish painter, sculptor, and architect, was born at Granada, in 1601. He was educated in Seville, whither his father, an architect, had removed; and he studied sculpture there, under J. Montanes, and painting under Pacheco and Juan de Castillo, all men of celebrity; but Cano's true masters in design were some antient statues in the Casa de Pilatos, belonging to the Duke of Alcalà. Cano is called the Michelangelo of Spain; in some respects they were similar, but the similarity is more in the extent of their abilities than in the quality. Cano, as did also Michelangelo, obtained his reputation first by sculpture, and as early as 1639, he had earned such celebrity, that he was appointed painter to King Philip IV. of Spain, and had the superintendence of various architectural works in the royal palaces of Madrid and in the city. After various adventures in the principal cities of the south of Spain, Cano died at Granada, in 1667, leaving a numerous school, but he had not a single scholar who approached him in ability. His works, which are conspicuous for vigour of design, richness of colour, and boldness of execution, are very numerous; there are many at Seville, Xeres, Cordova, Madrid, the Escurial, Toledo, Alcalà de Henares, Cuenca, Avila, Valencia, Murcia, Malaga, and Granada, where, in the church of San Diego, a Conception of the Virgin with angels is considered his masterpiece.

Cano was of a singular disposition and of a violent temper, which on more than one occasion placed him in great danger of the Inquisition. He was accused of having assassinated his wife out of jealousy; but the charge rests solely upon the testimony of Palomino, who wrote many years after the event which gave rise to the rumour. Cean Bermudez sought in vain for a record of any process against him. The story is, that at Madrid, in 1643, when he returned home one evening, he found his wife assassinated, his house robbed, and an Italian assistant who used to live with him had absconded; but notwithstanding the presumptive evidence against the Italian, Cano was himself accused of the murder, and was put to the rack; no confession however being elicited from him, he was released and absolved of the charge. Upon his plea of *excellens in arte*, his right arm had been exempted from the torture. Several years after, in 1658, when he was in Granada, a councillor of that city commissioned him to make a small figure of Saint Antony of Padua; for which, when finished, Cano asked 100 pistoles. The councillor, reckoning up the time that Cano had been about the work, said, 'Why, you have been 25 days only, over this figure, and you are charging me four pistoles per day for your work, an exorbitant rate; for I, who am a councillor, do not receive half so much.' Upon which Cano, greatly incensed at his misplaced arithmetic, furiously answered, 'I have been 50 years learning to make this figure in 25 days;' and immediately dashed the saint to pieces on the pavement, to the great consternation and horror of the simple councillor, who made all haste out of the house of a man who could so unceremoniously demolish a saint. The act was in fact a capital offence; but it appears to have been unknown to the Inquisition. A similar destruction of an image of the Virgin caused the death of Torrigiano, who was convicted of heresy, and died in prison, before his sentence was carried into effect. Cano is said also on his death-bed to have refused to take the crucifix presented to him by the priest, on account of its bad workmanship.

(Palomino, *Museo Pictorico*, &c.; Cumberland, *Anecdotes of eminent Painters in Spain;* Cean Bermudez, *Diccionario Historico*, &c.)

CANO'NICA, LUIGI, one of the most eminent of Cagnola's contemporaries [CAGNOLA, P. C. S.], executed many public and private buildings at Milan. Among his principal works, that which is the most noted and the most remarkable for its purpose and character, is the so-called Arena, or Amphitheatre, which, in regard to mere extent of plan, more than rivals the Colosseum at Rome, being an ellipsis of about 800 by 400 feet; but it is comparatively a mere spacious enclosure, surrounded by not more than eight rows of gradini, or seats, rising no higher than twenty feet from the ground. The principal entrance is at one extremity; and on one side in the centre of the longer axis, is an elevated pulvinare, or loggia, intended for the viceroy, and adorned with eight Corinthian columns of red granite. This singular edifice was begun in 1805, by order of Napoleon, who then sought to propitiate his Milanese subjects by embellishing their capital.

Canonica was employed on several other buildings at Milan, but the fame of the beautiful Palazzo Bellotti cannot be claimed for him, although it has been attributed to him. His chief works there are the Palazzo Orsini (the interior), the Casa Canonica, and the two theatres, Ré and Carcano. He also built three other theatres, at Brescia, Mantua, and Parma, or rather, the last was only executed from his designs, by Bettoli. Canonica died at Milan, in February, 1844, at the age of eighty-two, leaving a considerable fortune, and making several munificent bequests, one of them the sum of 174,000 francs (about 7000*l.*) to the Primary Schools of Lombardy; another 87,000 francs to the Milan Academy of Fine Arts, the interest of which is to be devoted annually to the education and support of some young artist, architect, painter, or sculptor.

CANOPPI, ANTO'NIO, an Italian artist, who resided during the latter half of his life in Russia, and died at St. Petersburg, in 1832, at the age of fifty-nine. His father, who was civil engineer in the service of the Duke of Modena, and was esteemed one of the ablest of his day in that profession, educated him. But though he profited by the instruction bestowed upon him, Antonio soon relinquished science for art—construction for design. He aspired to build after the manner of Piranesi, the study of whose works filled his imagination with visions of architectural pomp, which he had afterwards opportunities of displaying when he began to paint for the stage. His first practice however was as a fresco-painter, in which capacity he was employed by many Italian nobles to decorate their saloons. At this period, he obtained the notice of Canova, who did much to recommend him, and also gave him instruction in sculpture. At Venice he became scene-painter at the Fenice theatre, and was afterwards engaged in the same capacity at Mantua, where some of the scenery executed by him is said to be still preserved for the sake of its beauty. While he was thus winning public admiration, a cloud was suddenly thrown over his success by the political changes of the time, or rather, in consequence of the active part he took in them, which was such that he was marked out by the French government as a very dangerous opponent, one that was at all events to be got rid of. Finding his personal safety threatened by the emissaries of Napoleon, Canoppi fled to Germany, and having made his way to Vienna, was so fortunate as there to meet with a protector and patron in the Russian ambassador Prince Razumovsky, who proposed to him to establish himself in Russia. Accordingly, furnished with letters of recommendation by the prince, he proceeded to Moscow in 1807, where he was fully employed for several years, chiefly in adorning with mural painting and arabesque decorations the saloons of the principal nobles. The hall of the Senate thus embellished by him excited general and lively admiration, but that and all his other labours of the kind in that capital, perished in the memorable conflagration of 1812. Just before that event Canoppi had sought an asylum at St. Petersburg, where he was already known by reputation, and was readily engaged as scene-painter at the Imperial Theatre, in which service he continued till his death, with the exception of the interval of a twelvemonth, when being ordered (1819) to travel for the benefit of his health, he visited the regions of the Caucasus. Among the vast number of splendid architectural scenes which he produced for the theatre at St. Petersburg, in the course of nearly twenty years, those for the operas of the Zauberflöte and Semiramis were considered truly wonderful performances of their kind; and the name of Canoppi was enrolled with those of Sanquirico, Quaglio, Schinkel, and other great scenicisti. His engagements with the theatre did not however so completely occupy Canoppi as to prevent his exercising his pencil upon smaller subjects and easel-pieces. These were chiefly either architectural compositions or architectural views, such as those of the Winter Palace (the one destroyed by fire in 1838), and the Etat Major at St. Petersburg; both which are or were in the Gallery of the Hermitage. But he sometimes took historical, or rather, poetical subjects; among others, two from the descent of Æneas to the infernal regions, one representing Tartarus, the other the Elysian Fields; also a Bacchanalian Scene, remarkable for the masterly combination of two lights, that of the moon in the landscape and that of torches within the temple. The Interior of a Convent is another greatly admired piece by him.

Besides having a considerable taste for literature, Canoppi wrote on various subjects appertaining to his art, perspective and architecture included; and there is one publication by him, which appeared in 1830, entitled 'Opinion d'Antoine Canoppi sur l'Architecture en général, et en spécialité sur la Construction des Théâtres Modernes.'

(*Khudozhestvennya Gazeta*, No. 22, Nov. 1837.)

CANTARI'NI, SIMO'NE, called Il Pesarese, was born at Pesaro, in 1612, and in his youth was the scholar of Pandolfi; but he afterwards chose Guido Reni for his master, and lived some time with him in Bologna. He very shortly showed himself to be a formidable rival, even to Guido himself; but he was of such a contemptuous and arrogant disposition, that he made enemies of all the painters of Bologna, and of other people too, so that he became at length totally neglected and avoided by the Bolognese, and he accordingly felt himself compelled to leave Bologna. He removed to Rome, obtained a high reputation there, and in some respects, especially in grace of conception, was pronounced to be superior to his master Guido: even Count Malvasia, himself a Bolognese, styles Cantarini the best colourist and the purest draftsman of the seventeenth century. After spending some time in Rome, he returned to Bologna, and opened a school there, which however he gave up shortly afterwards, upon receiving an invitation from the Duke of Mantua to visit that city. The bane of his life however, his own conceit, followed him to Mantua, where by his arrogance and the depreciation of others he very soon disgusted the artists of that place, and he finally quarrelled with the duke himself, about a portrait with which the duke was not satisfied. From Mantua he went to Verona, where he died, in 1648, aged only thirty-six, under the suspicion of having been poisoned.

Cantarini's fault was not so much an exaltation of his own works beyond their merits, as a denial of merit to others. He was certainly a great painter, as far as execution could make him such; in the extremities he was perhaps perfect, and has had few rivals; he showed also great mastery in the general management of the nude; in draperies he was not so successful. He painted a few altar-pieces, several holy families, and many portraits, in which he was admirable. There is a head of Guido, when old, by Cantarini, in the gallery of Bologna, which cannot be surpassed, and has perhaps seldom been equalled. His masterpieces are, Sant' Antonio at the Franciscans at Cagli; San Jacopo, in the church of that saint at Rimini; a Magdalen at the Philippines; a San Domenico at the Predicants, and several others, especially the portrait of a young nun, at Pesaro. He etched also several plates in a masterly manner, some of which are sold as the works of Guido.

(Malvasia, *Felsina Pittrice*; Lanzi, *Storia Pittorica*, &c.; Bartsch, *Peintre-Graveur.*)

CA'NTHARUS, a genus of Acanthopterygious osseous fishes, established by Cuvier for the reception of certain species belonging to the family of *Sparidæ*, and presenting the common character of—a deep compressed body; a single elongated dorsal fin; a short muzzle; and teeth which are small, numerous, crowded, conical, and ranged in several rows, those of the external row being strongest and most curved. The fishes of this genus inhabit the Mediterranean and Atlantic. One of them, the Black Bream of Montagu (*Cantharus griseus*, Cuv. and Val.), is not uncommon on the southern shores of England, where it enters harbours and feeds on marine vegetables, though it will take bait like other fish. It attains the length of 20 inches, and is of a bluish grey colour, marked with alternate light and dark narrow longitudinal bands, the centres of the scales being darker than the edges. The dorsal fin is pale brown, and lodged in a groove throughout its length; the other fins are grey; the ventral, anal, and caudal fins are darker than the pectoral.

Besides *Cantharus griseus*, three other European species are enumerated by Cuvier: *Cantharus vulgaris*, *C. brama*, and *C. orbicularis*. There are eight exotic species from the coast of Africa and the Indian seas.

(Cuvier and Valenciennes, *Hist. Nat. des Poiss.* vol. VI.; and Yarrell's *History of British Fishes*, vol. i.)

CANTO'NI, SIMONE, a recent Milanese architect of considerable note, was born at Maggio, a small village in the north of Italy, and received his first instruction in architecture from his father Pietro, who was of that profession, and did a good deal at Genoa. He afterwards went to Rome for further improvement, and on his return settled at Milan, where the first work of any note he was employed upon was the Palazzo Mellerio. Two other noble mansions afterwards erected by him in the same city, are the Casa Perticati and the Palazzo Serbelloni, the former of which has engaged columns of the Ionic order, with Caryatid figures over them, against the attic; and the façade of the other (finished 1794) is remarkable for having granite columns and pilasters.' Among various other works, he erected the Seminary and Lyceum at Como, the Villa Raimondi near the same town, the Palazzo Vailetti at Bergamo, and the church at Gorgonzola, between Bergamo and Milan. On the destruction of the Great Council Hall in the Ducal Palace at Genoa, by fire, in November, 1777, Cantoni was employed to rebuild it, which he did with equal ability and taste, and in such manner as to secure it from any similar accident in future. Milizia, who notices this circumstance in his Life of Rocco Pennone, the original architect of the edifice, says that there is a work containing all Cantoni's designs for that purpose, but he does not specify either its title or date. Wiebeking attributes the *Arena* at Mantua to Cantoni, but it would it seem erroneously, no mention being made of it in the memoir of him by Lazzari, in Tipaldo's 'Biografia,' &c., where he is said to have rejected flattering invitations from St. Petersburg and Warsaw. He died March 3, 1818. Nagler, who makes no mention of Simone, speaks of a Giuseppe Cantoni of Forli as the architect of the amphitheatre at Mantua (which was opened in 1821); therefore he is, no doubt, the person meant by Wiebeking.

CANTONMENTS are the dwelling-places occupied by an army during any suspension of active operations in the field [Tactics, p. 512, P. C.]: the term, though frequently applied to winter-quarters, particularly designates the more temporary shelter which an army may occasionally take; for example, during a season of excessive heat. The troops are distributed in villages, houses, &c., as when in winter-quarters, but they are made to occupy a smaller extent of country, and hold themselves in readiness to take the field at a moment's warning.

CAOUTCHOUC. At the time when Caoutchouc, P. C., was written, 'water-proof' cloth for capes and other garments formed perhaps the best known among the applications of this material to the arts. But the use of caoutchouc has increased very largely since that time, and seems likely to do so yet more in future, when its peculiar qualities are considered.

The qualities on which the manufacture depends are mainly two, *elasticity* and *imperviousness to water*; and nearly the whole of the recent applications of the gum in the arts depend on one or other of them. We may begin by the former, viz., elasticity, and notice a few of the recent inventions bearing upon it.

The introduction of caoutchouc, or India-rubber, as one of the component materials for braces, springs, straps, bandages, and other like articles, depends on its power when in a filamentous state of being stretched out to a considerable length, and of regaining its former length without rupture. For such purposes a compound thread is formed, having a centre or core of caoutchouc, with an envelope of cotton or worsted twisted round it. The method is said to have been first practised at Vienna, from whence it extended to Paris, and thence to this country. The bottle-shaped masses of India-rubber are, in the first instance, cut up into slips. This used in the first instance to be done by cutting up the bottle with scissors, and then separating the layers of which it is formed; another plan was to soften the bottle, inflate it by a forcing-pump to the requisite degree of thinness, and then cut it; but the method now employed is to soften the bottle in hot water, cut it into two halves, press it between two iron plates till it assumes a flat form, and cut the discs or pieces thus produced into ribbons, by a cutter working spirally from the circumference of the disc towards the centre. The ribbons so prepared are next cut into filaments or threads of the desired width, by passing them through a machine having a number of cutting edges. The threads are softened in warm water, and stretched by a winding machine to many times their original length; and being kept in that tended state till cool, they do not spring back again when released. They are then attached to a braiding-machine, and are sheathed with threads of cotton, silk, linen, or other material. The threads so sheathed are used as 'warp' or long threads, and are woven into the kind of textile fabric required. A heated iron passed over the woven goods causes the India-rubber to relax, corrugates the sheathing, and gives to the whole a great elasticity and power of yielding without fracture. If the India-rubber thread were sheathed while in the natural state, it could not afterwards be stretched without breaking the sheathing; and it is for this reason that the sheathing is applied to a stretched thread of the inner material.

Sometimes the compound threads sheathed in this way are used as alternate warps only, sometimes both for warp and weft; and various other modifications occur, according to the purpose to which the woven material is to be applied. Gloves are made at Leicester and Nottingham with India-rubber knitted into the wrist; and stockings with the same material at the top, to serve in lieu of garters. In India this material has been in some cases used as a substitute for leather in soldiers' belts and other parts of their accoutrements. About four years ago a method was introduced of employing India-rubber, combined with other materials, as a substitute for corks for bottles. In the first place, fibres of wool are felted or worked into a cylindrical mass; this cylinder is cut up into pieces the proper length for corks; and the corks so made are coated with a thin sheeting or cover of India-rubber. The corks so made are said to close the bottle air-tight, and yet to be removed easily.

Another mode of applying this substance in respect to its elastic property, is for pavements for stables, lobbies, and halls. The idea of substituting this kind of pavement for that made of stone, seems to have arisen from the desirability of providing a flexible and yielding footing for horses in the stable. Some of the stables at Woolwich Arsenal are paved in this way; so likewise is the Admiralty Court-yard, and the carriage-entrance court at Windsor Castle. For all such purposes as these the India-rubber is combined with other materials. A project has been started for building boats of cork and India-rubber, in such a way that they shall be too light to sink and too elastic to fall to pieces in case of being thrown against a rocky shore. The elasticity of this substance has also caused it to be proposed as a material for the lining of vessels to prevent accidents from gun-shot splinters; and for hammock-nettings and bulwarks, to protect the crew from shot.

The *imperviousness to Water*, the other principal quality possessed by India-rubber, is rendered available by using a solution of the gum as a varnish or coating to the substance to be protected. When cloth is saturated with a solution of caoutchouc, it becomes not only water-proof but air-proof, and is then applied for such purposes as are noticed under Air-beds and Cushions, P. C. S. Its water-resisting power is that which makes it available for clothing, and for safety-boats and other like contrivances. [Buoys and Life-preservers, P. C. S.] For all such purposes as these the gum requires to be brought to a melted state before using; and many recent inventions have had for their object the best mode of effecting this solution. Besides the life-boats mentioned in the article just named, other forms of vessel have been devised, having India-rubber among their component materials. In 1839 pontoons were made of India-rubber cloth, and floated on the Serpentine, two of them bearing a platform on which forty men stood. In the next following year a boat made of India-rubber cloth was floated on the Neva at St. Petersburg, and another on the Hudson in America, both bearing several persons. The canvas for soldiers' tents, in France, is sometimes saturated with the solution of this gum; and rick-cloths are occasionally so treated in this country.

CAPELL, EDWARD, was born in 1713, at Troston in Suffolk. He was educated at Bury St. Edmunds, and spent the greater part of his life at Hastings and in London, occupying himself almost exclusively in studies relating to the works of Shakspere. He was enabled to command leisure for such pursuits by the patronage of the Duke of Grafton, who obtained for him the appointment of deputy-inspector of plays. He died on the 24th of February, 1781, at his chambers in the Temple. As a commentator on Shakspere, Capell is ranked much more highly now than he was in his own times, but he is really useful only as furnishing hints for others to work upon. There is not more excellence in the valuable parts of his matter, than confusion, obscurity, and pedantry in his manner of expression. 'The man,' said Johnson, 'should have come to me, and I would have endowed his purpose with words: as it is, he doth gabble monstrously.' The publications written or edited by Capell are the following:—1, 'Prolusions, or Select Pieces of Ancient Poetry,' 1760, 8vo.: a volume in which the most interesting part is the fine drama of 'Edward III.,' attributed by its editor to Shakspere on grounds quite inconclusive. 2, 'Mr. William Shakespeare, his Comedies, Histories, and Tragedies,' &c., 1767, 10 vols. 8vo. 3, 'Notes and Various Readings to Shakespeare,' 1775, 4to. 4, 'A Letter to George Harding, Esq.' (on a passage in Steevens's Preface), 1777, 4to. 5, 'Notes and Various Readings to Shakespeare; to which is added, The School of Shakespeare, or Extracts from divers English Books that were in print in the Author's time,' &c., 1783, 3 vols. 4to.

CAPITAL is a term used in commerce to express the stock of the merchant, manufacturer, or trader, used in carrying on his business, in the purchase or manufacture of commodities, and in the payment of the wages of labour; and is understood not only of money, but of buildings, machinery, and all other material objects which facilitate his operations in trade. The term itself and the practical qualities and uses of capital are sufficiently understood in this its commercial sense; but it is the object of the present article to treat of capital in a more extended form, as within the province of political economy, and embracing not only the capital of particular individuals, but the entire capital of a country. In this latter sense, capital may be defined as the products of industry possessed by the community, and still available for use only, or for further production.

To consider capital in all its relations to the material interests of man, to the increase of population, the employment and wages of labourers, to profits and rent, it would be necessary to travel over the entire range of political economy; but this article will be confined to the following points:—I. The origin and growth of capital. II. Its application and uses.

I. Capital is first called into existence by the natural foresight of man, who even in a savage state discerns the advantage of not immediately consuming the whole produce of his exertions in present gratification, and stores up a part for his future subsistence. The greater proportion of mankind possess this quality, and those who do not possess it are admonished of its value by privation. In civilized life there are many concurrent inducements to accumulate savings; of which the most general are—the anxiety of men to provide for their families and for themselves in old age; social emulation, or their desire to substitute the manual labour of others for their own, and of advancing themselves from one grade to another in society; and a love of ease and luxury, which can only be purchased by present sacrifices.

A desire to accumulate some portion of the produce of industry being thus natural to mankind and nearly universal, the growth of capital may be expected wherever the means of accumulation exist; or, in other words, wherever men are not obliged to consume the whole products of their labour in their own subsistence. From the moment at which a man produces more than he consumes, he is creating a capital; and the accumulated surplus of production over the consumption of the whole community is the capital of a country.

Thus far the origin and growth of capital are perfectly intelligible; but in order to understand completely the progress of accumulation, it will be necessary to advert to certain matters which interfere with its apparent simplicity. As yet no distinction has been noticed, either in the original definition of capital or in the succeeding explanation of its causes, between those parts of the products of labour which are reserved for the reproduction of other commodities, and those parts which are intended solely for use or consumption. These two classes of products have been divided by Adam Smith and others into capital and revenue; by which division all products are excluded from the definition of capital unless they be designed for aiding in further production. The impropriety of this distinction however has been pointed out by Mr. M'Culloch ('Principles of Political Economy,' p. 97), and it does not appear that any such division of the stock of a country is founded on a proper distinction. How can its future application be predicated? The fund exists, and so long as it is not sent abroad or consumed it must be regarded as capital. The whole of it may be made available for further production, or the whole may be consumed in present enjoyment; but no part is separable from the rest by an arbitrary classification. A man may choose hereafter to spend all his savings in drinking spirits and frequenting the theatres; or he may carefully lay them aside for the employment of a labourer in some profitable work: but in either case the stock has the same capacity for production while in the possession of the owner.

These different modes of expending capital produce very distinct results, both as regards the interests of the individual and of society, which will be examined under the second division of this article, where the application and uses of capital are considered; but here it must be observed that the accumulation of capital proceeds slowly or rapidly in proportion as one or other of these modes of expenditure is most prevalent. If men habitually consumed or wasted all the results of their industry, it is obvious that the effect of such conduct would be precisely the same to themselves, in preventing accumulation, as if they were unable to earn anything more than was absolutely necessary for their support. It is true that they would enjoy more of the luxuries of life, and, as will presently be seen, their expenditure would conduce, indirectly, to the accumulation of capital by others; but still their labour would only suffice for their own support from year to year, and no part of the produce of last year's labour would be available, in the present year, either for their support or for any other purposes. But when a man, instead of spending the results of a whole year's labour within the year, subsists upon one-half of them, the other half remains to him in the succeeding year, and in the course of two years such economy will have placed him a whole year in advance.

As it is evident, from these illustrations, that capital must increase in the ratio in which the products of labour exceed the expense of subsistence, it would seem to follow as a necessary consequence that, when a certain amount of capital has already been produced, the higher the rate of profit which may be obtainable from such capital, the greater will be the means of further accumulation. [PROFITS, P. C.] It is not necessary indeed that larger savings should in fact be made, as that must depend upon the conduct of those who enjoy the profits. The larger their profits may be, the greater may be their personal expenditure; and a taste for luxury and display may be engendered, the gratification of which may be more tempting than the desire of further accumulation. Nor can it be denied that, in practice, an unusually high rate of profits very often encourages an extravagant expenditure. It is perhaps more natural that it should produce self-indulgence rather than stimulate economy. The accumulation of savings is an act of self-denial very necessary and profitable, it is true, but not very pleasing when the sacrifice is about to be made; and its necessity is less obvious when large profits are rapidly secured than in less prosperous circumstances. When the profits arising from a man's capital, if expended, are already sufficient to satisfy his desires, we cannot wonder if he thinks less of the morrow.

Yet, whether savings proportionate to the means of saving be made or not, it is undeniable that a high rate of profit offers the best opportunity for augmenting capital. If three *per cent*. profit upon a man's stock will enable him to subsist as he has been accustomed, and to lay aside one per cent. annually as capital, the rise of profit to six *per cent*. would at once give him the power of adding four per cent., instead of one, to his capital, so long as he made no change in his style of living: and thus the doubling of the rate of profit would add to the means of accumulation in the proportion of four to one.

Making all due allowances, therefore, for greater profusion of expenditure, the proposition that large profits are favourable to accumulation may be held as demonstrable; for, reverse the circumstances, and suppose that profits were so small as to disable those who were willing to save from retaining any surplus whatever, the result must be precisely the same to themselves as if they had voluntarily consumed the whole excess of their production; while their poverty would not conduce indirectly to accumulation by others, as their expenditure of a surplus might have done.

But, apart from abstract reasoning, does the experience of different countries bear out the same conclusion? In England, for example, was capital accumulated more rapidly while profits were high, than within the last few years? These questions do not always receive the same answer. Mr. M'Culloch compares the progress of the United States of America, in wealth and population, with that of England and Holland, and ascribes the comparative rapidity of their advancement to the fact, that the rate of profit is generally twice as high in America as in either of the other countries (*Principles of Pol. Ec.*, p. 107). He adds (p. 110), that if the rates of profit have become comparatively low, the condition of a nation, 'how prosperous soever in appearance, is bad and unsound at bottom.' Professor Jones, on the other hand, denies this inference, and takes a more encouraging view of the state and prospects of our own country. He says, 'That fall of the rate of profits, which is so common a phenomenon as to be almost a constant attendant on increasing population and wealth, is, it will be seen, so far from indicating greater feebleness in any branch of industry, that it is usually accompanied by an increasing productive power in all, and by an ability to accumulate fresh resources more abundantly and more rapidly. So far therefore is this circumstance from being, as it has hastily been feared and described to be, an unerring symptom of national decay, that it will be shown to be one of the most constant accompaniments and indications of economical prosperity and vigour.' (*Distribution of Wealth*, Preface, p. xxxii.)

These opinions, apparently conflicting, upon matters of fact, may prove, upon examination, not to be wholly irreconcilable. It is doubtful whether the United States of America be a good example for the purpose of this inquiry, as there have been many concurrent circumstances in operation, in that country, all tending to the same result; and of which high profits may be regarded as the effect rather than the cause. It will be safer therefore to confine the examination of the effects of high profits upon accumulation to our own country at different times.

First, then, it will be admitted on all hands that individual fortunes have been more rapidly accumulated in England at those times in which the profits in particular departments of industry were the highest. This admission is no more, in other words, than the truism, that when a trade is prosperous money is made by it. The next question is, whether a high rate of profit in all departments of industry has the same effect in augmenting the sum total of national capital. Political reasoners are too apt to assume a universal analogy between individuals and nations, which is often deceptive, and leads to inaccurate conclusions. In the present instance, if this analogy were allowed, it would be decisive of the whole question, and would exclude all observation of facts. The fact, as stated by Professor Jones, is undeniable, that a fall in the rate of profits is the ordinary accompaniment of increasing population and wealth. There is more capital in England and in Holland, in proportion to the population, than in any country in the world, and in those countries the rate of profit is the lowest. The resources of England have been increasing in an extraordinary manner during the last forty years, as evinced by the productiveness of the property-tax and other imposts, compared with former periods, and as proved by all statistics (Porter's *Progress of the Nation*, sect. vi.); and, at the same time, the more evident the wealth of the country has become, the lower has fallen the general rate of profits.

The general principles of profit have been briefly stated in the article Profit, P. C.; but here it may be mentioned, that a fall in the rate of profits is a common result of enormous accumulations of capital. Capitalists are forced into competition with each other, and are ultimately obliged to content themselves with lower profits. But, in the meantime, does the aggregate accumulation of national wealth diminish? This inference is contradicted by all the statistics which illustrate the progress and present condition of Great Britain. [Census of 1841, P. C. S.] All evidence shows that British capital is positively overflowing, and seeking employment in every enterprise at home or abroad. It is true that no statistics can decide, with arithmetical precision, the comparative rate of increase in the accumulation of capital at different times; but so far as outward indications of wealth may be relied on, there are very few who are prepared to deny that accumulation is now advancing, in the aggregate, at least as rapidly as ever, in proportion to the population of the country.

This fact, it is submitted, is nevertheless consistent with the general proposition, that high profits are favourable to accumulation. In calculating the aggregate savings of a people already rich and populous, it must be borne in mind, first, that the existing generation has inherited the accumulations of many preceding generations; and, secondly, that a large number of persons continually saving a small portion of their individual gains, may produce a greater aggregate accumulation than the larger proportionate savings of a less number of persons.

With reference to the first point, it need only be observed, that if the inherited capital be not squandered or wasted, its annual interest alone affords the means of enormous accumulation; while the rent of land, the profits of trade, and the wages of labour, are continually supplying new funds for further production and accumulation. The second point may be made clearer by an illustration. Let us suppose one hundred men, each saving 100*l.* annually out of their profits. Their aggregate accumulations would amount to 10,000*l.* But suppose one thousand men, with equal capitals, but unable, on account of a lower rate of profit, to save more than 50*l.* a year; their aggregate accumulations would amount to 50,000*l.* In both cases, they would have maintained themselves and their families out of their profits, and have paid the wages of all the labour required in their business; after which their savings remain available for increased production, and for the employment of a larger quantity of labour. This example falls far short of the circumstances of Great Britain, for the number of small capitalists is even more extraordinary than the enormous capitals possessed by a comparatively small number of wealthy men; and their annual additions to the national capital are of incalculable amount.

The conclusions to which we are led by these inquiries, are,—that a high rate of profit is favourable to accumulation; that rich and populous countries are denied this advantage; that if they enjoyed it, their capital would continue to increase more rapidly than it does, in fact, increase; but that, under ordinarily favourable circumstances, the masses of inherited capital and the aggregate savings of vast numbers of capitalists still facilitate accumulation in a greater ratio than the increase of population, which a high state of civilization has a tendency to check. [Population, P. C.]

II. The consideration of the application and uses of capital will be disembarrassed of much complexity by explaining, at the outset, the distinction raised by political economists between what is called productive and unproductive labour and expenditure. The end of all production is use or consumption: some products are immediately destroyed by the use of them, as food or coals; others are consumed more slowly, but are ultimately destroyed by use, as clothes or furniture: but whatever the durability of the thing produced, its sole use is the enjoyment of man. A man is rich or poor according to his power of obtaining the various sources of enjoyment which the skill and industry of others produce; and the aggregate of such permanent sources of enjoyment constitutes the wealth of nations. Whatever labour or expenditure, therefore, may be devoted to the increase or continuance of those sources of enjoyment, must be deemed productive: and labour and expenditure which have no such tendency must be viewed as unproductive.

The most scientific classification of productive and unproductive descriptions of labour and expenditure which we have met with is that of Mr. Mill. According to his definition the following are always productive:—When their 'direct object or effect is the creation of some material product useful or agreeable to mankind,' or 'to endow human or other animated beings with faculties or qualities useful or agreeable to mankind, and possessing exchangeable value;' or 'which, without having for their direct object the creation of any useful material product, or bodily or mental faculty or quality, yet tend indirectly to promote one or other of those ends, and are exerted or incurred solely for that purpose.' Labour and expenditure are said to be unproductive when they are 'directly or exclusively for the purpose of enjoyment, and not calling into existence anything, whether substance or quality, but such as begins and perishes in the enjoyment;' or when they are exerted or incurred 'uselessly or in pure waste, and yielding neither direct enjoyment nor permanent sources of enjoyment.' (*Essays on unsettled Questions of Political Economy*, Essay III.)

Examples of these several classes would transgress our limits, but a study of the above definitions may serve to correct an erroneous impression, that no expenditure is productive unless it be incurred directly in aid of further production. The most common form in which this error appears, is in a comparison of the ordinary expenditure of a gentleman living upon his income, with that of a person employing workmen in a productive trade. It is hastily assumed that the expenditure of the former is unproductive, but it is, in fact, of a mixed character. His servants, for instance, perform many labours of a productive character. His cook prepares food for his table, and thus adds the last process of a manufacture. In point of productiveness it is impossible to distinguish this necessary labour from that of a butcher or baker. His gardener is an agriculturist and directly productive. The upholsterer who makes his furniture is productive: and in what manner is the labour of his housemaid less productive, who keeps it fit for use? In the same manner, why is the labour of his butler less productive than that of the silversmith; or of his coachman than that of the coach-builder and the breeder of horses? All are engaged alike, in increasing or continuing permanent sources of enjoyment. But the most important economical use of domestic servants is the division of employments which it facilitates. While they are engaged upon household services their employer is free to follow his own more influential duties—the management of his estates, the investment of his capital, or the labours of his profession. It is not, therefore, in the employment of servants that expenditure is unproductively incurred, but in the employment of excessive numbers; for then they are used directly and exclusively for the purpose of an enjoyment 'which begins and perishes in the enjoyment.'

We will now briefly examine the nature of productive and unproductive consumption of perishable articles, and the effects of consumption, generally, upon production. Those who produce anything have one object only in devoting their labour to it—that of ultimately consuming the thing itself, or its equivalent, in the form of some other product of labour. If the exchange be made in goods, each consumer is obviously also a producer, and adds to the common stock of enjoyment as much as he withdraws from it. But money is the representative of the products of labour, and if given in exchange for them, the character of the transaction would appear to be the same as the direct interchange of the products themselves. In the case of productive labourers, it would be admitted to be precisely the same; but a distinction is taken when the labour of the consumer is itself unproductive. It is true that he offers the results of past labour, but his immediate end in consuming is enjoyment. He parts with his money, which is an equivalent to the seller, but he produces no new source of enjoyment for society. But the consumption of a productive labourer may also be unproductive. Such part of his consumption as is necessary to keep him in health, to render him perfectly fit, in mind and body, for his employment, and to rear his children, suitably, is all clearly productive. If any residue remain, and he spend it upon immediate enjoyment—such as spirits, for example, which vanish with the enjoyment—that portion of his consumption is unproductive.

It must not be imagined, however, that the only result of money spent upon unproductive labour or of unproductive consumption, is necessarily waste. The results of a man's labour may be unproductive to society, but a great part of his gains may be productively expended; and again, the maker and seller of commodities unproductively consumed are productive, and their profits may be productively employed. The distiller and the publican are productive labourers, but the consumption of spirits is itself unproductive.

We are now enabled to confine our attention to the uses of capital as applied to its most important end, the employment and aid of productive industry. Its first and most important use is the division of employments, which, though necessary for any advance in arts, is impracticable without some previous accumulation of capital. Until there is a fund for employing labour, every man's business is the seeking of his own daily food; but as soon as the capital of another secures that for him, his labour is available for the general good. The more capital is accumulated, the more extended are the facilities for indefinite distribution of employments, according to the wants of the community.

Capital may be applied either directly in the employment of labour, or directly in aid of labour: it may be spent in the food and clothes of labourers, or in tools and other auxiliary machinery to assist their labour and increase its productiveness. The former is usually termed circulating capital, and the latter fixed capital. Both are equally essential to the progress of the arts and national wealth, and are used in combination; but the effects produced by each are not always the same. If a farmer employs three labourers, and his capital is afterwards doubled, it is a very important question whether he expend his increased stock in the payment of three additional labourers, or in providing auxiliary machinery to increase the power of the three labourers already employed. In the latter case we may be assured that his machinery will do the work of more than three men; for otherwise no ingenuity would have been applied to its contrivance. It is truly said by Professor Jones, that, 'when, instead of using their capital to support fresh labourers in any art, (a people) prefer expending an equal amount of capital, in some shape in which it is assistant to the labour already employed in that art, we may conclude with perfect certainty, that the efficiency of human industry has increased relatively to the amount of capital employed.' (*Distribution of Wealth*, p. 222.) The same able writer has pointed out another difference in the results of auxiliary capital, viz., 'that when a given quantity of additional capital is applied, in the results of past labour, to assist the labourers actually employed, a less annual return will suffice to make the employment of such capital profitable, and therefore permanently practicable, than if the same quantity of fresh capital were expended in the support of additional labourers.' (*Ibid.* p. 224.) This circumstance arises from the greater durability of the fixed capital, which may not require renewal for several years, while the direct expenditure on labour must be renewed annually. Thus 100*l.* spent in labour to cause a profit of 10 per cent. must produce results amounting in value to 110*l.*; but the same sum expended upon any machinery calculated to last for five years would be equally well repaid by a return of 30*l.* a-year; being 10*l.* for profit upon the outlay, and 20*l.* for the annual wear and tear of the capital.

Not only does capital facilitate divisions of employment, and increase the productiveness of industry, by which the enjoyments of man are multiplied, but it actually produces many sources of power and enjoyment, which without it could have no existence. It is the foundation of all social progress and civilization, for without it man is but a savage. It must precede his mental culture, for until it exists his noble endowments are idle or misemployed. Without it, his mind is a slave to the wants of his body: with it, the strength of others becomes subservient to his will, and while he directs it to increase the physical enjoyments of his race, his intellect ranges beyond the common necessities of man, and aspires to wisdom—to government and laws—to arts and sciences. In all the nations of the world riches have preceded and introduced intellectual superiority. Connected with the progress of the human intellect, the printing press is an apt example of the creations, so to speak, effected by capital. No dexterity of fingers, no ingenuity of contrivance, unaided by the results of former labour, could multiply copies of books. Without abundance of types and frames and other appliances of the art, secured by capital, the bare invention of printing would be useless; and its wonderful efficacy, in the present age, may be ascribed as much to the resources of capital as to human ingenuity. In numberless other processes of art capital enables work to be executed which could not otherwise be performed at all, or enables it to be performed better and in less time. In all ways it multiplies indefinitely the varied sources of enjoyment that are offered to civilized man; but never more conspicuously than when it stimulates and encourages invention. Look at the railways of Great Britain. What created them? The abounding capital of the people, which overflowing the ordinary channels of investments, found a new channel for itself. In ten years the land was traversed by iron roads, and millions of people were borne along by steam with the speed of the wind.

This rapid sketch of the uses of capital will not be complete without its moral. The paramount value of capital to the prosperity of a nation should never be overlooked by a government. Unwise laws, restrictions upon commerce, improvident taxation, which are unfavourable to its growth, should be dreaded as poison to the sources of national wealth and happiness. No class is the better for its decay or retarded growth: all derive benefit from its increase. And above all, when population in rapidly increasing, let a government beware how it interferes with the natural growth of capital, lest the fund for the employment of labour should fail, and the numbers of the people, instead of being an instrument of national power, should become the unhappy cause of its decay. The material happiness of a people is greatest when the national wealth is increasing more rapidly than the population; when the demand for labour is ever in advance of the supply. It is then also that a people, being contented, are most easily governed; and that taxes are most productive and raised with least difficulty. But while the natural growth of capital should not be interfered with by restrictions, the opposite error of forcing it into particular channels should equally be avoided. Industry requires from a government nothing but freedom for its exercise; and capital will then find its own way into the most productive employments; for its genius is more fertile than that of statesmen, and its energy is greatest when left to itself. The best means of aiding its spontaneous development are a liberal encouragement of science and the arts, and a judicious system of popular education and industrial training; for as 'knowledge is power' so is it at once the best of all riches and the most efficient producer of wealth.

(Smith's *Wealth of Nations*, Book ii. ch. 3, with Notes by M'Culloch and Wakefield; Ricardo *On Political Economy and Taxation*; M'Culloch, *Principles of Political Economy*; Professor Jones *On the Distribution of Wealth*; *Essays on some Unsettled Questions of Political Economy*, by John Stuart Mill.)

CAPITE, TENANTS IN. [Baron, Barony, P. C.; Feudal System, P. C.]

CA'PITO, ATEIUS C. [Labeo, P. C. S.]

CAPRIFO'LIUM. [Lonicera, P. C. S.]

CAPS, PERCUSSION. There have been three modes adopted, in different times, for firing off muskets, fowling-pieces, and other kinds of hand-guns, viz. the *match*, the *flint and steel*, and the *percussion cap*; the last of which depends for its principle on modern chemical discoveries.

It has been stated [Arms, P. C.] that the first kind of hand-gun, called the hand-cannon, was fired by a match applied to the priming at the touch-hole; and that the first approach towards the use of a gun-lock was by placing a small pan at the right hand of the touch-hole to contain the priming-powder, to prevent it from being blown away. The match was applied by hand; but in the *arquebus*, a later invention, it was brought over the touch-hole by means of a trigger, such as had before been used for shooting the arrow from a cross-bow. Next came into use the wheel-lock, in the time of Henry VIII.; this was a contrivance by which sparks of fire were elicited from a furrowed steel wheel, by friction against a piece of pyrites, or sulphuret of iron: the trigger acted on a lever and chain which made the wheel revolve, and also brought the piece of pyrites down in contact with it, so that the grating of the two together might produce a spark sufficient to kindle the priming of the gun. The next improvement consisted in the substitution of a flat furrowed piece of steel for the wheel, and a piece of flint for the pyrites. By gradual improvements made from time to time, the complicated arrangement of the flint and steel assumed a considerable degree of perfection, and made the gun-lock a very curious piece of machinery. The manufacture of these locks has formed, and still does form, an important branch of Wolverhampton trade; while the manufacture of the flints, especially during times of war, has been largely carried on in various parts of England and the Continent where the best flint is found.

The employment of percussion caps, instead of the above contrivances, arose out of the discovery of certain chemical substances which will explode by percussion or a blow without the aid of heat. Such substances are called detonating or fulminating compounds; and the idea of employing them for firing muskets is said to have originated in the following manner:—About the year 1793, on account of a scarcity of saltpetre in France, the French government caused experiments to be made to determine how far a certain preparation of chlorate of potash would answer as a substitute for gunpowder. The attempt was, from various causes, unsuccessful; but it suggested to the mind of Mr. Fordyce, a gentleman of Scotland, the thought of employing some such agent for igniting the gunpowder of a loaded gun. After several experiments, he took to London, in 1806, a fowling-piece having a lock, in which a small piece of apparatus struck smartly against a morsel of fulminating mercury, exploded it, and caused the ignition of the gunpowder. The principle was established, though the details were still imperfect; and Mr. Fordyce was encouraged by the then Master-General of the Ordnance to make further experiments, which he did. Fordyce proposed, as his reward, to be paid the price of the gunpowder which would be saved by the government in two years; but changes of administration, and difficulties of various kinds, interfered with the hoped-for progress of the method; and it was not till many years afterwards that its use became at all extensive in England, or indeed anywhere.

When however it became known that a slight blow would explode certain powders, and that this explosion would ignite gunpowder, numerous improvements became introduced by degrees. Various salts and chemical compounds, such as some of the chlorates, nitrates, and fulminates, will explode in this way; the most familiar example of which is afforded by the 'lucifers' or 'congreves' now sold so cheaply in the streets, and which ignite so readily by friction (in effect a series of minute percussions). About twelve or fourteen years ago Dr. Ure conducted a series of experiments for the Board of Ordnance on certain points connected with these detonating compounds; such as the best proportion in the ingredients for fulminating mercury and other varieties; the best mode of preparation; the mode in which gases produced by the explosion affect the iron and brass work of a gun; the degree to which moisture or damp injures the mixtures; the effect of difference of climate on them; the best mode of protecting them from injury; and the probable effect of the gases (resulting from the explosion) on the health of a close mass of men in an army. Dr. Ure gives the results of the experiments in his 'Dictionary,' in the course of which he states that the French prepare forty thousand percussion charges from two pounds and a half of fulminating mercury.

When the method was first introduced, there was some difficulty in causing the explosion of the mixture to ignite the gunpowder. But this is now effected by putting the detonating mixture into a little copper box or cell called a *cap*, which is adjusted over the touch-hole, and so arranged as to the other part of the lock, that a smart blow bursts the cap and explodes its contents: the little cell itself is destroyed, so that a new one is required for each firing. The size of the cell, or 'percussion-cap,' the nature of the mixture, the quantity employed with each charge, and the mechanism for firing it, have been the subjects of many improvements within the last few years, some of which are patented. The caps are now made in large numbers at Birmingham, in much the same manner as metal buttons; blanks being cut out of sheet copper or mixed metal, and stamped or pressed into the proper shape. One of the recent inventions has been to make the cap double, or one cap within another, with the mixture between the two, and a small hole in the inner one to communicate with the gunpowder.

Many contrivances have also been suggested for applying these caps under a modified form to larger guns. Thus, Commander Henderson, in 1838, contrived a means whereby a ship's armourer could adapt percussion caps to the common guns of a ship. The cap is applied to the touchhole, covered with an iron cap, and exploded with a slight blow from a mallet.

The detonating compound, with or without the small containing copper cap, has been applied to several varieties of shells to be fired from mortars, and to explode only when the shell strikes against the object against which it is directed. In ordinary circumstances a bomb-shell, or similar missile, has a fuse so attached to it as to ignite the gunpowder within after a certain space of time; but the object of the detonating shells is to dispense with such a fuse. Colonel Maceroni, in 1826, proposed the use of shells in which a short tube was screwed into one side of the shell, and a percussion cap placed in the tube, just before the shell was to be fired from the mortar: the striking of the shell against any solid object exploded the compound, ignited the gunpowder, and burst the shell.

Many other such shells have been from time to time proposed, of which those by Captain Norton were a good deal noticed in the public prints two or three years ago; the experiments at Woolwich, in 1842, with these shells, were made with the view of determining whether the shell would be *certain* to explode in striking the object. Another contrivance by Captain Norton was to make a shell explode when it reached the bed of the sea, but not before: there is an iron tube screwed into the shell, and an iron rod suspended within the tube by a piece of quill; a kind of wing or sail keeps the shell in one position during its descent throu h the water; and on striking the bottom, the iron rod falls through the tube, and a percussion cap attached to its lower end explodes. Another contrivance is to aid submarine explosions, for blasting or other purposes: a box filled with gunpowder is lowered to the bottom of the river or sea, and a sounding-lead provided with a percussion cap is guided down by a string so to strike the box, to explode the cap by the blow, and to ignite the gunpowder by the explosion.

Percussion caps are now used very extensively by sportsmen, and are also being gradually introduced into many of the armies of Europe.

CAPSELLA, a genus of plants belonging to the natural order Cruciferæ, the suborder Angustiseptæ, the tribe Lepidineæ. It has a triangular-obcordate pouch, compressed valves, keeled but not winged; numerous seeds, simple filaments. The species of the Linnæan genus Thlaspi, without wings to their valves, form this genus. The best known is the common Shepherd's Purse (*C. Bursa Pastoris*). It is an annual herb, very variable in habit, a follower of man, and springs up wherever he fixes his abode. As a weed it is frequently very troublesome in gardens. It may be got rid of by hoeing in hot and dry weather whilst it is in flower, but if it be allowed to ripen its seed, it is with difficulty eradicated. Koch describes several varieties of this plant. He also describes two other species as inhabitants of Germany, *C. procumbens* (*Lepidium procumbens* of Linnæus), and *C. pauciflora*, apparently a variety of the last.

(Koch, *Flora Germanica;* Babington *Manual Brit Bot.*)

CAPSTAN. [Windlass, P. C.]

CARADOC FORMATION, the uppermost of the two great divisions of the lower Silurian strata of Murchison. It is not well and clearly seen except in Salop, the Abberley and Malvern Hills, Woolhope, May Hill, and other points on the eastern borders of Wales.

CARA'GLIO, GIANGIA'COMO, a very celebrated old copper-plate, medal, and gem engraver, born at Verona or at Parma, about the commencement of the sixteenth century. He was the pupil of Marcantonio at Rome, and is one of the best of the early Italian engravers. His prints are rather numerous, though their number has not been accurately ascertained. Bartsch describes sixty-four; and Brulliot knew only of sixty-five. In the latter part of his life Caraglio gave up engraving on copper, and confined himself to medal, cameo, and gem engraving, an art in which he obtained so great a reputation, says Vasari, that Sigismund I., King of Poland, invited him to Warsaw to execute some works for him. He returned to Italy well rewarded, and died about 1570, at his own estate in the neighbourhood of Parma. The fact of his settling in the Parmesan territory is in favour of the supposition that Parma was his native place: he signs himself Parmensis on several of his works, yet more are signed Jo. Jacobus Veronensis; some Jac. Caralius.

He engraved after Il Rosso, Raphael, Titian, Michelangelo, P. del Vaga, Julio Romano, Parmegiano, and other famous masters. His heads are well executed, as is the nude generally, but the draperies are hard and unnatural: his lines are distinct and show great mastery for the period, but he did not reach the excellence of his master Marcantonio.

(Vasari, *Vite de' Pittori*, &c.; Bartsch, *Peintre-Graveur;* Brulliot, *Dictionnaire des Monogrammes*, &c.)

CARAVA'GGIO, POLIDO'RO DA, a celebrated Italian painter, born at Caravaggio about 1495; his family name was CALDARA. When he was eighteen years of age he was a labourer, and was with many others employed as such about 1512 in the Vatican, when Raphael was painting the loggie and stanze there, in the pontificate of Leo X. He appears to have taken great interest in the progress of the works, and he made some attempts at design himself, which had sufficient merit to induce Maturino of Florence, one of the assistants employed, to undertake to teach him to draw, for which he soon displayed extraordinary ability. A strong attachment grew up between the two young painters. Maturino employed Polidoro to assist him in his work. Their joint labour soon attracted the notice and admiration of Raphael, and Polidoro was considered, before those works were completed, says Vasari, the 'più bello e più nobile ingegno' of all the young painters employed.

Vasari evidently gives the greater merit to Polidoro, but as the later works which he painted when alone, were very different in style from these and others which were done in Rome in this period, in company with Maturino, some recent writers have ventured to give Maturino the greater credit. These works were in fresco and in light and shade, or what the Italians call *chiariscuri*, and consist mostly in friezes and other decorations in imitation of bronze or marble, applicable for buildings, interiors or exteriors. Their figures, of which they were not sparing, were drawn in a pure antique style, and not inferior in that respect to the works of any modern master. They imitated antient statues and bassi-rilievi, and antient sculptured ornaments of any kind. Vasari says that there was not a fragment of antient ornamental art in Rome which they did not copy; they painted also original works from sacred and modern story. Of all these works however, scarcely a vestige remains, but some are in a measure preserved by the prints of Cherubino Alberti, P. S. Bartoli, and Galestruzzi. The last engraved, in five sheets, the story of Niobe, which Maturino and Caravaggio painted as a frieze on the façade of a house opposite the Palazzo Lancellotti: it was one of their masterpieces.

The sack of Rome, by the soldiers of Bourbon in 1527, put an end to the joint labours of Polidoro and Maturino; they both fled, but Maturino is supposed to have returned, and to have died of the plague, in the same year. Polidoro went to Naples, where he was received into the house of Andrea da Salerno: he practised there some time, but finding that his works were not duly appreciated, he removed to Messina. Here, in 1536, upon the visit of Charles V., on his return from his victorious expedition to Tunis, he was intrusted with the conduct of the triumphal decorations on the occasion. He dwelt several years in Messina in high esteem, and executed many good works, not in his early style of chiariscuri, but in colours; and some of them were for altar-pieces: Vasari mentions a Christ led to Calvary amidst a crowd of people, as a masterpiece. In 1543 he made up his mind to return to Rome, having, to his misfortune, as it proved, amassed a considerable sum of money. Polidoro had provided himself with a large sum of money, and all things were prepared for his departure the ensuing morning; a servant whom he had had many years was to accompany him. This wretch however loved his master's money much better than his person, and he hired some assassins to strangle him during the night, when he was asleep, and shared his booty with the assassins, who, having stabbed the body of Polidoro in two or three places, carried it to the door of the house where a lady lived whom he had been in the habit of visiting; and the servant went weeping and lamenting, and related the discovery of the body to a certain count, a friend of Polidoro's. This count however eventually suspected the truth of the man's story, and caused him to be put to the rack, upon which he made a circumstantial confession of the whole infamous affair. The miserable wretch was tortured with heated forceps, hanged, and quartered, but as Vasari has observed, this did not bring Polidoro to life again: he was buried in the cathedral of Messina. Some of the pictures which he painted at Messina are in the Gallery of Naples. He excelled in landscape. He also etched several plates in a good style; they are however extremely scarce: the prints after him are likewise scarce.

(Vasari, *Vite de' Pittori*, &c.; Gandellini, *Notizie Istoriche*, &c.; Lanzi, *Storia Pittorica*, &c.)

CARBONIFEROUS SYSTEM, the great group of strata which includes nearly all the valuable coal yet discovered. It consists of

D. The coal formation.
c. The millstone-grit group.
B. The mountain limestone formation.
a. The limestone-shale group.

The portions marked *a*, *c*, are the least constant in range and character; the limestone-shale graduates in South Wales to Devonian strata, and in Ireland constitutes the yellow sandstone series of the northern counties. (Griffith.) Most of the coal of Ireland belongs to the millstone grit group.

CARDAMINE, a genus of plants belonging to the natural order Cruciferæ, the suborder Siliquosæ, and the tribe Arabideæ. It has a compressed pod, flat nerveless valves, a capitate stigma, the seeds in a single row, with the funiculus simple and filiform. The species, which are numerous, are usually smooth herbs, with stalked, entire, lobed, or pinnately cut leaves, and racemes of white or red flowers.

C. pratensis, Cuckoo-flower, Bitter-cress, common Ladies' Smock, has pinnate leaves, the leaflets of the lower leaves roundish, slightly angled, those of the upper leaf linear-lanceolate, entire; the petals three times longer than the calyx, spreading, the stamens half the length of the petals, stem terete. This plant has large lilac-coloured flowers, and is exceedingly abundant in some parts of the country. It has a bitter taste, hence its name Bitter-cress. It is generally in blossom when the cuckoo returns to this country, and at that period covers the fields as though linen was bleaching: these circumstances explain its other common English names. It still retains a place in the London and Dublin Pharmacopœias, but why it is difficult to say. At one time it had the reputation of being a diuretic and antispasmodic, and a drachm of the flowers was administered as a dose in hysteria, chorea, epilepsy, and other nervous affections. It is a native of Europe, Asia, and America, and is abundant throughout Great Britain.

Babington describes four other species of Cardamine as natives of Great Britain, *C. impatiens*, *C. sylvatica*, *C. hirsuta*, *C. amara:* with the exception of the last they are common plants. *C. bellidifolia* has been figured in the 'English Botany' as a British plant, but no station for it is known. The leaves of *C. hirsuta*, when ripe, and laid upon the ground, put forth buds which produce a new plant. It is extensively propagated in this way in moist soils. It is said that other species have the same property. *C. impatiens* is so named from its pods when fully ripened expanding suddenly with force when touched, and throwing the seeds to a distance.

These plants are easily cultivated. Many of the perennial species are ornamental, but the annual and biennial species look like weeds. They will grow in almost any kind of soil, but most of them prefer a damp shady situation. The annual species may be increased by seed, the perennial by dividing the roots.

(Don, *Gard. Dict.;* Loudon, *Encyc. of Plants;* Babington, *Manual of British Botany.)*

CARDAMINE PRATENSIS—*Medical Properties of.* This indigenous herbaceous plant decorates our meadows and pastures in April and May with its light purple reticulately veined flowers, which are the officinal parts. They possess a faint mellifluous odour, which is nearly lost by drying. The taste is acrid and pungent, similar to but less agreeable than that of the common watercress, which is dissipated by age. The chief constituents are a bitter extractive and a volatile oil. To these it is indebted for such medical powers as it possesses, which are very slight, and altogether insufficient to entitle it to a place in the Pharmacopœia. It is said to be stimulating, diuretic, and anti-spasmodic; and hence of service in hysteria, chorea, and epilepsy. In some of the slighter cases of these, dependent on irritation of the intestinal canal, from imperfectly digested food, unhealthy secretions, or worms, it may, along with purgatives, bitters, and exercise, be of some benefit. It is however as an anti-scorbutic herb that it is best entitled to notice. The health of many persons is low in early spring from the want of green vegetables during winter, and the blood passes into the condition which obtains in persons suffering from scurvy. The use of fresh vegetables, such as this, and watercresses, with fruits, and lemon-juice, will spedily remove this state.

(Lecture of Dr. Budd on *Scurvy*, in *London Medical Gazette*, vol. xxxii. p. 713.)

CARDI, LUDOVICO. [Cigoli, P. C. S.]

CARDIFF. [Glamorganshire, P. C.]

CARDS, CARD-MAKING MACHINE. In the cotton manufacture one of the early processes consists in disentangling the fibres of cotton, so as to arrange them in a position more or less parallel, free from knots or other interruptions. The instrument employed for this purpose is a kind of brush called a 'card,' set with wire-teeth disposed in a regular manner. The action of this instrument is very similar to that of a comb for hair, or a heckle for flax and hemp, the fibres being made to pass between the teeth, or the teeth between the fibres, according to the arrangements of the mechanism. The wire teeth of the cards are inserted in carefully-prepared strips of leather, which used formerly to be affixed to flat handles or supports, but are at the present day bent round the exterior surface of a cylinder. Several such cylinders being arranged nearly in contact, and fibres of cotton being laid within reach of one of them, the cylinders by their rotation catch up the fibres, pass them on from one to another, and comb out or straighten them in the transit.

When the manufacture was in a ruder and less important position than at present, these cards were made by hand; the leather being dressed and cut, the holes pierced, the wire straightened and brought to the necessary shape, the teeth cut off and inserted into the holes in the leather, by persons who made this a regular branch of employment. But machines are now employed to effect this, so intricate and beautiful in construction as to have been often alluded to as among the most admirable pieces of mechanism known in our workshops and factories. It was in the year 1811 that Mr. Dyer, of Manchester, first took out a patent for one of these machines; two other patents were obtained in 1814 and 1824; and more recently further improvements have been made in the construction by Mr. Walton.

The machine consists of a large number of levers or rods, capable of motion in various directions, and moving one after another in a particular and definite order. The different kinds of work to be performed by it are so numerous and so dissimilar, that the mass of details becomes exceedingly complex, and not easily followed even with the aid of woodcuts. In the first place, the strips of leather which are to form the cards are attached to the machine, in such a way as to shift laterally as fast as they are supplied with wires. A series of forks or points are thrust out, to pierce holes of the requisite depth in the leather, and are drawn back again when this is effected; sliding pincers unwind the wire from a coil, and bring it forward, a moveable cutter descends upon each wire, and cuts off a piece long enough for one of the teeth; a blunt kind of stud or rod presses against the middle of the piece so cut off, and presses it into a staple-shape, with the two points parallel; each staple or tooth is seized by nippers, thrust half-way into a hole in the leather, bent angularly by another piece of apparatus, so as to give an exactly determined obliquity to it, and lastly driven home to its proper depth in the hole. All this is effected by successive movements in the different parts of the machine; and several teeth, forming those in one row, are made and fixed at once. When one cycle or series of the processes is completed, the leather is made to shift onwards through a small space, and to present a new surface for the reception of teeth.

The efficiency of the machine was such, even some years ago, that a steam-engine of five-horse power could set a hundred of them at work, while each machine could make and fix from a hundred to a hundred and fifty teeth in a minute; but successive improvements have so increased the power, that now four or five hundred teeth are formed in the same space of time. There are not often opportunities of seeing these beautiful machines, except in the Lancashire and Yorkshire districts; but occasionally they are exhibited at Mechanics' and Scientific Institutions. At an exhibition of works of art in Leeds, in the autumn of 1843, one of them was shown at work, the cards being properly filled by the agency of the same steam-engine which set many other pieces of mechanism in action.

So large is the consumption of this kind of 'garniture,' as it is called, for the carding-engines of the cotton districts, that it has been estimated four thousand hides and forty-eight thousand feet of wire are cut up weekly to make them. The wires are inserted in leather, because the flexibility of this material allows it to be bent round the surface of a cylinder. Patents have been recently taken out for improving the surface of these leathers. If a hard and tangled tuft of cotton occurs in the process of carding, the rigidity of the surface of the leather prevents the tooth from bending or yielding to the obstruction; and it has been proposed to remedy this by applying to the face of the leather, before the wires are inserted in it, a coating of woollen cloth, saturated with caoutchouc to render it very pliable. Another suggestion is for the use of a textile material, with a warp of hemp, flax, or cotton, and a weft of woollen, saturated in like manner with a solution of caoutchouc. But both are alike in their object, and have relation only to the minor working of the method, the card-making machine being independent of them.

CARDU'CCIO, the name of two very able Florentine painters, brothers, who settled and chiefly resided in Spain, where, agreeably to Spanish orthography, they wrote their name Carducho.

Bartolomeo, the elder, was born in 1560. Vincenzio, the younger, was born in 1568. Bartolomeo was painter, sculptor, and architect, and was the scholar of Federigo Zuccaro, whom both brothers accompanied into Spain, in 1585, where they attained great distinction in the service of the kings Philip II., III., and IV. Bartolomeo was equally excellent in fresco and in oil, and there are still some of his works extant in Spain. He drew in the style of the antique, and with great exactness; he excelled also in composition, in expression, and in colour. There is a Deposition from the Cross by him in a chapel of San Felipe el Real at Madrid, which Cumberland says may well be taken for one of Raphael's. His principal works were the frescoes he painted in the Escurial; he painted also works at Segovia, Valladolid, and Miraflores: and according to Cean Bermudez few Italian artists did so much for the arts in Spain as Bartolomeo Carducho. He died at Madrid in 1608, having served the Philips II. and III. for twenty-three years. The latter, who had appointed him his painter, granted a pension to his widow, and to his two daughters, both of whom were born in Madrid. Vincenzio was the scholar of his brother, and succeeded him as painter to Philip III. in 1609, and his services in the advancement of the arts in Spain were even greater than those of his brother, though in the technicalities of art he was a less able painter. He however educated a numerous school, and in 1633 published a book of dialogues on painting in Spanish, 'Dialogos sobre la Pintura,' &c., which, says Bermudez (1800), is the best work in the Castilian language on the subject. He died in 1636. There are many of his works at Madrid, and some at Valencia, Toledo, Salamanca, and Valladolid, but his greatest work is the series of paintings from the life of Saint Bruno and other saints, in the Carthusian Convent of Paular, commenced in 1626 and finished in 1630.

(Cean Bermudez, *Diccionario Historico*, &c.; Cumberland, *Anecdotes of Eminent Painters in Spain.*)

CA'RDUUS. [Thistle, P. C.]

CAREW, THOMAS, born in 1589, of a good family in Gloucestershire, was educated at Oxford, and attached himself to the court of Charles I., at which he held several easy offices. He died in 1639, leaving a volume of small poems (1640, 8vo.), besides scattered pieces never yet wholly collected, and a masque, 'Cœlum Britannicum,' 4to., 1634. Carew's poems are light and airy effusions, chiefly lyrical, and all dealing with topics of a trifling kind. But their merit in their own kind is great. Thomas Campbell pronounces him to be pre-eminently beautiful among poets of his class; and Mr. Hallam hesitates in determining the preference between him and Waller, to whom he holds Carew superior both in fancy and in tenderness, though inferior in judgment and in care of execution. Two of the best poems in his volume appear also among the pieces of Herrick.

CAREY, HENRY, was said to be an illegitimate son of George Saville, marquis of Halifax. He was professionally a musician in London, but attained no great success in his art; although he composed both the words and the music of several songs. One of these was the popular song of 'Sally in our Alley.' He wrote several farces and musical pieces for the stage; among which were 'Chrononhotonthologos,' 1734, and 'The Dragon of Wantley,' 1737. His pecuniary affairs were repeatedly much embarrassed; and, in a fit of despondency, owing perhaps to this cause, he put an end to his own existence, in 1743.

CAREX, a genus of plants belonging to the natural order Cyperaceæ, and to the tribe Cariceæ. The flowers are diclinous, arranged in imbricated spikes, each covered by a glume; the female flowers have a single urceolate persistent perigone, in which the nut is completely inclosed; one style with two or three stigmas; the male flowers have three stamens without a perianth. The species for the most part are inconspicuous and unattractive plants. They are however exceedingly numerous. Lindley, in Loudon's 'Encyclopædia of Plants,' describes one hundred and five species, and this is probably not more than half that are now known. Babington describes sixty-six species as natives of Great Britain, being the largest number of species of any genus of phænogamous plants in this country. Koch, in the 'Flora Germanica,' describes one hundred and three species as natives of Germany and Switzerland. Although so numerous, they serve directly few of the purposes of man or the higher animals. Their leaves are tough and hard, so that none of them are eaten by cattle except in cases of great necessity. They are for the most part inhabitants of wet and swampy grounds, in bogs, fens, and marshes, in the temperate and northern parts of the world. In the hop-grounds of Great Britain the leaves of some of the species are used for tying the bines of the hops to the poles. In Italy they are used for placing between the staves of wine-casks, are woven over Florence flasks, and occasionally employed for making chair-bottoms. The leaves of the *Carex sylvatica*, according to Linnæus, are combed and dressed, and used as a warm lining for gloves and shoes; and thus protected, the Laplanders seldom suffer from being frost-bitten.

C. arenaria has a place in some of the continental Pharmacopœias; its root-stock being a reputed diaphoretic and diuretic. It is used under the name of German Sarsaparilla, and is employed in cases of skin-disease, as well as in secondary syphilis. The *C. hirta* and *C. disticha* are often substituted fraudulently or by mistake for it, but do not, according to Bischoff, possess such active properties. It is not known to the practitioners in medicine of this country.

C. arenaria grows on the sands of the sea-shore, and is one of the plants which, in conjunction with the Elymus and Arundo, binds the loose sands, and forms them into solid embankments. Although most of the species are devoid of striking beauty, some of them when in flower are much admired on account of the elegant drooping of their panicles of golden-coloured flowers. This is the case with *C. remota* and *C. Fraseri*. Unattractive as the mass of these plants are to the general observer, they have been carefully studied by botanists, and Willdenow, Goodenough, Wahlenberg, Sckuhr, Scopoli, Boott, Babington, and S. Gibson have done much to throw light upon this obscure genus. Their importance in nature however must not be estimated by their appearance, or their utility to man. They frequently form the only vegetation of the swamp, and by their existence and decay they gradually form a soil, on which plants more immediately useful to man may be grown.

CARLI, or CARLEE. [Poonah, P. C.]

CARLI'NA. [Thistle, P. C.]

CARLISLE, SIR ANTHONY, surgeon, was born near Durham, in the year 1768. He commenced his professional education with an uncle at York, and from thence he was transferred to Durham, where he remained for some time under the instruction of Mr. Green, the founder of the hospital in that city. Having finished his preparatory studies he repaired to London, and attended the lectures of the Hunters, Dr. Baillie, and Mr. Cruikshank. He was at the same time pupil to Mr. Watson, then surgeon to the Westminster Hospital. On the death of Mr. Watson, in 1793, Mr. Carlisle was appointed his successor. He became a member of the College of Surgeons, and was early appointed one of the council of that body. He was for many years on the Board of Examiners, and one of the curators of the Hunterian Museum. He also held the appointment of Professor of Surgery and Anatomy, and in 1829 he filled the office of President. He was appointed Surgeon Extraordinary to George IV., when he was Prince Regent, and was knighted by him at the first levee he held as king. He was also surgeon to the late Duke of Gloucester, to whom he was introduced by the learned Dr. Samuel Parr. In 1808, on the death of Mr. Sheldon, he was appointed Professor of Anatomy to the Royal Academy, an office he held for sixteen years.

Sir Anthony Carlisle owed his position to the activity and industry with which he pursued the various departments of science connected with his profession. His early acquaintance with John Hunter gave him a taste for comparative anatomy, which he pursued with much ardour, and many of his earlier literary productions were on this subject. One of his first papers was 'A Case of an unusual Formation in a part of the Brain,' which was printed in the Transactions of a Society for the Improvement of Medical and Surgical Knowledge in 1793. To the second volume of the Transactions of the Linnæan Society, published in 1794, he contributed a paper entitled 'Observations upon the Structure and Economy of those Intestinal Worms called Tæniæ.' He supposed these Entozoa fed on chyle, and that their organization was adapted to their food. In 1800 he was admitted a Fellow of the Royal Society, and contributed a paper to the Philosophical Transactions of that year, entitled 'An Account of a peculiar Arrangement in the Arteries distributed on the Muscles of slow-moving Animals.' This paper was the result of dissections of the Lemur Tardigradus and Bradypus Didactylus, in which the author pointed out the peculiar distribution of the arteries in these animals. He conceived that the division and anastomosing of the arteries tended to retard the velocity of the blood, and thus to secure a greater supply to the muscles of these animals, which living upon trees and only moving slowly, required that their muscular system should be constantly in action. There are several other anatomical and physiological papers by him in the Philosophical Transactions: 'An Account of a monstrous Lamb,' 1801; 'The Physiology of the Stapes,' 1805; 'Account of a Family having hands and feet with supernumerary fingers and toes,' 1814. After the paper on the distribution of the blood-vessels in the slow-moving animals, his attention was directed to the connection between the circulation of the blood and the action of the muscles, and in 1804 he gave the Croonian lecture on 'Muscular Motion.' In this lecture he pointed out the difficulties which then invested the subject, and which may have been the means of drawing the attention of others to the subject, who followed up the inquiry with more success.

To medical literature more especially Sir Anthony made many contributions. One of the first was 'On the Nature of Corns and the mode of removing them,' published in Simmons's 'Medical Facts and Observations,' 1797; 'A New Method of applying the Tourniquet,' Lond. Med. and Phys. Journal, 1797; 'On the general and indiscriminate use of Bougies,' Ibid. 1800; 'Letter to Sir Gilbert Blane on Blisters, Rubefacients, and Escharotics, giving an account of the employment of an instrument adapted to transmit a defined degree of heat to effect those several purposes,' London, 1826. In 1817 he published a larger work entitled 'Essay on the Disorders of Old Age and the means of prolonging Human Life,' 4to. London. A second edition was published in 8vo. in 1818. This work is principally devoted to the dietetics of the aged. There is also a good chapter on the subject of the propriety of performing certain surgical operations on aged persons. It is probable that amongst old people, if the question were examined statistically, the knife kills many more than the diseases it is intended to remove. In 1829 Sir Anthony published 'an alleged discovery of the use of the spleen and thyroid gland,' being a paper read at one of the evening meetings of the College of Physicians. The author's object was to demonstrate the connexions and the physical effects produced by these organs upon more important contiguous parts, and thus to offer an explanation of their respective offices. That he failed to perform this, the still unexplained functions of these organs proves.

During his connection with the College of Surgeons he delivered two of the Hunterian orations: one in 1820, and one in 1826. The first was on the constitution of organised bodies, and the second on the connection between vascular and extra-vascular parts. There are some preparations illustrative of the union of these parts in the Hunterian Museum prepared and presented by Sir Anthony Carlisle. One of his last papers on medical subjects was published in the 'London Medical Gazette' in 1828, 'On Erysipelas,' in which he regards this disease as 'a humoral and constitutional inflammation, occasioned by alimentary crudities, because certain vegetable acids and acidifiable viands are often the notorious antecedents of the disease.' It was manifest from this and other papers that he was not keeping up with the knowledge of his day.

He published numerous other papers: two on plants, in the 'Horticultural Transactions,' two on antiquities, in the 'Archæologia;' on the breeding of eels, and the health of workmen in sewers, in the 'Philosophical Magazine;' on the decomposition of Eggs, in 'Nicholson's Journal;' and on Cathartics, the bite of vipers, the venereal disease, &c., in the 'New Medical and Physical Journal.' One of the most remarkable of his papers on general subjects was one on 'Galvanic Electricity,' in 'Nicholson's Journal,' in which he first pointed out the fact that water might be decomposed by the galvanic battery. He was also a frequent contributor to the newspapers, and letters of his appeared in the 'Times' on the Salt-Duties, the importance of Salt to the Health of Human Beings, Military Flogging, Hygeian Quackery, &c. Amongst other subjects on which he wrote with great vehemence was that of man-midwifery, and in the 'Times' of February 26, 1829, is a letter addressed to Mr. Robert Peel on that subject, earnestly entreating him, for the sake of propriety, not to degrade the College of Surgeons by making midwifery a part of the requirements of a surgeon.

Great progress was made in this country in surgical science at the beginning of this century, and Sir Anthony early in life was always anxious to improve, and surgery is indebted to him for many minor improvements in instruments, &c. 'He first,' says Mr. Pettigrew, 'substituted the thin-bladed straight-edged amputating knife, approaching in its kind to the ordinary carving-knife, for the clumsy crooked knife of former days; and also was the first to employ the carpenter's saw, simple in its construction compared with that formerly employed. He was the first to use the *bistouri caché* in this country, and he has by the aid of Mr. Stodart introduced various improvements in surgical apparatus.'

The talents of Sir Anthony Carlisle consisted in his observing power. His contributions to science are frequently deficient in sound generalization. His rapidity of observation and his power of application made up for this deficiency, and gave him a position while he lived which his works will hardly claim for him now that he is dead. He died in London, on the 2nd of November, 1840.

(Pettigrew, *Medical Portrait Gallery; Lancet; London Medical Gazette.*)

CARPENTER, DR. LANT, was born September 2, 1780, at Kidderminster, and was descended both on the father's and mother's side from old non-conformist families in that town. In consequence of his father's failure in business, he was at an early age adopted by a Mr. Pearsall, a relation of his mother, a man of piety and benevolence. To his care and instruction young Carpenter was much indebted, and while a boy in Mr. Pearsall's family he began to display that self-denying benevolence and that interest in education which characterised him through life. Mr. Pearsall had established a Sunday-school at Kidderminster, about the time that Mr. Raikes commenced his Sunday-school at Gloucester, and without knowing of Raikes's efforts. Young Carpenter, then eleven years of age, who taught in his school, was anxious to give to the boys of his class some additional instruction in writing and arithmetic, and other branches of useful knowledge, during the week. As they went to their work at five in the morning, he was called by them at four o'clock to give them their lesson before the commencement of their daily labour. This he continued through the year, the lesson in summer being given under a mulberry-tree, and in winter in a small summer-house without fire.

His school-education was received partly under the Rev. Robert Gentleman, minister of the congregation to which Mr. Pearsall belonged; partly under the Rev. W. Blake, who conducted a school at Kidderminster, which Mr. Pearsall had founded and endowed for the better instruction of the sons of dissenters of the middle class; and partly under his uncle, the Rev. B. Carpenter of Stourbridge. Being designed for the ministry, he was sent (A.D. 1797) at the age of seventeen to the academy at Northampton, which had been established by Dr. Doddridge, and which still exists in London under the designation of Coward College. But about a year after Lant Carpenter entered it, the establishment was for a time broken up, the trustees being dissatisfied with its condition, and especially with the real or supposed heterodoxy of the students. Lant Carpenter's friends were probably for the most part Arians: his own views appear to have been still more remote from the standard of reputed orthodoxy. The students had however their exhibitions continued to them for the full term, and Lant Carpenter finished his academical career at the university of Glasgow, though he was obliged to leave (A.D. 1801) too soon to take a degree, but furnished with the most gratifying testimonials from the professors under whom he had studied.

On leaving college he was engaged for a time as assistant in the school of the late Rev. J. Corrie at Birmingham, and was afterwards one of the librarians of the Athenæum at Liverpool, where he became acquainted with Mr. Roscoe, Dr. Currie, and other literary men. While here, he received overtures from several congregations to become their minister, and was offered a tutorship in Manchester College, York, the principal academical institution of the Unitarians. He declined these, but accepted an invitation to succeed the Rev. T. Kenrick as one of the ministers of the Unitarian congregation at Exeter, to which place he removed in 1805. About this time he married. He remained at Exeter twelve years, fulfilling the duties of his sacred office with exemplary diligence, and especially devoting himself to the instruction of the young people of the congregation. He had also a small boarding-school. In 1806 he applied for the degree of M.A. to the university of Glasgow, and the senate sent him instead the degree of LL.D.

While at Exeter Dr. Carpenter was engaged in controversy with some of the clergy of the town and with other persons, but however unpopular his opinions might be, he was held personally in the highest regard. In 1808 he proposed the establishment of a public library at Exeter, took the lead in carrying the proposal into effect, and managed the institution for the first year. This library still exists. He also aided in the establishment of a Lancasterian school and of a savings'-bank in the town, and incited his congregation to establish a Sunday-school. He occasionally took part in public affairs when questions of religious liberty were concerned; and in 1813 moved the adjournment of a meeting held to oppose the Roman Catholic claims; and failing in this, got up a counter petition in support of those claims.

In 1817 he removed to Bristol, as one of the ministers of the Unitarian congregation there. Here his labours in the discharge of his ministerial duties were continued; and his own school was much enlarged. He also interested himself in objects of general utility, and took an active part in organizing the Bristol Literary and Philosophical Institution. Among his coadjutors in this work were the Rev. W. D. Conybeare, Mr. (now Sir) H. T. Delabeche, and Dr. J. C. Prichard. He did not take part in the establishment of the Bristol College, as he was given to understand that his religious sentiments would render his co-operation injurious rather than otherwise. In his own congregation he succeeded, amid some discouragements, in the establishment of a Sunday-school, and continued his exertions for the instruction of the young people of his congregation.

These various exertions, combined with the preparation of his numerous publications, were too much for his strength. He had been laid by through illness for a year in 1807, and would have resigned his ministry at Exeter, but for the affection of his congregation. In the summer of 1826 he was again laid aside: both body and mind had been overwrought, and a long and painful season of weakness and depression ensued. He resigned his pastorship at Bristol and spent some time in travelling in England and on the Continent; by which his health and spirits were gradually restored. At the beginning of 1829 he resumed, by invitation, his ministry at Bristol, the congregation having abstained from appointing a successor, in hope of his recovery; but his school, which had been for a time carried on for him, was given up. In 1839 his health, which had been for some time declining, once more gave way, and in June a painful depression of health and spirits came on. He was again recommended to travel, and while going in a steam-boat from Naples to Leghorn, fell overboard unperceived and was drowned, in the night of the 5th April, 1840. His body was afterwards found on the coast of the Papal territory near Porto d'Anzo, the antient Antium, and was interred on the sea-shore.

Dr. Carpenter was an industrious and useful writer. His publications, including those which were posthumous, amounted to forty-four. Many of these were polemical or other sermons or pamphlets which do not require notice here. The following are his more important works:—1, 'An Introduction to the Geography of the New Testament,' 12mo., 1805: this work has gone through six editions. 2, 'Unitarianism the Doctrine of the Gospel,' 12mo., 1809: this has gone through three editions. 3, 'An Examination of the Charges made against Unitarianism, &c. by Dr. Magee, in his Discourses on Atonement,' &c., 8vo., 1820. 4, 'Principles of Education, Intellectual, Moral, and Physical,' 8vo., 1820: this work is a reprint of articles which he had contributed to Rees's 'Cyclopædia.' 5, 'A Harmony or Synoptical Arrangement of the Gospels,' with dissertations, notes, and tables, and illustrated by a map and plans, 8vo., 1835: a second edition, under the title of 'An Apostolical Harmony of the Gospels,' was published in 1838. It is probably on this valuable work that Dr. Carpenter's reputation as a divine and an author will ultimately rest. 6, 'Sermons on Practical Subjects,' 8vo., 1840: this posthumous volume was edited by his son, Dr. W. B. Carpenter, a gentleman well known as a physiologist and natural philosopher. A deeply interesting memoir of Dr. Carpenter, by his second son, the Rev. Russell Lant Carpenter of Bridgewater, forms a companion volume to the Sermons, and has furnished the materials of the present article. 7, 'Lectures on the Scripture Doctrine of Atonement,' 12mo., 1843; also posthumous, edited by his third son, the Rev. P. P. Carpenter of Stand near Manchester. Besides his separate publications he contributed the chapters on Grammar, Mental and Moral Philosophy, and Antient Geography, to a work called 'Systematic Education,' 2 vols. 8vo., 1815; his coadjutors in which were Dr. Shepherd of Gatacre near Liverpool, and the late Rev. J. Joyce. This work has gone through three editions. He contributed the articles on Grammar, and Mental and Moral Philosophy, to Nicholson's 'Cyclopædia;' on Education, on Language, and on Philosophy, Mental and Moral, to Rees's 'Cyclopædia;' and several papers to Aikin's 'Annual Review.' He was also a frequent contributor to the periodicals of his own religious denomination. He edited two selections of hymns and some other works.

Few men have been more deservedly esteemed than Dr. Carpenter. Even the strongest opponents of the theological system with which he was identified softened their tone when speaking of this good man. As an instance of this it may be mentioned that his 'Harmony' and 'Practical Sermons' and the Memoir of his Life were favourably and largely reviewed in the 'Eclectic Review.' Men of all opinions testified their cordial respect for him. In his own denomination his extensive influence was derived perhaps more from the reverence felt for his piety and goodness, than from his varied attainments and his literary eminence; and among his family and friends, and even among those who had, like the writer of the present notice, but few opportunities of personal intercourse, his memory will ever be cherished as something peculiarly dear and sacred.

CARPENTRY is defined by Robison as 'the art of framing timber for the purposes of architecture, machinery, and in general for all considerable structures.' Considered as a branch of the art of building, it embraces the construction of the framing of partitions, floors, and roofs; the neater woodwork of doors, window-frames, the planking of floors, skirtings, and stairs, being the work of the joiner. [Joinery, P. C. S.]

As in the article Building, P. C. S., our object here is rather to point out and connect various articles in other parts of the work than to present even a complete outline of the theory and practice of carpentry, which involves a knowledge of the nature and properties of various descriptions of timber, of the strength of materials exposed to various kinds of strain, of the mechanical principles involved in the construction of trusses, roofs, and the various framings which tend to bind the several parts of a building together, or to sustain and distribute pressure, and of the practical details relating to the cutting up of timber, and the union of several pieces by various kinds of joints and connections.

Of the properties of timber an account is given under Wood, P.C., p. 518, and also, in connection with other matters relating to theoretical carpentry, under Materials, Strength of, P. C., p. 8. Of the woods used in carpentry in this country oak is one of the most durable, though its comparatively high price, and the difficulty of working it, restrict its use. It should be borne in mind however, that the irregular direction of the fibres of oak greatly impairs its strength when sawn into beams and planks, so that a sawn beam of oak may be weaker than one of equal size of fir, because in the latter the fibres extend in almost perfectly straight lines from end to end, while in the former their course is so tortuous that those which come near the surface are frequently cut through by the saw. Hence arises the superiority, for some purposes, of split over sawn timber, to which allusion is made under Saw, P. C., p. 476. Fir, which is very easy to work, and is peculiarly advantageous for house carpentry, on account of its straightness, is the timber most extensively used by English carpenters. The supply is chiefly from foreign countries, and the principal forms in which it is brought are those of *baulks*, or large beams of various sizes, each of which consists of a whole trunk roughly squared; *deals* and *deal-ends* [Deals, P. C., p. 338], which are boards from 2½ to 4 inches thick, and more than 7 inches wide; and *battens* and *batten-ends* [Battens, P. C., p. 41], which are similar to deals, but only 7 inches wide. Various technical terms are applied to the smaller pieces of timber cut out of baulks, deals, and battens, the transverse dimensions of which are frequently called their scantling. [Scantling, P. C., p. 10.] *Stuff* is a general name given by carpenters to the wood upon which they operate. By the drying-up and evaporation of its vegetable juices, timber will continue to shrink for a considerable time after it is hewn, and in so doing it frequently warps or winds, and splits, or becomes *shakey*, or full of longitudinal cracks, which, as noticed under Saw-Mill, P. C., p. 481, are usually in a radiating direction as regards the centre or heart of the tree. The shrinkage alluded to is almost entirely in a lateral direction, the length of a piece of timber, in the direction of its fibres, being affected only in the most trifling degree. To prevent as far as possible the injurious effects of shrinking, warping, and flying or cracking, all timber should be well seasoned by long exposure to a current of air before it is used, an object which is effected by various modes of stacking and piling with interstitial openings for the admission of air; but as no ordinary amount of seasoning will perfectly accomplish the desired object, precautions should be adopted to lessen the evil of subsequent shrinkage. Where it is required to bend timbers they are softened by boiling or steaming, then brought to the required shape, and secured at the proper curvature until they become cold and dry, when they will retain their new form with very little variation. For the various modes of cutting timber see the articles Saw and Saw-Mill, already referred to, and Wood-Cutting Machinery, P. C., p. 521; and for a notice of the principal boring tools used by the carpenter, see Boring Instruments, P. C. S., p. 225.

Of the employment of timber in immediate connection with brickwork, as in bond-timbers, wall-plates, camber-beams over doorways and windows, &c., a notice will be found under Building, P. C. S., p. 248; and in the articles Roof, P. C., p. 142, and Floor, P. C. S., will be found most of the information required in a work of this character on carpentry as connected with building. In Roof especially, and in the account of centering under Scaffolding, P. C., p. 498, an explanation is given of those elementary principles of trussing or combining several pieces of timber into a rigid framework in which the strength of each is used to the greatest advantage which must be applied, with such modifications as circumstances may dictate, to almost every construction in carpentry; while under Trussing, P. C., p. 318, the application of the same principles to the support of large beams or girders is explained. The construction of timber partition-walls, or rather of the timber framing of such partition-walls as are covered with lath and plaster, though based on the same general principles as are involved in the trusses of a roof, may be noticed here, because, though a distinct branch of carpentry, it does not, like the construction of floors, demand a separate article.

Partitions formed of brick-nogging, or of brickwork included within the intermediate spaces of a timber framing, are noticed under Building, and as, from their weight, they are inapplicable excepting in cases where there is a solid bearing or foundation for the whole length of the partition, as in basement partitions, or in such partitions of upper rooms as are immediately over partition-walls rising from the basement, they call for but little skill in the arrangement of the timbers. For such, and for lath and plaster, or, as they are called (from the use of small timbers denominated quartering in their construction), *quarter partitions*, wherever they rest upon a solid basis, it is sufficient to fill the rectangular framing which bounds the partition at the sides, top, and bottom with a series of upright rectangular bars, the greatest width or thickness of which is disposed in a direction at right angles with the face of the partition. These upright timbers, or quarterings, are placed at uniform distances from each other, the intervening spaces being, in a brick-nogging partition, either 18 or 27 inches, so as to receive either two or three bricks in length, while in other cases they are usually less; and the depth of the quarterings, which regulates the thickness of the partition, is usually from 3 to 5 inches. Those for brick-nogging, where the surface is to be covered with lath and plaster, should somewhat exceed the thickness of the brick-work, so as to allow for irregularities in the form of the laths. When however the floor upon which the partition rests is not solid, but unsupported in the centre, the whole stress should be borne by the extremities of the lower edge of the partition, which should be constructed as nearly as possible like the trusses of a roof, and should be capable of affording support to the floor above it, and also, if needful, to that below it, on which it appears to rest. The simplest mode of accomplishing this is to insert in the frame two inclined bars, resembling rafters, abutting upon the lower corners of the partition, which of course must be firmly supported by the timbers of the floor at the point where they rest upon the wall-plates or are otherwise immoveably connected with the brickwork, and either meeting in the centre of the top of the partition, like the rafters in Roof, *Fig.* 9, or being *joggled* into the head of a central upright timber resembling the king-post in Roof, *Fig.* 10, which, like it, may be made to support the middle portion of the bottom of the partition, and, if needful, the floor beneath it also. In either case the point of meeting becomes a fixed point for supporting the ceiling or floor above it. If the length of the partition be too great for this arrangement, or if a doorway be required where the central post would come, two posts may be used instead of one, with an horizontal bar of wood between their upper ends, the two uprights then resembling the queen-posts *i i*, and the horizontal bar the collar-beam *h*, in the truss represented in Roof, *Fig.* 11. The diagonal bars are called *braces*, and the horizontal piece between the posts is sometimes called an *intertie*, but the names are objectionable because their action is the reverse of that of a tie, or of what would be generally understood by a brace. Doorways often derange the bracing of partitions, and sometimes render it impossible to retain the advantage of the tie afforded by the bottom piece of the rectangular frame which bounds the partition. In some cases the intertie, or rather collar-beam, forms the head of the doorway; but as the doorway is mostly much lower than the partition, it is not unusual to extend the horizontal piece which forms the head of the doorway the whole length of the partition, and to form the long rectangular space above it, and the rectangular spaces below it on each side of the doorway, or the whole space below it, including the doorway, into separate trusses. The long unbroken truss above the doorway may indeed be made to support the whole partition without the aid of bracing in the lower compartments. Sometimes, instead of the ordinary mode of bracing, which necessarily interferes with the fixing of the upright quarterings to which the laths are to be attached, a mode of bracing with parabolic arches of iron or wood, as illustrated in Roof, *Fig.* 18, is adopted. The usual mode of bracing is occasionally used for brick-nogging partitions, or, in rural cottages, for the brick-nogging of external walls; but of course its adoption occasions much trouble in cutting the bricks to fit the oblique lines and angles produced by the braces.

Respecting the various kinds of joints required in carpenter's works some remarks are made near the end of the article Roof; while Scarfing [P. C., p. 13], or the mode of joining timbers longitudinally, is the subject of a separate article. Robison mentions an ingenious modification of the common mortise-and-tenon joint which is worthy of notice, under the name of *fox-tail wedging*. It consists in the insertion in the end of the tenon of a thin wedge, which, when the mortise is not cut through, but simply into, the piece of wood in which it is formed, is forced into the tenon, and consequently imparts to it somewhat of the dovetail form, by the mere act of driving the tenon into its place. Robison suggests that, to guard against the liability of the tenon to split beyond the shoulder, the required effect may be better produced by the use of several very thin wedges, which will collectively enlarge the end of the tenon in the necessary degree, than by the employment of a single wedge of greater thickness. This mode of wedging is much employed by ship-carpenters in securing tree-nails, which are the large pegs of wood used in certain cases in lieu of metal fastenings. The subject of naval carpentry is treated under Ship-Building, P. C., p. 393.

The series of articles written by Professor Robison for the 'Encyclopædia Britannica' on the science of carpentry, and republished, with notes, in his 'System of Mechanical Philosophy,' form perhaps the most valuable body of information on the subject; though the numerous practical works of Nicholson, by whom the treatise on carpentry in the 'Encyclopædia Metropolitana' was supplied, and Tredgold's 'Elementary Principles of Carpentry,' go much more into details. The nature of the last-mentioned work is noticed under Tredgold, P. C., p. 180.

CARPI, UGO DA, a celebrated old Italian wood engraver, who lived in the early part of the sixteenth century, and has the credit in Italy of having been the inventor of printing in light and shade with wooden blocks. Scarcely a circumstance of his life is known beyond the above, and that his father was Count Astolfo di Canicho. From his name it would appear that he was born at Carpi, but even this is disputed: he seems to have lived chiefly at Modena. He was also a painter, and some authorities make him the scholar of Parmegiano, others the scholar of Raphael. In painting however he did very little; only one of his pictures is recorded, St. Veronica between St. Peter and St. Paul, and that for the following singular inscription upon it:—'Ugo da Carpi ha fatto questa pittura senza pennello; chi non lo crede si becca il cervello' (Ugo da Carpi painted this picture without a brush; who does not believe it, may scratch his head). He painted it with his finger. It is still preserved in the Sacristy of St Peter's at Rome, and when it was shown to Michelangelo, he coolly remarked, 'It would have been a much better picture, if he had used a brush.'

Heineken and Bartsch describe thirty-one of Ugo's prints, but only some of these have his name to them. It is difficult therefore to identify his cuts, because Andreani and Antonio da Trento engraved in a similar style, and also published many prints without their names. Ugo's prints are very scarce, and nearly all after Raphael and Parmegiano; some of them are very large. They are generally well drawn, and executed with perfect understanding of the light and shade: the earliest date upon them is 1518. Vasari, in the Life of Marcantonio, mentions as among his masterpieces Diogenes and his Tub, after Parmegiano, and Æneas bearing away Anchises, after Raphael. He used generally three blocks; one for the outline, another for the middle tints, in which the high lights were cut out, and the third for the shadows.

(Vasari, *Vite de' Pittori*, &c.; Gandellini, *Notizie Istoriche degli Intagliatori*, &c.; Tiraboschi, *Notizie degli Artefici Modenesi*; Bartsch, *Peintre-Graveur*.)

CARPI'NI, JOHANNES DE PLANO. Early biographers and historians are so silent with regard to this remarkable monk of the thirteenth century, that we can neither discover the time nor the place of his birth. Indeed little is known of him except through his own account of his travels; and this account was probably not all written by himself. The probabilities are, that he was born at a village in the province of Capitanata, in the kingdom of Naples (Piano di Carpino), about A.D. 1210. He became a friar of the order of St. Francis, or of the Minorites—an order which was then recently established, and which was distinguished in its earlier stages by the zealous, enterprising, and fearless spirit of its members. In 1246, when Europe was thrown into consternation by the irruptions of the Mongols, who had ravaged Russia, Poland, Hungary, and other countries, Pope Innocent IV., after holding a grand council of the church at Lyon (1245), resolved to send legates to these formidable conquerors, in order to pacify them, and, if possible, to convert them to the Christian faith. For this purpose six monks or friars were selected from the new and severe orders, namely, two from the Franciscan order and four from the Dominican order. Johannes de Plano Carpini (as his name is latinized) appears to have been the first chosen by the pope, on account of his abilities and courage; and his companion, a monk of his own order, was one Benedict, a Polander, whose knowledge of some of the north-eastern countries of Europe was very useful. These two friars were instructed to take their route through Bohemia, Poland, and Russia, and then by the north of the Caspian Sea. The other four friars, Asceline, and Alexander, Albert and Simon de St. Quintin, were ordered to proceed through Syria, Persia, and Khorassan by the south of the Caspian Sea. The most fearful accounts prevailed of the ferocity and indomitable courage of these Asiatic invaders. A letter had been recently circulated, written by one Yvo of Narbona or Narbonne to the Archbishop of Bordeaux, containing the confession of an Englishman (who had lived among them), touching the barbarous demeanour of these Tartars. The Englishman, according to his confession, or according to this letter, had been perpetually banished out of the realm of England for certain notorious crimes, and had betaken himself to the Holy Land. Not long after his banishment, being at Acon (Acre, or St. Jean d'Acre), and thirty years old, he there lost all his money at dice. Then, having nothing but a shirt of sackcloth, a pair of shoes, and a hair-cap, and being shaven like a fool, he set out on his travels through Syria and Asia Minor; and, to prosper the better, he feigned idiotcy and dumbness, for idiots have been at all times objects of superstitious reverence with the Turks; and the pretence of being dumb aided in concealing the fact that he was a Ghiaour or Christian. After long wandering, he fell among the Mongol Tartars, learned their language, and went with them when they began to march upon Europe. The horde which he followed was defeated and driven back by a mighty army collected by the duke of Austria, the duke of Bohemia, the patriarch of Aquileia, and others, including the prince of Dalmatia, who took eight prisoners, and among them this strange Englishman. The letter describes our countryman as being 'somewhat learned,' and as having been employed as interpreter and ambassador by the Tartars in their communications with the Christian princes. The account the fellow gave to his captors was flimsy and very short, and full of horror and exaggeration. Matthew Paris records this famous letter under the date of the year 1243.

But the intrepid monks of the two new orders were not deterred by any prospect of danger. 'And although,' says the introductory epistle to the travels of Carpini and his comrade friar Benedict, 'we personally dreaded from these Tartars and other nations that we might be slain or reduced to perpetual slavery, or should suffer hunger and thirst, the extremes of heat and cold, reproach, and excessive fatigue beyond our strength (all of which, except death and captivity, we have endured, even beyond our first fears); yet did we not spare ourselves, in order that we might obey the will of God, according to the orders of our lord the pope, and that we might be useful in some things to the Christians, or at least, that the will and intention of these people might be assuredly known and made manifest to Christendom, lest suddenly invading us, they should find us unprepared, and so make incredible slaughter of the Christian people.' In Poland and Russia, and wherever the widely spread Sclavonian language was spoken, Friar Benedict the Pole served the Italian as interpreter. The two monks ran great danger of being murdered by the people of Lithuania, who appear to have been at this time many degrees less civilized than the Mongols. In Russia they were upon the whole hospitably and kindly entertained. As the Russians adhered to the Greek or Eastern church, Carpini in a public meeting exhorted the grand duke and his bishops to abandon their heresy, and boldly read to them the letters of Pope Innocent, wherein they were admonished to return into the unity of the Roman Catholic church. Although our Franciscan effected no conversion, he raised no animosity by this boldness. He and his companion Benedict received good advice as to the best means of dealing with the Tartars, and were sent forward to Kiow, then the chief city of Russia, and not very far from the uncertain moveable frontier of the Mongols. At Kiow they hired an interpreter; but they afterwards found reason to lament that this man was unequal to the duties he had undertaken to perform. The Mongols at this time occupied all the country between China, Siberia, and the Caspian Sea, the van of this nomadic pastoral army being on the river Dnieper, and its rear under the great wall of China. The subordinate khans or chiefs passed the two monks onward from post to post until they came to the head-quarters of the great Baatu. These posts were far apart. The country where Baatu had his camp (called by the travellers Comania) was far beyond the Caspian Sea. But their toils were not yet over: Baatu ordered them to proceed to the court of his sovereign, the Khan of khans and Emperor of all men. They then entered a country called by them 'the country of the pagan Naymani,' where they travelled for many days, till they came to the proper lands of the Mongols. Through this latter country they journeyed for about three weeks, continually riding with great expedition. 'In the whole of this journey,' say the monks, 'we used extraordinary exertion, as our Tartar guides were commanded to bring us on with all expedition: on which account we always travelled from early morning till night, without stopping to take food; and we often came to our quarters so late, as not to get any food that night, but were forced to eat in the morning what we ought to have had for supper. We changed horses frequently every day, and travelled constantly as hard as our horses could go.' It is not easy to name the places or even to trace the route which they followed; but they appear to have passed by the head of the Baikal lake, and to have traversed great part of the country vaguely denominated Chinese Tartary, going in the direction of the 'Everlasting Wall,' or the great wall of China. In all the vast regions occupied by the Mongols and their flocks and herds there was not one fixed town, there was scarcely a house; for the people of all degrees, and even their khans and the very emperor himself, lived constantly in tents, and moved from place to place as pasturage, or war, or other business required. Wherever the great chiefs were, the assemblage of tents and the camp had a name, which the monks set down; but in all probability, within a short time after their passage, these tents were all struck and removed to a distant quarter, and the populous spot was left a solitude in the vast surrounding wilderness. They must have found the Emperor or Great Khan somewhere to the north of the sandy desert which spreads itself between the Great Wall and Tartary, as there is no mention made of their travelling on camels, or of their entering upon that desert. Here they do not attempt to name the place, merely calling it the Court of the Emperor. This great potentate, whom they call Kujak or Cuyne Khan, had many spacious tents, one being so vast that it could have contained 2000 men. Princes and great lords from China, a duke from Russia, two sons of the king of Georgia, and an envoy of the caliph of Bagdad, were waiting submissively upon the Mongol conqueror. In these circumstances, scarcely intelligible letters and an admonitory message from the pope delivered by two poor bare-legged friars were not likely to make much impression upon the great shepherd-warrior. While the friars stayed about the gilded tent, a warlike ceremony was performed, which they interpreted into a defiance against the Church of Rome, the Roman empire, and all the Christian kingdoms and nations of the West; and they were otherwise informed that it was the intention of these Mongols to subdue all the kingdoms of the earth as Zinghis (Genghis) Khan had commanded them to do. The Lord of the World however admitted them to an audience, received from them the letters of the pope, and gave them in return letters for his Holiness written in the Mongol language and also in Arabic. The monks complain that during their stay there, which continued a whole month, they were in such extreme distress for victuals and drink that they could hardly keep themselves alive; adding that they must verily have perished at last if God had not sent to their aid a Russian goldsmith, who was in favour with the emperor, and who procured them some food. At last, on the feast of St. Brice (the 13th of November, 1247), they received permission to depart from this inhospitable court. They returned by the same route, travelling the whole winter through the desert, and often sleeping at night on the snow. On the 9th of June, 1248, they reached Kiow, where their Russian friends joyfully received them. In all they had passed sixteen months entirely among the Mongols and the people that had been conquered by them. Pope Innocent had enjoined them to be diligent and accurate in their observations, and faithful in reporting what they saw and heard of these strange people who had made all Europe tremble. The friars acted up to these instructions, and, allowance being made for the state of geography and other sciences, and for the condition and superstitions of the time, the account which Carpini or his friends gave to the world was an admirable little book of travels, the accuracy of which has been confirmed by John Bell of Antermony [Bell, John, P. C.], and other and later travellers through the vast regions which intervene between European Russia and China. Carpini was the first to uproot a set of monstrous fables, and to give a true and striking picture of the peculiar civilization of the Tartars. But at the same time he revealed their number, warlike strength, and close political union; and warned the disunited and distracted kingdoms of Christendom that if these hordes moved westward they would be found irresistible, unless a league of Christian princes were previously formed for the single purpose of opposing them. The chapter entitled 'How the Tartars are to be resisted,' is full of good sense.

It appears that Friar John returned to Italy, and that there, with some assistants, he published his plain unvarnished account of his travels in a 'Libellus,' or small book, in Latin. Of this book or manuscript (of which no doubt there were once many copies) we have never been able to obtain a sight. It seems to be known solely through the 'Speculum Historiale' of Vincentius Belvacensis, where it is inserted at full length, together with some information about their journey, which the author or editor, Vincentius, says he received from Simon de St. Quintin, one of the four friars who had gone by the south of the Caspian, and whose information was very meagre compared with that of Carpini. From the 'Speculum Historiale' Ramusio transferred all this matter, together with an Italian translation to follow the Latin text, into the second volume of his 'Raccolta di Navigazioni e Viaggi,' which was printed by Giunti at Venice, in the year 1556. From this admirable work of Ramusio, our own good compiler, Richard Hakluyt, copied the matter into the first volume of his 'Navigations and Discoveries,' which was published in London towards the close of Queen Elizabeth's reign, in the year 1599. Hakluyt, who of course only transfers the Latin text, gives a good sterling translation of his own; but he omits several passages which are given by Ramusio. One instance may explain this, and at the same time throw a light upon the motive of the suppression. There is a section or short chapter in Ramusio about the heroism of the Franciscan friars in refusing to bend their knee to some Tartar idol: Hakluyt omits this chapter altogether. From Ramusio or from Hakluyt all modern and indeed all existing accounts of Carpini and Friar Benedict have been drawn. Bergeron gave an abridgment of the matter in his 'Voyages faits principalement en Asie dans les 12^e, 13^e, 14^e et 15^e siècles, par Benjamin de Tudele, Carpin, Rubruquis, &c.,' la Haye, 1729-1755. A somewhat modernised translation of the Latin text of Hakluyt is given in R. Kerr's 'History and Collections of Voyages and Travels,' Edinburgh, 1824.

A writer in the 'Biographie Universelle,' who seems determined to finish the good monk's story without having materials for such a completion, says that it appears that after his return from Tartary he devoted his life to the missions in the north of Europe; preached the gospel in Bohemia, Hungary, Norway, and Denmark, and died in the midst of these apostolical labours, at an advanced age. Neither Ramusio nor Hakluyt says anything of the sort (they both indeed confine themselves strictly to his Mongol mission and travels); and we have looked in vain among old Italian biographers and other writers for these details. The same French writer says that Carpini was the first to speak of Prester John, that Christian priest and potentate who was so much famed among the travellers of the middle ages, and whose existence and the geographical situation of whose country gave birth to such a variety of theories and opinions. Now, neither in the full text of Ramusio, nor in the slightly mutilated text of Hakluyt, does our Franciscan speak of or even name this Prester John, whose fabulous existence had a different and a more ancient origin. In these texts Carpini says that the great khan or emperor always kept some Christian priests about his person, and had at all times a Christian chapel, in which the clergy sang their devotions publicly, and struck the hours on bells, according to the custom of the *Greek* Church. But these dependent priests of a schismatic church have little or nothing in common with the notion of Prester John, that great but always undiscoverable orthodox Roman Catholic priest-king. This French biographer, although he does not name at all the older and completer Ramusio, names Hakluyt, as well as Bergeron; but it should appear that he had never read this portion of Hakluyt's book, which is well worth the reading. Carpini divides his general observations and his journal into short, easy, and comprehensive chapters, and throws away no words. Many of his descriptions are truly admirable, from their brevity, point, and accuracy. In these particulars he was not exceeded even by Marco Polo.

CARR, JOHN, a noted English architect in the latter half of the eighteenth century, was born in 1721, at Horbury, near Wakefield, Yorkshire, at which place he afterwards erected a church that was founded by himself. His practice was very considerable in Yorkshire and the adjoining counties, where he erected several stately mansions, and other buildings both public and private. He was twice lord mayor of York, in 1770 and 1785; and realized a handsome fortune, being said to have been at the time of his death worth not less than 150,000*l.* He died at his residence, Askam Hall, Yorkshire, February 22, 1807, aged eighty-six. Carr belonged to the Anglo-Palladian school, and if he rarely displayed much fancy, he never fell into frippery, like Adam, nor did he, like Wyatt, mistake nakedness and tenuity for simplicity. Among his principal works are the Town Hall at Newark, Notts; the Crescent at Buxton; the Bridge at Boroughbridge; Harewood House, Yorkshire, one of his best mansions; Tabley House, and the splendid Mausoleum of the Marquis of Rockingham at Wentworth. This last-mentioned structure, erected in 1788, is 90 feet high, and consists of a square Doric basement, above which is an Ionic order, with a large open arch in each front, through which is seen a sarcophagus in the centre, and the third story is a circular peristyle of the same order, crowned by a dome. Within the basement is a circular chamber covered by a dome, resting on eight Doric columns, and in the centre stands a statue of the Marquis by Nollekens. This mausoleum is shown in plate 61 of Stieglitz's 'Belle Architecture.'

There is a good portrait of Carr in the second volume of Dance's 'Collection of Portraits,' which work also contains those of several other architects of the same period.

CARRAGEEN MOSS. [SEA-WEEDS, P. C.]

CARRA'RA, DA, the name of an historical family of Italy, which held sovereign sway over Padua and the neighbouring provinces during the middle ages. Like most of the north Italian nobility of that period, the Carrara appear to have been of Longobard origin. One of their ancestors, by name Luitolf, is recorded as the founder of the abbey of Carrara, in the territory of Padua, about A.D. 1027, and as having built a castle in the neighbourhood, which had feudal jurisdiction granted to the owner by the Emperor of Germany. Several of Luitolf's descendants filled municipal offices in the community of Padua. Marsilio da Carrara was put to death by Eccelino, tyrant of Padua. After the death of Eccelino, A.D. 1259, Padua was restored to its municipal independence as an important member of the Guelf league, and as such found itself at variance with the Della Scala, Lords of Verona, who were Guibelines. Jacopo da Carrara commanded the troops of Padua against Can della Scala, in the early part of the fourteenth century. The citizens of Padua, being distracted by factions, elected Jacopo for their lord, in 1318. Jacopo died in 1324, and was succeeded by his nephew Marsilio, who being hard pressed by the Della Scala of Verona, was assisted by the republic of Venice in repelling them. He died in 1338, and was succeeded by his nephew Ubertino, who dying in 1345, was succeeded by Marsilietto his relative, who belonged to a distant branch surnamed Carrara Pappafava. After two months Marsilietto was stabbed by Jacopo II., nephew of the first Jacopo. This Jacopo II. was himself murdered by a relative in 1350, and was succeeded by his brother Jacopino, jointly with Francesco his nephew, son of Jacopo II. Francesco da Carrara being at the head of the troops, arrested his uncle in 1355, and confined him in a fortress. He then remained sole lord of Padua. His reign was eventful. He was at the head of the Lombard or Guelf league against the Visconti of Milan. He afterwards entered into a war against Venice, but was obliged to conclude a humiliating peace, and to send his son to Venice to make apology. In 1378 he joined the Genoese in their attack against Venice, by which the republic was brought to the brink of ruin, a consummation which Francesco was determined to effect, but which was prevented by the patriotism of the citizens of Venice, and by the timely arrival of Carlo Zeno with his squadron. In 1381 peace was made. A fresh quarrel of Francesco with Antonio della Scala of Verona, led to an alliance of the former with Gian Galeazzo Visconti, who after taking Verona, turned round against his ally, took Padua and Treviso, arrested Francesco in 1388, and kept him prisoner till his death at Monza in 1393. Francesco da Carrara was intimate with Petrarch, who speaks of him in his works.

Francesco II., called Novello, after his father's imprisonment wandered as an emigrant about Italy and France, begging for assistance to recover his father's territories, and at last he re-entered Padua in 1390. Having made peace with Visconti, he repaired to Venice, where, in presence of the senate, he expressed his gratitude for the assistance which he had received from the republic during his struggle against Visconti, swore perpetual friendship to Venice, and had his name inscribed in the golden book in the roll of the patricians. He however broke his word, and lost thereby his territory, and was taken prisoner to Venice, where he was strangled with two of his sons, in the dungeons of the Ducal palace, in 1406, according to the barbarous practice of those times. Venice took possession of Padua, Treviso, and the other territories of the Carrara. [VENICE, *History of*, P. C.]

Many years after, the last remaining son of Francesco, named Marsilio, having formed a conspiracy to recover possession of Padua, was seized and put to death in 1435.

(Litta, *Famiglie Celebri Italiane*; Sandi, *Storia Civile di Venezia*; Vergerio, *Vitæ Carrariensium Principum ad ann.* 1355; Verci, Gianbattista, *Notizie Storico-genealogiche de' Signori da Carrara*; Ticozzi, *Viaggi de Messer Francesco Novello da Carrara, Signor di Padova e di Taddea d'Este sua Consorte*, Milan, 1823. This last is a kind of historical novel of the wanderings of Francesco II., after his father's imprisonment.)

CARRAWAY. [Carum Carui, P. C. S.]

CARSTARES, WILLIAM, a Scottish ecclesiastic, more distinguished for his political exertions in furtherance of the Revolution settlement than in connection with his profession, was born at Cathcart, near Glasgow, on the 11th of February, 1649. His father was the Rev. John Carstares, minister of the High Church, Glasgow, who, like his son, but in a less degree and with less diplomatic capacity, took a lively share in the ecclesiastico-political movements of his time; offered a violent opposition to Cromwell's schemes of general toleration, and suffered by the prevalence of his own principles of clerical coercion during the persecutions of the Covenanters under Charles II. (See 'Notices of the Life of the Rev. John Carstares, by the Rev. William Ferrie.') William Carstares acquired the rudiments of his education in a neighbouring village school, and afterwards studied in the University of Edinburgh. Early in life he seems to have resolved to plant the seeds of subsequent distinction by arduous study, and he appears to have become in early life not only an accomplished scholar, but an accurate observer of men. During a great portion of the latter end of the reign of Charles II. he lived in Holland, and studied theology at Utrecht, where he is supposed to have taken orders. Accident introduced him to the notice of the pensionary Fagel, who, finding in the young clergyman great sagacity and self-reliance, and a knowledge of the political institutions of his own country seldom equalled at his early years, recommended him to his master, the Prince of Orange, afterwards William III. It was natural that the prince, whose wife, in the absence of male issue of the Duke of York, was after him next heir to the crown, should have about his person individuals acquainted with the politics of the country of which he might eventually become ruler. In this view he chose young Carstares as one of his confidential advisers, and events justified the selection. The time of his return to Britain is not precisely known. He was in London in 1682, and was more or less connected with the projects on which the prosecutions in connection with the Rye-house and assassination plots were founded. There is much reason to presume that he was the medium of communication between the court of Holland and some of the parties prepared for insurrection. He was, at all events, in the secrets of the Argyle party in Scotland, and the key to a cipher through which Argyle and Monmouth corresponded was found to be in his handwriting. A warrant to apprehend him was issued, and he was found attempting to conceal himself in Kent. Sufficient evidence could not be found to bring him to trial in England, and he sued out a writ of habeas corpus, which was defeated by sending him to Scotland, where the practice of torture still remained a stain on the administration of justice, which Carstares was subsequently a main instrument of removing In the presence of the Privy Council of Scotland he was subjected to the torture of the 'thumbigen,' or thumb-screw, which he bore with great fortitude, refusing to divulge the secrets he possessed. He was subsequently presented by the Privy Council with one of these cruel instruments, which he bequeathed as an heir-loom to his family; and it is a traditional anecdote that William III., having desired to experience the initial symptoms of this species of torture, the divine turned the screw at his request, but rather too vigorously for his Majesty's nerves. Whether the general supposition be true that Carstares was then acquainted with state secrets, the divulgence of which might have baffled the projects of the Prince of Orange in connection with the British crown, is likely to remain as much a mystery as he left it. That he knew much must have been conjectured by those who spared neither industry nor cruelty to overcome his firmness; but that no clue was obtained to the character of his knowledge is pretty clear from the circumstance of his afterwards being released on a sort of compromise, by which he confessed a knowledge of matters which were otherwise proved in the trial of Baillie of Jerviswood. He returned to Holland with all his secrets undivulged, and was warmly received by the prince, who, in devising the expedition which created the Revolution of 1688, is said to have mainly relied on the full knowledge of British parties, and the advice, both bold and sagacious, of Carstares. He was subsequently of great service in producing a reconciliation between the Scottish Presbyterians and William III., who could not precisely understand the pertinacity with which his northern subjects adhered to the principle of spiritual independence. A General Assembly being about to convene, at which it was understood that there would be a violent opposition to the oath of allegiance, the king, taking advice from less sagacious counsellors, had prepared and delivered to a messenger dispatches directing the peremptory enforcement of the act. It is said that Carstares assumed authority to stop the messenger in his Majesty's name; and presenting himself to the king (who had gone to bed) in the middle of the night, in the guise of a petitioner for his life, forfeited by his having thus committed high treason, to have prevailed on him to dispense with the oath. Whether the anecdote be true or not in all its circumstances, there is little doubt that his influence obtained the dispensation. He became now virtually prime minister for Scotland. He received the popular designation of 'Cardinal Carstares;' and as Laing observes, 'It is curious to remark how the haughty nobility condescended to stoop and truckle to a Presbyterian clergyman, whom their predecessors in office had tortured and deceived.' Even after the death of William, his knowledge of Scottish affairs, and the respect paid to his talents, left him with considerable influence. In 1704 he was chosen Principal of the University of Edinburgh. He died on the 28th of December, 1715.

(*State Papers and Letters addressed to William Carstares; to which is prefixed the Life of Mr. Carstares*, 4to. 1774.)

CA'RTHAMUS TINCTO'RIUS. [Safflower, P. C.]

CARTRIDGE, a cylindrical case containing a charge of gunpowder or shot, or of powder and ball, for fire-arms. Those used for military purposes, to facilitate the loading of muskets, carbines, and pistols, are formed of a strong hard paper manufactured for the purpose, called cartridge-paper, and are styled ball or blank cartridges according as they contain both powder and ball or powder only; while the larger cartridges for cannon and mortars, which always consist of powder only, are usually cased with flannel, though sometimes pasteboard, tin, or even wood is employed. The North Americans, during their last war with England, are said to have employed very thin sheets of lead, resembling those used for lining tea-chests, for this purpose. The advantage of such a substance is, that it obviates the danger of burning particles of the cartridge-case which remain in the piece after it is fired, an accident which is liable to occur when flannel is used, and which may be productive of the most fearful consequences.

Wire cartridges, for containing a charge of small shot, without powder, have been introduced for sporting purposes within the last few years. The author of the article 'Shooting,' in the new edition of the 'Encyclopædia Britannica,' states that they were invented in 1828 by Mr. Jenour, but that they were not brought to perfection until nearly ten years later, owing chiefly to the difficulty of regulating the precise time for the dispersion of the shot. Eley's wire cartridges have been brought, by successive improvements, to a high degree of efficiency, and are made of various qualities, according to the distance at which the charge is required to take effect. Wire cartridges consist of an inner case of wire network inclosed in a thin paper case, to the outer end of which a wadding is attached. The shot, with which it is usual to mix bone-dust or some other substance to fill up the interstices, is put within this case, which is rammed down upon the charge of powder. When the gun is fired the paper case is torn to pieces as soon as the cartridge leaves the gun, and the shot immediately begins to quit the cartridge by passing through the meshes of the wire net-work, which is carried forward with the charge until it is quite empty, when it falls to the ground. By this contrivance the leading of the gun is avoided, and the recoil produced by the discharge is lessened, the charge leaving the barrel like a bullet. The shot are also carried so much more closely than when loose, that lighter charges, and consequently a lighter gun, may be used; much time is saved in loading, especially as no separate wadding is required; and, as the cartridge has no inclination to move before it is impelled by the explosion of the powder, the danger arising from the accidental shifting or rising of loose charges is avoided. Greener, in his work entitled 'The Gun; or a Treatise on the various descriptions of small Fire-arms,' which was published before wire cartridges had been brought to their present state of comparative perfection, suggests the use of a case of felt, made much thicker at the bottom than at the sides, as a substitute for wire.

In the 'Transactions' of the Society of Arts, vol. xlv. pp. 106, 107, is a description, illustrated by figures, of a machine invented by Mr. Caffin for filling cartridges, in which two cylindrical cases, each of which will contain the proper charge for one cartridge, open at both ends, and tapering a little at the lower end, are so mounted that by moving a handle each may be brought alternately under a hopper, from which it receives a supply of powder, and over an aperture in a plate upon which it moves, through which the charge escapes by a conducting channel into the paper case of the cartridge. With one of these machines one boy is able to deliver 12,500 measures of powder in a day, supplying the hopper himself.

CARTWRIGHT, WILLIAM, born in 1611, was the son of a person who, after having possessed a good estate, had sunk to the station of an innkeeper at Cirencester. He was educated at Westminster and Oxford; and, taking orders, received, in 1642, an appointment in the church of Salisbury. In the same year he was one of the council of war named by the University of Oxford; and, early in 1643, he became junior proctor and reader in metaphysics. He died in that year of a malignant fever, then epidemic in Oxford. Although Cartwright thus died before having completed his thirty-second year, he had attained high reputation both for learning and for genius. Precocity, rather than strength, must have been the quality which gained for him Ben Jonson's commendation, 'My son Cartwright writes all like a man.' A collected edition of his 'Comedies, Tragi-comedies, and other Poems' appeared in 1647, and again in 1651. The miscellaneous poems which the volume contains are much inferior in merit to the four plays, one of which, 'The Ordinary,' has very justly received a place in the collection first published by Dodsley.

CARUM (from Caria in Asia Minor, where the plant was originally found), a genus of plants belonging to the natural order Umbelliferæ, to the suborder Orthospermeæ, and to the tribe Ammineæ. It has an obsolete calyx, obcordate petals, with a narrow acute inflexed point, oblong fruit, carpels with five filiform ridges, interstices with single vittæ, a depressed stylopodium. The species are glabrous herbs with perennial tuberous edible roots, pinnate leaves, and white flowers.

C. Carui, Common Caraway, has a fusiform root, bipinnate leaves, leaflets cut into linear segments, no partial involucre, the general involucre absent or of only one leaf. It is a native throughout the whole of Europe in meadows and pastures. It is found in Great Britain, but can only be regarded as a naturalised plant. The fruit of this plant is known in shops by the name of caraway seeds. [Carum Carui, P. C. S.] The leaves of this plant are frequently used in spring to put in soups, and the roots are boiled and eaten as parsnips, to which some persons prefer them.

On account of its varied uses this plant is both sown in the garden and in the field. When raised in the garden, a quarter of an ounce of seed will serve for a bed four feet by six. It should be sown in the autumn, and when the seedlings have put forth their stems, they should be thinned to about a foot distance each way. In the field the culture of the caraway is conducted in the same manner as that of the coriander, and 'in all probability,' says G. Don, 'both plants would answer if sown like clover among a crop of corn, hoed and thinned when the crop was removed, and again in the following spring.' The mode of cultivating the caraway in Essex, is to plough some old pasture land, the older the better, composed of a strong clayey loam soil. 'Twelve pounds of caraway-seed are mixed with ten pounds of coriander and twelve pounds of teasel-seed; this is sufficient for an acre, and is sown directly after the plough, harrowing the land well. When the plants appear of sufficient strength to bear the hoe, which will not be until about ten weeks after sowing, it must not be omitted, and in the course of the summer the crop will require three hoeings, besides one at Michaelmas. The coriander being annual will be fit to cut about the beginning of July. It is left in the field after cutting, and thrashed on a cloth in the same manner as rapeseed. About April following the caraway and teasel will want a good hoeing done deep and well, and another about the beginning of June. The caraway will be fit to cut the beginning of July, and must be thrashed in the same manner as the coriander. This compound crop is mostly sown on land so strong as to require being a little exhausted to make it fit for corn. Caraway and coriander are oftenest sown without teasel; the latter being a troublesome and uncertain crop, and the produce of caraway much greater without it. The produce of caraway, on very rich old leys in the hundreds or low lands of Essex, has often been twenty hundred weight to the acre.' (Don.) There is always a demand for the seed, or more properly speaking the fruit, in the London market. Dr. Anderson says that the roots and the herbage may be given to cattle in the spring. Several varieties have been described by botanists. One of these is the American species *C. c. elongatum*, which has the segments of the leaves linear elongated.

C. verticillatum has the general and partial involucres of many leaves, the leaves pinnate, and the leaflets linear. The segments of the leaflets spread in such a way as to appear whorled, hence the trivial name. It is a native of the western parts of Europe. In Great Britain and Ireland it occurs as a rare plant in damp, hilly pastures.

C. Bulbocastanum of Koch, is the *Bunium bulbocastanum* of Linnæus. [Bunium, P. C. S.] It is the Scandix and Sium Bulbocastanum of Sprengel and Moench. Babington, in his Manual, has restored the Linnæan species.

(Babington, *Manual of British Botany*; G. Don, *Gardener's Dictionary*.)

CARUM CARUI, Common Caraways—*Medical Properties of*. This umbelliferous plant is indigenous in most parts of the south of Europe, where its roots are used in the same way as those of the parsnip and carrot, and its fruits, incorrectly termed seeds, are collected as aromatic stimulants, for a variety of purposes. It is cultivated in England, chiefly in Essex, for the fruit alone; but much of what is used in this country is imported from Germany, where it is in extensive use to form a liqueur. The fruit is too familiarly known to require description; but to secure it in perfection it must be ripe, brown, not green, and when rubbed or bruised it should emit a strong characteristic odour. This depends on the presence of a volatile oil, which exists in the proportion of 4 to 5 per cent. It is obtained and purified by repeated distillation. The officinal preparations are the oleum carui, aqua, and spiritus. The directions in the Pharmacopœia for preparing the two latter are never complied with; as a portion of the oil dissolved, or diffused through the menstruum, is a more speedy mode of obtaining the object. The oil is sometimes given dropped on sugar. The powers of caraway are similar to those of dill [Anethum graveolens, P. C. S.], and the observations there made on the use and abuse of this carminative are applicable here.

CARY, REV. HENRY FRANCIS, was born at Birmingham in 1772, and was entered a commoner of Christ Church, Oxford, in 1790; having however already commenced author by the publication of 'An Irregular Ode to General Elliott' in 1787, and of a 4to. pamphlet of 'Sonnets and Odes' in 1788. While at the university he devoted much of his time to the study of Italian, French, and English literature, as well as of Greek and Latin. Having taken his degree of M.A. in 1796, he was in 1797 presented by the Marquis of Anglesey to the vicarage of Bromley Abbat's, in Staffordshire, worth 187*l.* a year, with a residence. The same year he published 'An Ode to General Kosciusko.' In 1805 appeared his translation of the 'Inferno' of Dante in English blank verse, accompanied with the original Italian; and in 1814 his entire version of the 'Divina Commedia.' It was some years however before this work, to which Cary principally owes his literary reputation, attracted much attention. It was first brought into general notice by Coleridge, who is said to have become acquainted with it and with Cary himself about the same time. Ultimately its merits were generally acknowledged, and the author had the satisfaction of bringing out a fourth edition of it before his death. It is not only unusually careful and exact, but deserves the praise of very considerable force and expressiveness. It must, however, be considered as a defect detracting materially from its claim to be regarded as a faithful representation of the 'Divina Commedia' that it is in blank verse: rhyme is an essential element of the Gothic spirit and character of Dante's poetry. Cary afterwards produced verse translations of the 'Birds' of Aristophanes, and of the 'Odes' of Pindar; a series of Lives of English Poets, in continuation of Johnson's, and another of Lives of Early French Poets, in the 'London Magazine;' besides editions of the works of Pope, Cowper, Milton, Thomson, and Young. In 1826 he was appointed assistant librarian in the British Museum, out he resigned that situation in 1832, on the claim that he and his friends conceived he had to the office of keeper of the printed books being passed over in favour of another person. He afterwards received a pension of 200*l.* a year from the crown, which he enjoyed till his death, which took place at his house in Charlotte-street, Bloomsbury, 14th August, 1844. He was interred on the 21st in Poets' Corner, Westminster Abbey.

(*Gentleman's Magazine*, for October 1844.)

CARYOCRINITES, a genus of Crinoidea, from the Palæozoic limestone of North America.

CASH CREDIT. [Bank, Banker, Banking, P. C., p. 387.]

CASHMERE, or CACHEMERE, a peculiar textile fabric formed of the fine downy wool found about the roots of the hair of the Tibet goat [Goat, P. C., p. 283], and so called from the original seat of the manufacture, in the valley of Cashmere, in the north-west of India. [Cashmere, P.C., p. 342.] Shawls of exceedingly delicate quality are the principal articles manufactured of this material, but a cloth woven in imitation of them is also made, and called by the same name, or by corruption, Cassimere.*

An interesting description of the manufacture of Cashmere or Kashmir shawls is given in Vigne's 'Travels in Kashmir,' from which an extract, entering more fully into the subject than can be done here, is given in the 'Penny Magazine' for August 13, 1842. From this it appears that the thread is dipped in rice-water before weaving, by which process it is made stronger, the stiffness thus imparted being subsequently removed by washing. Of the actual process of weaving we find no satisfactory account. The author of the article 'Shawls' in the new edition of the 'Encyclopædia Britannica' intimates, in common with some other writers, that the process more nearly resembles the weaving of tapestry [Tapestry, P. C., p. 46] than the ordinary operation of weaving. The needle is occasionally used in the production of the patterns, but Vigne observes, that 'if the pattern be worked with the needle the shawl is far inferior, in every respect, to those in which the pattern is woven in,' and that 'an excellent pair (the shawls being always made in pairs) of the former description may be purchased in Kashmir for 150 rupis (about 10*l.*), whereas an equally good pair of the usuleh (the real), or the latter kind, could not be procured for less than 700 or 800 rupis.' The process is exceedingly slow, the weaving of a pair of shawls, or, as some writers have it, of a single shawl, often employing three men with a clumsy old-fashioned loom for a period of six months; and owing to the numerous heavy duties charged upon the shawls between leaving the loom and reaching a purchaser in this country, the price of real Cashmere shawls of the best quality is very high. They have frequently been sold in London at from 100 to 400 guineas each, and in one instance, when the import duty, which has since been greatly reduced, amounted to 80 per cent. on the value, as much as 500 guineas was demanded for a single shawl.

The peculiar softness of Cashmere shawls appears to be in some degree attributable to the processes of washing to which they are subjected after weaving. 'The best water for this use,' observes Vigne, 'is found in the canal between the lake and the floodgates at the Drogjun.' 'Some ruins, in large limestone blocks, are lying on the washing-place, and in one of these is a round hole, about a foot and a half in diameter, and a foot in depth; in this the shawl is placed, and, water being poured over it, it is stamped on by the naked feet for about five minutes, and then taken into the canal, by a man standing in the water: one end is gathered up in his hand, and the shawl swung round and beaten with great force upon a flat stone, being dipped into the canal between every three and four strokes.' The shawls, if coloured, are then dried in the shade, as the hot sun would injure the colours, and about ten days afterwards the same process is repeated, though for a less time. White shawls however, after being treated in like manner, are spread in the sun, and bleached by sprinkling water upon them; and the alternate washing and beating, and drying and bleaching in the sun, is repeated three times, soap being occasionally used in the second washing and stamping. 'There is something in the water of the canal,' observes Vigne, 'which certainly communicates to the shawl a softness which cannot be given to those manufactured at any place in the plains of Hindustan.' 'At the same time,' he adds, 'those made in Paris or at Norwich would be, I think, as soft, were it not for the greater closeness of texture, consequent on their being made by a machine instead of the hand.' 'For the same reason,' he proceeds, 'it is well known that the calico made in India is much softer, and is much more durable, than that made in England.' The water is readily found near the surface of the ground, is bad tasted, and, Vigne believes, brackish. Old shawls that require cleaning, and sometimes also new ones, are washed by means of the freshly-gathered root of a parasitical plant called kritz. A pound of this is bruised and mixed with about three pints of water, to which is added a piece of pigeon's dung, equal in size to a turkey's egg, beaten up in about an equal quantity of water. The shawl is saturated with this liquor, stamped upon, washed with the hand, and then steeped in the canal. Vigne gives further particulars respecting the mode of producing a fine pale yellow colour by the fumes of sulphur, and various other matters relating to the manufacture of and trade in Cashmere shawls, and an enumeration of the various kinds of fabric produced in the looms of Cashmere, and states that a cloth called siling is manufactured from the shawl wool in Yarkund and China, which resembles a coarse English kerseymere in texture. Respecting the statistics of the manufacture some additional information will be found in the articles Cashmere and Goat, above referred to, and in M'Culloch's 'Dictionary of Commerce,' art. 'Shawls.' Various attempts have been made to naturalize the Cashmere shawl goat in this and other European countries, but as the peculiarities of its wool appear to be dependent upon climate, the perfect success of any such attempt is problematical. The wool itself has also been imported as a raw material, and Dr. Ure, in the 'Dictionary of Arts,' art. 'Cashmere,' gives an account of the various plans adopted in France for working both the imported wool and that produced in France from a breed of Tibet goats imported in 1819, into shawls in imitation of those of Cashmere, in which plans the Jacquard loom has been employed to great advantage. Of the shawl manufacture of Scotland generally, much interesting information is given in the article already cited from the 'Encyclopædia Britannica;' and also in the article 'Glasgow' in the same work, from which it appears that in 1830, at which time the weaving of shawls from Cashmere yarn imported from France had become an important branch of manufacture, a premium of 300*l.* was offered by the Board of Trustees for the Encouragement of Arts and Manufactures in Scotland, to the person who should first establish the spinning of Cashmere wool upon the French principle. In consequence of this offer, Captain C. S. Cochrane devoted himself to the subject, and having succeeded, after some difficulty, in obtaining a knowledge of the secret, he patented the plan, and subsequently sold his patent to the Messrs. Holdsworth, of Glasgow, who established the manufacture successfully, and obtained the offered reward in 1832.

CA'SSICUS, a genus of Passerine birds, of the family *Conirostres*, allied to the beef-eaters and starlings. They are distinguished, among other characters, by their large, conical, and sharply pointed beaks. The species of *Cassicus* are all inhabitants of America. They are gregarious, and feed upon grain and insects.

CA'SSIUS, AVI'DIUS, was, according to Dion Cassius, a native of Cyrrhus in Syria, and the son of a rhetorician, Heliodorus, who was praefect of Egypt in the joint reign of Antoninus Pius and Marcus Aurelius. Cassius served in the Parthian wars (A.D. 162 or 165) under Lucius Verus, in which he defeated Vologesus, and took Seleuceia and Ctesiphon on the Tigris. He also served on the Danube, probably about A.D. 166. He was subsequently appointed governor of Syria, and in A.D. 170 he went to Egypt to suppress an insurrection in the lower country which was excited by some fanatics. He succeeded in putting an end to the rebellion; but a few years after (A.D. 175) he himself rebelled against the Emperor Marcus Aurelius, and proclaimed himself Imperator in the East. Cassius was assassinated in a few months, and his head was carried to Aurelius. The humane emperor lamented his death, and declared that he wished Cassius alive that he might upbraid him for his ingratitude. The family and children of Cassius were spared, but it is said that Commodus the son of Aurelius burnt alive all the then surviving members of the family of Cassius, on the pretence of a fresh conspiracy.

Dion Cassius, who loved a tale of scandal, says that Faustina, the wife of Aurelius, being apprehensive that her husband would not live long, and considering the youth of her son Commodus, attempted to secure the interests of herself and her family by corresponding with Avidius Cassius, and urging him to proclaim himself emperor whenever he heard of the death of Aurelius, and take her for his wife. It is said that there was a report of the death of Aurelius, and that this was the immediate occasion of Cassius proclaiming himself emperor. It is also said that he was himself the author of the report of the death of Aurelius. The letters between Aurelius and his wife Faustina on the occasion of the rebellion of Cassius are probably not genuine. Vulcatius attempts to show from these letters that Faustina was not privy to the design of Cassius.

---

* See Woollen and Worsted Manufactures, P. C., p. 555. It may be well to observe that *kerseymere*, though almost identical in sound with *cassimere*, is a different fabric, which, according to a letter upon the woollen district of Norfolk, published in the 'League' newspaper for August 31, 1844, takes its name from a *mere*, or miry brook, at the village of Kersey, in Suffolk.

(Vulcatius Gallicanus, *Avidius Cassius;* Dion Cassius, lib. lxxi.; Tillemont, *Histoire des Empereurs*, vol. ii.)

CASTAGNO, ANDREA DEL, a distinguished Florentine painter, sometimes called the Infamous, was born at Castagno in Mugello, near Florence, about the year 1409, and died aged about seventy-four. He was contemporary with Cosimo Roselli and Masaccio, and painted in a style which in some respects resembled the styles of both masters, but he always remained far behind Masaccio, though he survived him many years. He was the first Florentine painter to adopt the new method of oil painting, which he learnt from Domenico Veneziano, and whom, after he had mastered the secret, he basely murdered. [Veneziano, Domenico, P. C.] Very few of Castagno's works still remain: there are three in the gallery of the academy of Florence, of which St. Jerome in the Desert is a work of great merit for its period; there are also two or three of those noticed by Vasari, in religious buildings of Florence. In 1478, the Pazzi and other conspirators concerned in the murder of Giuliano de' Medici, were all painted by Castagno hanging by the feet on the façade of the palace of the Podestà; they were done with such ability, and in such a variety of attitudes, that Castagno was thenceforth called Andrea degli Impiccati (of the hanged). It was his best work, but it has long since perished.

(Vasari, *Vite de' Pittori*, &c.; Baldinucci, *Notizie dei Professori del Disegno*, &c.)

CASTIGLI'ONE, GIOVANNI BENEDETTO, called by the French LE BENEDETTE, and at Mantua IL GRECHETTO, was born at Genoa in 1616, and was one of the most distinguished of the Genoese painters, and an admirable etcher. He was placed by his father with G. B. Paggi, and upon his death very soon afterwards with Andrea de' Ferrari, and finally, it is said by Soprani, Lanzi, and others, with Vandyck, who certainly lived some time in Genoa, but, except for a short visit, scarcely later than 1625, when Castiglione was only nine years old, if Soprani's date is correct. This improbability, and the fact that Paggi did not die until 1627, render the report of his having studied with Vandyck highly improbable. Vandyck was established in England in 1632, and Castiglione was then only 16 years of age, and Vandyck did not settle in England until some years after his return from Italy.

Castiglione painted in various styles, as history, portrait, landscape, and animals. He excelled in all, but most in animal painting and in pastoral landscape; in animals he has not had a superior in Italy. His masterpiece is the Nativity of the Saviour in the church of San Luca, and it is one of the finest pictures in Genoa: there is an etching of it by himself. He died at Mantua in 1670, in the service of the Duke Carlo I.: he had lived also for short periods in Venice, Florence, Rome, Naples, and Bologna; in Florence he was solicited to paint his own portrait to be placed in the painters' portrait-gallery there.

Castiglione executed a considerable number of etchings, which are very highly valued; many of them are much in the style of those of Rembrandt: Bartsch describes sixty-seven. One, of the entrance of the beasts into the ark, is characteristic of the particular taste of Castiglione; he generally chose subjects in which he could introduce animals, as fairs, markets, &c., and he seems to have had also a partiality for treating Scripture subjects of the kind. For execution, three of his best etchings are—the Discovery of the bodies of St. Peter and St. Paul, a night-piece; Diogenes in search of an honest man; and Melancholy. The majority of his paintings are small, and the figures introduced into them are seldom very excellent; he is also sometimes inharmonious in his colouring, and heavy in his shadows. The name of Grechetto was given to Castiglione, according to Soprani and Lanzi, on account of the beauty of his colouring; but how the term is applicable is not very evident. Salvatore and Francesco Castiglione, the brother and the son of Giovanni Benedetto, were both his pupils, and were able painters.

(Soprani, *Vite de' Pittori, &c. Genovesi;* Lanzi, *Storia Pittorica*, &c.; Bartsch, *Peintre-Graveur.*)

CASTOR OIL. [Ricinus Communis, P. C.]

CASUARINA. [Casuaraceæ, P. C.]

CAT-FISH. [Anarrhicas, P. C. S.]

CATABRO'SA, a genus of plants belonging to the natural order of Grasses, and to the tribe Festucineæ of that order. It has unequal very short glumes, rounded or truncate, without lateral ribs, much shorter than the spikelet; the flowers usually two, rounded on the back, distant; the outer palea membranous, with three ribs ending in teeth, which do not quite extend to the summit, and are connected by the scarious margin; the styles terminal; the upper glume has two very short faint lateral nerves, the awn absent. This is a genus formed by Palisot de Beauvois, and adopted by Babington in his 'Manual of British Botany.' The only British species is the *C. aquatica;* it has an equal panicle, with half-whorls of patent branches, and obtuse broadly linear leaves. It is found in ponds and ditches, and wet sands.

(Babington, *Manual of Brit. Bot.*)

CATALPA, a genus of plants belonging to the natural order Bignoniaceæ. It has a two-parted calyx; campanulate corolla, with a ventricose tube, and an unequal four-lobed limb; five stamens, two of which are fertile, the other three sterile; the stigma bilamellate; the capsule silique-formed, long, cylindrical, two-valved; the dissepiment opposite the valves; the seeds membranous at the margin, with pappus at the base and apex. The species are trees with simple leaves, opposite or disposed three in a whorl; the flowers terminal, panicled.

C. syringæfolia has flat cordate leaves, three in a whorl. This plant is a native of North America, and is found on the banks of the Ohio, Mississippi, and Delaware, also in the forests on the Wabash in Illinois, where it occurs in so great abundance that the wood is cut up for palings. It is a low-spreading, singular-looking tree, with succulent shoots, easily injured by the frost. The leaves are large and come out late; the petals are white, spotted with purple and yellow. It is a plant well adapted for large shrubberies. There is one in the gardens of Gray's Inn, which is said to have been planted by Lord Bacon. The branches are used for dyeing wool of a cinnamon colour. The name of the genus appears to have been derived from the plant growing on the banks of the Catawba river. It does not bear fruit in this country.

C. longissima has oblong or ovate-lanceolate leaves, acuminated, three in a whorl, undulated. It is a tree thirty or forty feet in height. It contains much tannin in its bark, and might be used for tanning. It is said to be serviceable in humoral asthma. It is known in the West Indies by the name of French oak, and the French call it *Chêne-noir.*

There are several other species of Catalpa, all elegant plants. The *C. syringæfolia* thrives well in common garden soil, and may be propagated by seeds or divisions of the root. The other species grow well in a mixture of loam, peat, and sand, or any light rich soil. Cuttings, half-ripened, root readily, if planted in sand with a hand-glass over them.

(Don, *Gardener's Dictionary;* Burnett, *Outlines of Botany.*)

CATAMARAN is a name given both in the East and West Indies to some kinds of rafts which are used in short navigations along the sea-shore. The rafts which are used by the fishermen and others at Madras consist of three logs of timber, each eight or ten feet long, which are lashed together. With these rafts the rowers pass through the surf to fish, or to convey refreshments to ships when no boat could venture off. On the coast of South America the rafts are of considerable size, being made of trunks of trees from 70 to 80 feet long, lashed together, and being from 20 to 25 feet wide: the middle trunk is longer than the rest, and projects beyond them at the after extremity. They carry sails on masts resembling shears; and they are steered by raising or lowering, as the occasion may require, a board which enters vertically between the timbers either at the fore or after part of the raft.

CATCHFLY. [Silene, P. C.]

CATECHI'NUM, *Medical Properties of.* This peculiar principle is obtained not merely from Catechu, strictly so called, but also from gambir and some kinds of cinchona bark. Certain slight differences are found in it, according to the source whence it has been obtained, such as that from catechu having no acid reaction on litmus, while the others have. The best mode of procuring it is to digest catechu in sulphuric æther, then evaporate the æther, wash the residuum in cold water, repeatedly dissolve it in boiling water, and by renewed evaporation procure it pure. The appearance is that of a white semicrystallized powder (resembling magnesia or grape-sugar), with an astringent taste, which is followed by an unpleasant and somewhat sweetish one. It is persistent at the ordinary temperature of the air, but by long exposure to damp it resolves into a mould-like mass; at a moderate heat it melts into a transparent fluid; by a strong heat it becomes brown.

Of hot water it requires only from three to four parts for its solution, but of cold 16000: of boiling alcohol from two to three, of cold from five or six parts for its solution; of boiling æther it requires seven to eight, while of cold it needs a hundred and twenty for its solution. It is one of the most delicate tests of some of the salts of iron (when these are devoid of any free acid), as it strikes a most beautiful dark green colour, without precipitation; which colour results if there be but [illegible] part of iron in solution. It does not precipitate either a solution of gelatine or of starch, a peculiarity which distinguishes it from tannin; and which constitutes its claim to attention as a therapeutic agent, as a means of arresting hæmorrhage in distinct organs. Pure tannin is almost certainly precipitated by the starchy or gelatinous principles it meets with in the food in the primae viae, and has therefore little influence on hæmorrhage from remote organs. All who know the difficulty of checking the flow of blood in those of a hæmorrhagic diathesis, especially from leech-bites, scarification of the gums, &c., will be glad to have a new resource in catechin.

CATENI'PORA, a genus of corals found only in the Palæozoic strata, and in Britain only in Silurian rocks. [Madrephyllιœa, P. C.]

CATGUT, AND VIOLIN-STRINGS. Several useful articles, manufactured from the intestines of the sheep, are, for some unexplained reason, denominated catgut. The catgut is generally in the form of cord, string, or twine. The chief purposes to which such cord is applied, are musical strings, for harps, violins, and guitars; hatters' bowstrings, for the bowing of fur and wool; clockmakers' cord, and thongs or cords for whips; for all of which purposes the material requires a careful preparation before being brought into the state of cord

The intestines, when taken from the animal, are, by repeated washing and scraping, freed from the loose adherent matters; and are further steeped for some time, as a means of loosening the surface membranes. When this steeping has brought them to a particular state or stage, they are laid on a sloping board, and scraped with the back of a knife, in such a manner as to peel off two strips of peritoneal or external membrane, each equal in width to half the circumference of the intestine. The membrane so removed is called by the French *filandre*, and is employed by them, when further prepared, for making the cords for rackets and battledores, and also as thread for sewing pieces of intestine together for other purposes. When the membrane is removed, the intestine is again steeped in water, and the inner or mucous membrane scraped from it; and it is also exposed to the action of an alkaline ley, until at length it is brought to as clean a state as possible. The large ends are cut off and applied to other purposes; the smaller ends are laid by for making cord.

In the making of violin-strings, after the cleaning, the intestines have a certain degree of twist imparted to them. Two or more are affixed, at the ends, to a rotating machine, and twisted round each other somewhat in the same way as twine or silk. The size of the membranes and the number of them twisted together, depend on the thickness of the string to be made. The twisted strings are exposed to the action of sulphur in a closed chamber, and are then rubbed with a horsehair cloth; these processes are repeated two or three times. If a string be sulphured too much, it becomes too brittle; if too little, it rarely keeps in tune, and the determination of the proper degree of sulphuring is a nice point in the manufacture.

The Italians have often had the reputation of making better violin-strings than any other people. The violinists of England, France, and Germany acknowledge the fact, but without being able to assign a sufficient reason for it. Dr. Ure suggests the following considerations: It is well known to physiologists that the membranes of lean animals are far more tough than of those animals which are fat or in high condition. In London, where no lean animals are slaughtered, the membranes of the sheep are supposed to be less tough and tenacious than those of Italy, which are not so highly fed. Hence it is inferred that the membrane employed by the Italians is better fitted for the manufacture than that used by the English manufacturers. Whether this be so or not, the fact of the pre-eminence is admitted. Otto, in his Treatise on the Violin (translated from the German by Mr. Fardely), says in relation to violin strings: 'The best strings which have come under my observation are those from Milan, which are sold under the name of Roman strings; they are now to be had at almost every music shop. I shall point out the signs by which the best strings may be distinguished, as there are some imitations of them manufactured at Neukirch, in Voigtland, in Bohemia, and in the Tyrol, which are sold for Italian. The Milanese strings are as clear and transparent as glass. The third string should be equally clear as the first. They must by no means feel smooth to the touch, for they are not ground or polished off by any process, as all other manufactured strings are. If a good string be held by one end in the finger, and opened out, it will recoil to its former position like a watch spring. Every string, when stretched on the instrument, should look like a thin strip of glass on the finger-board: those which are of a dull and opaque appearance are useless. The Milanese strings are also distinguished by each separate one being tied twice with red silk; which however the Neukirch string-makers have imitated. Their elasticity is after all the best criterion; as no other strings which I have tried have that strength and elasticity for which the Milanese are so much esteemed.'

The thickest string of the violin, and many other musical strings, are coated with an envelope of fine wire. This is done by stretching the string very tightly, applying the wire at one end of it, and causing the wire to coil helically round the string by giving to it a rotatory motion.

For the strong thick cord used for hatters' bowstrings, the largest of the membranes are used, after being cleansed and prepared; from four to twelve of them being twisted together, according to the size of the cord to be produced. The pieces are twisted to a length of fifteen, twenty, or twenty-five feet; and to effect this, pieces of the membrane are sewed end to end, till they produce the required length. While under the process of twisting, the cord is well rubbed between the fingers, to equalise the thickness. The cord is exposed twice to the fumes of sulphur, and is rubbed repeatedly afterwards.

The catgut employed by clockmakers is prepared from the smaller intestines, well prepared with potash. The hollow membranous tube is sometimes cut into two strips in a curious way. The tube is drawn over a ball, behind which is a kind of knife having two cutting edges or blades, whereby the tube is ripped up into two oblong strips of equal width. The method somewhat resembles that by which straws are split for the straw-plait manufacture. For larger and stronger purposes, clockmakers sometimes use cord composed of two or more intestines twisted together, as for violin-strings. The catgut for whips and similar purposes is prepared and wrought much in the same way; short pieces being sewed together to produce a piece of the requisite length, and this being twisted to give it a sufficient degree of strength.

For the mode of preparing, from a membrane covering the intestine of the ox, the fine pellicle known by the name of 'gold-beaters' skin,' see Gold-Beating, Gold-Beaters' Skin, P. C. S.

CATHARTOCARPUS (from *καθαίρω*, to purge, and *κάρπος*, fruit), a genus of plants belonging to the natural order Leguminosæ. It has very blunt sepals, hardly joined at the base, more or less unequal; five unequal petals; ten unequal free stamens, the three lower ones longest, the four middle ones short and straight, the three upper ones bearing abortive difformed anthers; the anthers ovate, opening by two chinks at the apex; the ovary stipitate; the legumes terete or a little compressed, indehiscent, woody with elevated sutures, transversely many-celled inside, the cells 1-seeded and filled with pulp; the seeds elliptic, rather compressed, horizontal. The species are trees with abruptly pinnate leaves and racemes of large yellow flowers. In appearance they are not unlike the common laburnum when in flower. This genus of plants was formerly comprehended under Cassia [Cassia, P. C.], but was separated by Persoon, who has been followed by Lindley, Nees von Esenbeck, and others. The habit of these trees, and the character of their fruit, differ from the species of Cassia. It is also undoubtedly desirable that a genus like Cassia, with nearly two hundred species, should be subdivided.

C. Fistula, the Purging Cassia, or Pudding Pipe-tree, has leaves with 4-6 pairs of ovate, rather acuminated glabrous leaflets; the petioles glandless; the racemes loose, bractless; the legumes cylindrical, rather obtuse, smooth. It is supposed to have been originally a native of tropical Africa, but is now extensively diffused over the globe, and is found abundantly in Hindustan, China, the East Indian Islands, the West Indies, and South America. It is a tree from thirty to forty feet high, with yellow flowers and long cylindrical black pods, from nine inches to two feet in length. The valves of this pod are thin, hard, and brittle; and its cavity is divided by numerous thin brittle transverse dissepiments; the partitions thus formed have each a single hard flattened ovate seed, surrounded by a soft pulp. The pulp has a sweetish flat, not unpleasant taste, and is separated by boiling the pod in water, straining the fluid, and then evaporating it to the consistence of a thick extract. This extract acts as a mild purgative on the system, and was long in great repute in Europe on that account. It is now however seldom used; and although admitted into the lists of materia medica of the British Pharmacopœias, is only placed there as entering into the composition of the Electuarium Cassiæ and the Confectio Sennæ. The pulp, according to Henry, consists of 61 per cent. of sugar, 6·75 of gum, and 13·25 of tannin. It probably also contains *Cathartine* or an analogous principle.

C. Javanicus, Horse Cassia, has leaves with 12-15 pairs of ovate, obtuse, glabrous leaflets; glandless petioles; axillary racemes; nearly cylindrical, very long, and transversely torose legumes. It is a native of Java and the Moluccas. Its legumes are above two feet in length, and contain a black cathartic pulp, which is used as a horse-medicine in the East Indies. G. Don has described a species of Cathartocarpus (*C. conspicuus*), a native of Sierra Leone, where the pods are called Monkey Drum-sticks. In the Gardener's Dictionary there are fifteen species of Cathartocarpus described.

(Christison, *Dispensatory*; Don, *Gardener's Dict.*)

CATILLUS, a fossil genus of bivalve shells, allied to Crenatula and Perna, so named by Cuvier and Brongniart. In the chalk occur species of large size, remarkable for their largely fibrous texture. They have also been called from this circumstance Inoceramus by Sowerby, who includes in the genus one species from the lias and others from the golt.

CATO, DIONYSIUS. [DIONYSIUS CATO.]

CAU'CALIS, a genus of plants belonging to the natural order Umbelliferæ, the suborder Campylospermeæ, and the tribe Caucalineæ. It has a calyx of five teeth, the petals obcordate, with an inflexed point, outer ones radiant and bifid, the point slightly laterally compressed, the carpels with filiform bristly primary and more or less prominent secondary ridges, all bearing 1-3 rows of prickles. The species are herbs with multiplied leaves, and white flowers. They are called by the common name of Bur-parsley. Two of the species are found in England, *C. daucoides* and *C. latifolia.* They are found in corn-fields on chalky soils; the last is a rare plant, and has been probably introduced.

(Babington, *Manual of Brit. Bot.*)

CAULERPITES, a group of fossil fucoid plants, of which many species occur, scattered through nearly all the marine formations. In the oolites seven species have been found. The recent genus Caulerpa is found in warm southern climates.

CAULO'PTERIS. [COAL-PLANTS, P. C.]

CAVALLI'NI, PIE'TRO, a celebrated old Roman painter of the fourteenth century, and one of the earliest masters of the modern Roman school, was born at Rome in the latter half of the thirteenth century, and lived at Rome during the interval that the popes resided at Avignon. Vasari's account of Cavallini is somewhat inconsistent with the period of his death as adopted by Manni and Lanzi, 1344; for if, as Vasari says, he was eighty-five when he died, he must have been a much older painter than Giotto, and can scarcely, as he states, have been his pupil. Vasari however says that Cavallini was living in 1364, but so many of his dates have been found to be incorrect, that he cannot be strictly depended upon. Cavallini was painter, architect, and worker in mosaic. He assisted Giotto in the mosaic or Navicella of the porch of St. Peter's; and there are still some of his own mosaics in the Basilica of San Paolo and at Santa Maria in Trastevere at Rome. He executed also many paintings in the churches, but there are no remains of them; the last were destroyed by the fire which, in 1824, almost entirely consumed the above-mentioned old Basilica of San Paolo, outside the walls of the city: the mosaics however, and a miracle-working wooden crucifix made by Cavallini, remained uninjured.

Cavallini painted also several frescoes at Florence, Orvieto, and at Assisi, some of which are still in a tolerable state of preservation. A crucifixion in the church of Assisi is the most remarkable and the best preserved. It contains a crowd of figures, some on horseback, and dressed in a variety of costumes; in the sky, which is a deep bright blue, are several angels. It is a work of great labour, and though the design is very angular, the figures sometimes distorted, and the perspective incorrect, the figures have expression and character, and if we consider the examples which can have been his only guides, we must pronounce it a highly creditable and meritorious work. The fact that Cavallini's works, especially his heads, are very inferior to those of Giotto, is, considering his industry and powers of observation, one reason for concluding that he was an older painter than Giotto. Under this supposition there is nothing inconsistent in the belief of Vertue, that Cavallini designed the crosses which were erected to Queen Eleanor, and that he was the Petrus Romanus Civis of the inscription on the shrine of Edward the Confessor in Westminster Abbey, and accordingly the architect of the shrine, which was finished in 1270. Walpole adopts the supposition, and concludes that Cavallini returned to England with the abbot Ware, who was elected in 1260, and went shortly afterwards to Rome to receive consecration from Urban IV.

The celebrated miracle-performing picture of the Annunciation, or la Nunziata, in the church de' Servi at Florence, formerly attributed to Cavallini, is now with more certainty attributed to a Maestro Bartolomeo who lived at Florence in 1236.

(Vasari, *Vite de' Pittori*, &c.; Lanzi, *Storia Pittorica*, &c.; Walpole, *Anecdotes of Painting*, &c.)

CAVALLO, TIBERIUS, a distinguished electrician, was born at Naples in 1749, and in the university of that city he completed his education. In 1771 he was sent to London, in order that he might attain a correct knowledge of the mode in which mercantile transactions are conducted in England, but he soon abandoned the pursuits of commerce for those of natural philosophy, and in these he continued to be engaged till his death, which took place December 6, 1809. He was buried in old St. Pancras churchyard, London.

Cavallo was less distinguished for originality of thought than for his vast industry in the research of the laws of nature by the way of observation and experiment, and for his highly retentive memory; he possessed this faculty to such a degree that, at an age when he was unable to comprehend the reasoning employed, he knew by heart all the propositions and demonstrations in the books of Euclid. He had considerable skill in music, for which he retained the taste even after his sense of hearing was considerably impaired. He was appointed a member of the Academy of Sciences of Naples in 1779, and in the same year he was elected a fellow of the Royal Society of London.

The labours of Cavallo consisted chiefly in the performance of experiments relating to electricity and magnetism, by which he contributed much to the improvement of those branches of philosophy: he also made researches concerning the composition of the atmosphere and the characters of minerals. In order to determine the nature of the electricity in the atmosphere he employed what he called an 'atmospherical collector:' this was a long rod having at one extremity a small glass tube terminating with a cork from which were suspended two pith balls. The rod being held out as far as possible from an upper window of the house, when the balls diverged by the electricity of the atmosphere, they were drawn in, and the nature of the electric fluid was ascertained by examination. In 1775, while residing near Islington, he made a remarkable experiment with a kite, raised in the air to the height allowed by 120 yards of string, from which he ascertained that a great quantity of electricity may exist in the atmosphere without producing thunder or lightning. A small cloud passing over the house, he charged some jars with the electricity obtained from it, which he found to be positive; by degrees the quantity diminished till it became insensible, but after a short time a great dark cloud rising towards the zenith, the fluid, which began again to be manifest, was found to be negative: the electricity continuing to increase and the rain falling copiously, he pulled in the kite lest some serious accident should happen; and in doing this, he received many strong shocks in his arms, breast, and legs. He frequently made experiments of this kind, with kites which were about four feet long and two feet wide; the string was of common twine twisted with threads of fine copper-wire.

He invented an instrument called a 'condenser of electricity,' which consisted of a tin plate between two parts of a wooden frame covered interiorly with gilt paper: the plate was isolated by being supported on glass pillars; and one edge being connected with the body containing the electricity, the effect of the condensation was shown, at the opposite edge, by the electrometer. He invented also a 'multiplier' of electricity, which consisted of two brass plates insulated by being supported on glass pillars, and of a third plate which could be insulated or uninsulated at pleasure: this last being fixed to a lever which turned on a pivot, after receiving electricity from one of the former plates, conveyed it to the other, with which an electrometer was connected: returning from the second plate to the first it received a fresh supply of electricity, which it conveyed in like manner to the other; and so on, till a sufficient quantity was accumulated on the latter.

Among his experiments was one in which were exhibited some remarkable phenomena of the electricity in glass tubes containing mercury. The mercury was boiled in the tube, and the latter being afterwards sealed, on elevating and depressing alternately the ends, electricity was excited by the friction of the mercury: this changed from positive to negative, and the contrary, as the tube was placed in direct and inverted positions.

Cavallo invented also a simple micrometer consisting of a thin and narrow slip of mother-of-pearl divided into parts each equal to $\frac{1}{200}$ of an inch; this being fixed in the diaphragm of a telescope, at the focus of the eye-glass, served for measuring small angles.

Besides four Bakerian lectures on thermometrical and magnetical phenomena, and several papers on electricity and other subjects, in the 'Philosophical Transactions,' Cavallo published, in London, 1, 'A Complete Treatise on Electricity,' 8vo. 1777; 2, 'An Essay on the Theory and Practice of Medical Electricity,' 8vo. 1780; 3, 'A Treatise on the Nature and Properties of Air,' &c. 4to. 1781; 4, 'The History and Practice of Aerostation,' 8vo. 1785; 5, Mineralogical Tables,' 1785; 6, 'A Treatise on Magnetism in Theory and Practice,' 8vo. 1787; 7, Description and Use of the Mother-of-Pearl Micrometer,' 8vo. 1793; 8, 'Essay on the Medicinal Properties of Factitious Airs,' &c. 8vo. 1798; and 9, 'Elements of Natural and Experimental Philosophy,' 4 vols. 8vo. 1803.

(Aikin's *General Biography;* Chalmers's *Biographical Dictionary.*)

CAVENDISH, MARGARET, DUCHESS OF NEWCASTLE. This eccentric lady, the youngest daughter of Sir Charles Lucas, was born in Essex towards the close of the reign of James the First. In 1643 she was appointed a maid of honour to Henrietta Maria; and, accompanying the queen to Paris, she became in 1645 the second wife of William Cavendish, who had formerly been Earl and was then Marquis of Newcastle, and who had borne arms in the civil war with courage and self-devotion. The exile of the Marchioness and her husband was chiefly spent at Antwerp, and was accompanied by frequent pecuniary embarrassments, which she had the spirit to avow in her memoir of her husband's life. Both of them were forced at one time to pawn even their clothes. A visit which she paid to England was unsuccessful in procuring any grant out of the family estates; but assistance furnished by relations enabled the Marquis and his wife to subsist more comfortably till the Restoration. On that event they returned to England; and in 1664 the Marquis was created Duke of Newcastle. The remainder of their married life was spent in the retirement of the country. The Duchess died in the end of the year 1673, and her husband, aged eighty-four, in 1676.

The period which succeeded the acquisition of the dukedom was chiefly devoted by the noble pair to that course of literary study and composition, which, however creditable in the motive, was rendered so whimsical by the eccentric character of the parties. Horace Walpole, in his 'Royal and Noble Authors,' found a tempting theme for his ill-natured wit in the picture of the duke and duchess, prosecuting their harmless occupations with an aristocratic forgetfulness of the whole world besides, each regarding the other as the greatest genius of the times, and each lavishing on the other, in conversation and in print, the most extravagant hyperboles of commendation. The Duke had long before appeared more than once as an author; and particularly by the publication of his work on Horsemanship, first printed in French at Antwerp in 1658, and afterwards in English, with alterations, at London m 1667. In the later period of his life, the example of his wife tempted him to perpetrate some comedies which were even worse than her own. She was indeed at once the more ambitious and by far the more industrious writer of the two. There was scarcely any department of composition, either in prose or in verse, on which she did not exercise her ready pen. Her singularly constituted mind was always in fermentation; and, not content with recording its products at ordinary hours, she kept some of her attendant ladies within call even during the night, to write down the bright thoughts that arose in hours of sleeplessness. The result of this distempered activity was a collection of ten printed folios, besides other works that never saw the light. Catalogues of these, and of the Duke's works, will be found in Walpole and in the Biographia Britannica. The best known works of the Duchess are her two volumes of plays, published respectively in 1662 and 1668. These effusions deserve a passing inspection from the student of literary history, both as monuments of unredeemed and self-satisfied absurdity, and as examples of some principles in literary composition to which no author before or since has ever been bold enough to avow obedience. Not only for the higher laws of style, but even for the ordinary rules of English grammar, 'the thrice noble, illustrious, and excellent Princess' (as her title-pages call her) professed a sovereign contempt. In several of those nine addresses 'to the Readers' which, besides other prefaces, stand in succession before her first volume of plays, she magnanimously declares her willingness that her writings should be unread by 'such pedantical scholastical persons' as attach importance to grammatical distinctions of gender, and to those other laws of language, as to which she announces, that, if she understood them, as she does not, she would not follow them. Her practice was quite conformable to this frank profession. It is rarely, for example, that she condescends to join a plural verb with a plural nominative. But all such technical faults are as nothing, compared with the childish and senseless extravagancies which in those plays make up the whole tissue of the matter. There is not in one of them a scene that is dramatic in anything but the form. That they should be free from coarseness was not to be expected in such an age; but some of the most indelicate scenes are carefully marked as having been written by 'the Lord Marquess.' The philosophical discussions which abound throughout are claimed by the lady as her own.

CAVENDISH, WILLIAM, Duke of Newcastle. [CAVENDISH, MARGARET.]

CEAN-BERMUDEZ, JUAN AUGUSTIN, one of the few writers on art Spain has produced, was born at Gijon in the Asturias, in 1749, and was the son of poor parents. He was educated in the Jesuits' College at Oviedo, where it was his good fortune to find not only a companion but a friend and protector in Jovellanos [JOVELLANOS, P. C.], with whom he resided two years at Alcala and Seville, and then went with him to Madrid, in 1778. During Jovellanos' retirement shortly afterwards from office he returned with him to Seville, where his admiration of the monuments of that city led him to apply himself to a systematic course of study in architecture and drawing. Encouraged by Jovellanos, he proceeded to Madrid in order to place himself under Mengs, but as that artist shortly after returned to Rome, he had not much time to profit by his instruction. When Jovellanos was recalled to office he procured an appointment for his friend. Some years afterwards Bermudez obtained a small pension, which enabled him to devote himself entirely to his literary pursuits as the historian of Spanish art. His first publication was the 'Diccionario Historico de los mas illustres Professores de las bellas Artes en España,' 6 vols. 8vo. 1800; and his others are: 'Descripcion Artistica de la Catedral de Sevilla,' 1804; 'Descripcion del Hospital del Sangre,' 1804; 'Carta sobre el Estilo, etc. de la Escuela Sevillana,' 1806, in which he traces the progress of the Seville school of painting from the middle of the fifteenth century; 'Dialogo sobre el Arte de Pintar,' 1819; and lastly the 'Noticias de los Arquitectos y Arquitectura en España,' 4 vols. 4to., 1829, &c., a work founded upon materials collected by Eugenio Llaguno, who shortly before his death gave them to Bermudez, insisting upon his making use of them. Bermudez accordingly afterwards not only arranged and shaped them for publication, but made extensive additions and enlargements, and carried on the history to the close of the eighteenth century. Valuable as this work is for the mass of information and copious documents which it contains, it is rather one for mere reference than perusal, it being not so much a critical history of Spanish architecture as an industriously compiled register of facts, names, and dates.

Besides the preceding there is one other publication of his to be mentioned—the ‘Memorias para la Vida de Jovellanos,’ Madrid, 1814, in which he has left an affectionate portraiture of that excellent friend. Cean-Bermudez died in 1834, and left several manuscript works, one of which, on the Roman antiquities of Spain, was afterwards edited at the expense of the Royal Spanish Academy of History.

CEANOTHUS, a genus of plants belonging to the natural order Rhamnaceæ. The calyx is 5-cleft, campanulate, cut round after flowering, with the base permanent and adhering to the fruit; petals hooded, with long spreading claws; fruit dry, 3-celled, loculicidal, with papery valves; cells 1-seeded. The species are smooth or pubescent shrubs, with erect branches; alternate serrated, 3-nerved leaves; and very slender, white blue or yellow flowers disposed in terminal panicles, or in axillary racemes. They are natives of North America.

C. *Americanus*, Red Root, New Jersey Tea, has ovate, acuminate, serrated leaves, pubescent beneath; flowers arranged in axillary elongated thyrses, with a pubescent rachis. An infusion of the twigs of this plant is used in Canada for venereal diseases. During one of the wars with America, the leaves of this plant were used in New Jersey as a substitute for tea. It dyes wool of a fine strong nankin-cinnamon colour, and is a beautiful shrub when in flower.

There are several other species of this genus, natives of North and South America. They are small neat shrubs, with large red roots, which give them the name of Red Root. They grow very well in this country, and may be planted in any common garden soil, and form proper plants for the front of a shrubbery. They may be propagated by layers or seeds. Those from Mexico and the greenhouse species must be protected from frost during the winter. Cuttings will root in sand under a hand-glass.

(Lindley, *Flora Medica;* Don, *Gardener's Dictionary.*)

CECILIANS. [SIPHONOPS, P. C.]

CECRO'PIA. [URTICACEÆ, P. C.]

CEDRELA'CEÆ, a natural order of plants, belonging to the syncarpous group of polypetalous exogens. The species are timber-trees: the timber is usually compact, scented, and beautifully veined; the leaves are alternate, pinnated, without stipules; the flowers in terminal panicles. The essential characters of the order are: calyx 4-5-cleft, petals 4-5 longer than the sepals; stamens 8-10, the filaments either curled into a tube, or distinct, and inserted into a hypogynous disk; the style and stigmas simple; the cells of the ovary equal in number to the petals or flower, with the ovules 4 or often more imbricated in two rows; the first capsular with the valves separable from the dissepiments, with which they alternate; the seeds flat winged, albumen thin or none. This order is nearly related to Meliaceæ, from which it is chiefly distinguished by its winged and indefinite seeds. The following is a synopsis of the genera:—

1. *Cedrela.* Calyx 5-toothed; petals adnate to the torus; stamens 5 distinct; capsule 5-celled, 5-valved; seeds numerous, on each side of the dissepiment ending in a wing.
2. *Swieteina.* Calyx 4-5-cleft; stamens 8-10, joined into a tube; capsule 5-celled, 5-valved; seeds numerous, each drawn out into a wing.
3. *Chloroxylon.* Calyx 5-cleft; stamens 10, connected at the base; capsule 3-valved, 3-celled; seeds 4 in each side, the dissepiment drawn out into a wing.
4. *Flindersia.* Calyx 5-cleft; stamens 10, alternate ones sterile; capsule 5-valved, 5-celled; seeds 2 in each side of the dissepiment, ending in a wing at the top.
5. *Oxleya.* Capsule 5-celled, 5-valved; seeds 3 on each side of the dissepiment, ending in a wing at both ends.

Cedrela Toona, Bastard Cedar, has lanceolate leaflets, acuminate entire, pale glaucous beneath. It is a native of the East Indies, where it is called Toon. It has an erect trunk of great height and size, with smooth grey bark. The flowers are very numerous, small, white, fragrant, like honey. The seeds are numerous, imbricated, winged. The bark is a powerful astringent, and is said to be a good substitute for Peruvian bark in the cure of periodic diseases. Dr. Blume used it in Java with much success in the various forms of fever, dysentery, diarrhœa, &c. Horsfield also used it in dysentery.

C. *odorata*, leaflets ovate-lanceolate entire on short stalks. It is a native of Barbadoes and the Caribbee Islands. It is a large tree with a rough bark. The fruit is about the size of a partridge-egg. When fresh, the bark and berries smell like assafœtida. The trunk is hollowed out into canoes and pariaquas. The wood is of a brown colour, and has a fragrant odour, from which circumstance it is called in the British West India Islands, Cedar. It is frequently cut into shingles for covering houses, but is not adapted for ship-building, on account of its being subject to the attacks of worms. It is not adapted for casks, as it gives its odour to whatever is placed in contact with it.

C. *febrifuga* (*Soymidia febrifuga*) has leaflets ovate-oblong, acuminated quite entire. It is a native of Java. Its bark is said to have a better effect on some of the fevers of India than cinchona. It is also a powerful astringent. The wood is good for many purposes.

An essential oil called wood oil is found in *Chloroxylon Swietenia*, which is a native of the East Indies. The wood is of a deep yellow colour, and called *Satin-wood*, remarkably close-grained, heavy, and durable, and comes nearer to box-wood than the produce of any other tree. *Flindersia* possesses a volatile oil. *F. Australis* is a native of New Holland, and its wood is said to be not inferior to mahogany. *F. Amboinensis* is a native of the islands of Hitu and Ceram. The spiny part of the fruit is formed into rasps. It was on this account called by Rumphius *Arbor radulifera*. *Oxleya xanthoxyla*, is a native of New Holland. It attains a height of 100 feet. The wood is yellow, and employed for building boats. It is called *yellow-wood.* For the properties of other species of the order see SWIETENIA, P. C.

(Lindley, *Flora Medica;* Don, *Gardener's Dictionary;* Lindley, *Natural System.*)

CELE'STI, ANDRE'A (*Cavaliere*), a very distinguished painter of the Venetian School, was born at Venice in 1637, and died there in 1706. He was the scholar of the Cav. Matteo Ponzone, but not his imitator. Celesti's works are very attractive, especially in colouring, in which he resembles Paul Veronese; they display also great power both of conception and design, and are remarkable for their costly draperies and general facility of execution. He painted landscape, history, sacred and profane, and *genre;* cabinet pictures, gallery pictures, and altar-pieces. He is seen to much advantage in the gallery of Dresden, where there are five pictures by him, three of unusually large dimensions, and the figures are the size of life in all. The following three are strikingly rich in colour, Bacchus and Ceres, Samson delivered into the power of the Philistines, and the Murder of the Innocents. The remaining two are the Israelites bringing offerings for the making of the Golden Calf, and the sack of a city by night: the last is the largest picture in the collection, being very nearly 23 feet long by 13 high. Notwithstanding however the attractive colouring of Celesti, his middle tints are often insignificant compared with his lights and shadows, a defect which is attributable probably to his painting upon dark grounds, a practice which prevailed very much in Venice in his time.

(Boschini, *Pitture di Venezia.*)

CELLULARES. [VASCULARES, P. C.]

CELSIA (named by Linnæus in honour of Olaf Celsius, D.D., professor of Greek, and afterwards of Theology, in the University of Upsal), a genus of plants belonging to the natural order Solanaceæ. It has a 5-parted calyx, a rotate 5-lobed corolla, 4 perfect stamens, didynamous, bearded. All the species are herbs with simple or pinnate leaves, the flowers disposed in loose terminal racemes, each rising from the axil of a bract or small leaf.

C. *orientalis* has the lower leaves jagged, those of the stem bipinnate. It is a native of Cappadocia and Armenia.

C. *sublanata*, shrubby clothed with woolly tomentum, the leaves oval-oblong obtuse, crenated, wrinkled, soft. It is now cultivated in this country, but its native district is unknown. It has sweet-scented flowers. There are several other species of *Celsia*, all of them closely resembling the species of *Verbascum*, under which genus many of them have been described.

In the cultivation of the species of Celsia, the seeds should be sown on a gentle hot-bed, and when the plants are large enough, they should be set in separate pots, as they require the protection of a green-house or frame the first winter. In the second year they may be planted out, about the month of May, in any warm sheltered situation. They will flower and ripen their seed in the open air. *C. sublanata* and *C. parviflora*, being shrubby plants, should be treated as Pelargoniums or other greenhouse shrubs.

(Don, *Gardener's Dictionary.*)

CELSUS, P. JUVE'NTIUS, was the son of Juventius Celsus, also a jurist. This Celsus the father is spoken of by Celsus the son, and also by Neratius and Ulpian, in which passages he is always spoken of as Celsus the father. The extracts from Celsus in the 'Digest' are supposed to be from the works of Celsus the son. The son was twice consul according to Pomponius (*Dig.* 1, tit. 2). It is uncertain in what year he was first consul, but his second consulship belongs to the thirteenth year of the emperor Hadrian (A.D. 129), as appears from an extant inscription and a senatusconsultum of that time which is preserved (*Dig.* 5, tit. 3, s. 20). Celsus is also mentioned as a member of Hadrian's consilium, by Spartianus (c. 18); but he is called Julius Celsus.

The younger Celsus was the author of a work entitled 'Digesta,' in thirty-nine books, as appears from the Florentine Index. He wrote also Epistolae, of which the eleventh book is cited by Ulpian (*Dig.* 4, tit. 4, s. 3); Commentarii, of which the seventh book is cited; and Quaestiones, of which the nineteenth book is quoted in the 'Digest' of Justinian. Celsus is mentioned by Salvius Julianus, his contemporary, and by subsequent jurists. The tendency of his juristical opinions was to the maintenance of equity and fair-dealing (bonum et aequum). His definition of 'jus' is that it is the 'ars aequi bonique,' a definition quoted with approbation by Ulpian (*Dig.* 1, tit. 1, s. 1), though it is not a true definition. Celsus said more truly that in cases in which the good and the equitable were matters for consideration, mischievous mistakes were made under the authority of legal science (*Dig.* 45, tit. 1, s. 91); an opinion which is quoted by Paulus, who calls him Celsus adolescens, apparently to distinguish him from the father.

CEMETERY. [INTERMENT, P. C.]

CENONY'CE. [LIVERWORTS, P. C. S.]

CENSORI'NUS, a Latin grammarian who lived under the emperors Alexander Severus, Maximinus, and Marcus Antoninus Pius Gordianus. This Gordianus, the grandson of the elder Gordianus, was proclaimed sole emperor of Rome A.D. 238. Censorinus is the author of a small work entitled 'De Die Natali,' addressed to Q. Caerellius, his friend. He treats of the time of the birth of men, and on the influence of the Genii and of the stars on human birth; and he also treats of other matters relating to chronology, mathematics, and cosmography. This is the work of a man who in his day was a man of learning. The style is good for the period. The work is of some value for antient chronology. Carrio in his edition considered the last part of the work, from the 24th chapter, as a separate treatise of some unknown author, and published it with the title 'De Naturali Institutione.' A treatise on accents by Censorinus is mentioned by Cassiodorus; and one on geometry is also mentioned, but both are lost. A fragment 'De Metris' is still extant.

The first edition of Censorinus is probably that of Bologna, fol. 1497. The edition of L. Carrio was published at Paris, 1585, 8vo. The edition of Haverkamp, Leyden, 8vo., 1743, was published after Haverkamp's death by his sons: it contains also the fragments of the Satires of Lucilius. The edition of 1767 is the same as that of 1743, with a new title-page. The last edition is by J. S. Gruber, Nürnberg, 8vo. 1805: the edition of 1810 has only a new title-page.

CENSORSHIP OF THE PRESS, a regulation which has prevailed in most countries of Europe, and still prevails in many, according to which printed books, pamphlets, and newspapers, are examined by persons appointed for the purpose, who are empowered to prevent publication if they see sufficient reason.

There are different modes of censorship; the universal previous censorship, by which all MSS. must be examined and approved of before they are sent to press; the indirect censorship, which examines works after they have been printed, and, if it finds anything objectionable, stops their sale and confiscates the edition, and marks out the author or editor for prosecution; the optional censorship, which allows an author to tender his MS. for examination in order to be discharged from all responsibility afterwards; and lastly, by a distinction which has been very commonly made between newspapers or pamphlets and works of a greater bulk, the censorship of the journals, which exists even in countries where larger works are free from this superintendence. All these forms of censorship imply an establishment of censors, examiners, inspectors, or licensers, as they have been variously called, appointed for the purpose, a provision quite distinct from the laws which define the various offences which a man may be guilty of by publication. These are repressive or penal laws, whilst the censorship, and especially the previous censorship, is essentially a preventive regulation.

The censorship may be said to be coeval with printing. In more antient times, those writings which were obnoxious to the prevailing political or religious systems, if they fell under the eyes of men in authority, were condemned to be destroyed. Thus, all the copies of the works of Protagoras which could be found in Athens were publicly burnt by sentence of the Areopagus, because the author expressed doubts concerning the existence of the gods. Personal defamation and satire were also forbidden. Naevius at Rome was banished, some say put in prison, for having, in his plays, cast reflections on several patricians. Augustus ordered the satirical works of Labienus to be burnt, and Ovid's alleged or probable cause of exile was his amatory poetry. The senate under Tiberius condemned a work to be burnt, in which Cassius was styled the last of the Romans. Diocletian ordered the sacred books of the Christians to be burnt, and afterwards Constantine condemned the works of Arius to the flames. All these however were penal enactments independent of any censorship. The councils of the Church condemned books which they judged to be heretical, and warned the faithful against reading them. Afterwards the popes began to condemn certain works and prohibit the reading of them. In the time of Huss and Wycliff, Pope Martin V. excommunicated those who read prohibited books. The introduction of printing having awakened the fears of the ecclesiastical authorities, several bishops ordered books to be examined by censors. One of the earliest instances of this is that quoted by Johann Beckmann, in his 'Book of Inventions,' of Berchthold, Archbishop of Mainz, who in the year 1486 issued a mandate, in which, after censuring the practice of translating the sacred writings from the Latin into the vulgar German, a language, he says, too rude and too poor to express the exact meaning of the inspired text, he adverts to the translations of the books of the canon and civil law, works, as the archbishop says, so difficult as to require the whole life of man to be understood, a difficulty which is now increased by the incompetence of the translator, which renders obscurity still more obscure. His grace therefore, setting a full value on the art of printing, 'which had its cradle in this illustrious city of Mainz,' and wishing to preserve its honour by preventing it being abused, forbids all persons subject to his authority, clerical and lay, of whatever rank, order, and profession, to print the translation of any work from the Greek, Latin, or any other language, into German, concerning any art, science, or information whatever, publicly or privately, unless such translation be read and approved of before being printed, and, when printed, before being published, and furnished with the written testimony of one of the doctors and professors of the University of Mainz, named by the archbishop, one for theology, one for law, one for medicine, and one for the arts. All who violated this order were to lose the book, pay a fine of one hundred gold florins to the Electoral Chamber, and be excommunicated.

Then follows the archbishop's commission to the censors—That no one in his province translate, print, or publish, any book in German, unless the censors previously read and approve its contents. And he directs them to refuse their approbation to such works as offend religion or morals, or whose meaning cannot clearly be made out, and may give rise to error and scandal. To those works which they approve of they shall affix their approbation, two of them jointly, in their own handwriting.

There were works printed at Cologne in 1479 bearing the approbation of the rector of that university, and there is also an Heidelberg edition of 1480 of the book entitled 'Nosce te-ipsum,' which bears four approbations, one by Philip Rota, Doctor utriusque Juris, and another by Maffeus Girardo, Patriarch of Venice and Primate of Dalmatia. There was however no general system of censorship in the fifteenth century, which was an age of freedom for printing; and it is a curious fact that the learned scholar Merula, in a letter to his friend Poliziano, dated 1480, expresses a wish that a previous censorship should be established over all books, such as Plato recommends for his republic, 'for,' says Merula, 'we are now quite overcome by a quantity of bad or insignificant books.'

In 1501, Pope Alexander VI. (Borgia) issued a bull, in which, after sundry complaints about the devil who sows tares among the wheat, he goes on to say that having been informed that by means of the art of printing many books and treatises, containing various errors and pernicious doctrines, have been and are being published in the provinces of Cologne, Mainz, Treves, and Magdeburg, he by these presents strictly forbids all printers, their servants, and all who exercise the art of printing in any manner, in the above provinces, to print hereafter any books, treatises, or writings, without previously applying to the respective archbishop, or his vicar and officials, or whomever they may appoint for the purpose, and obtaining their licence free of all expense, under pain of excommunication, besides a pecuniary fine at the discretion of the respective archbishops, bishops, or vicars-general. The bull provides for the books already printed and published, which are to be examined by the same authorities, and those containing anything to the prejudice of the Catholic faith are to be burnt.

At last, in 1515, the Council of the Lateran decreed that in future no books should be printed in any town or diocese, unless they were previously inspected and carefully examined, if at Rome by the vicar and the master of the sacred palace, and in the other dioceses by the bishop or those by him appointed, and by the inquisitor of that diocese or those by him appointed, and countersigned by their own hands gratis and without delay. Any book not so examined and countersigned was to be burnt, and the author or editor excommunicated.

Here then was the origin of the principle of a general censorship of the press, which has been ever since maintained by the Church of Rome in all countries where it had power to enforce it. The bishops were the censors in their respective dioceses; but the tribunal of the inquisition, wherever the inquisition was established, were the censors: they examined the MS. of every work previous to its being printed, and granted or refused an 'Imprimatur' or licence at their pleasure. The inquisition moreover sought after all books published beyond its jurisdiction, and having examined their contents, condemned those which were contrary to the doctrine or discipline of the Church of Rome, and of these it formed a list known by the name of Index of Forbidden Books, to which it has made copious additions from time to time. There are several of these Indices, made at different times and in different places: the Index of the Spanish Inquisition was different from that of Rome. Collections of these Indices have been made. One of the latest is contained in the 'Dictionnaire Critique et Bibliographique des principaux Livres condamnés au Feu, supprimés ou censurés,' by Peignot, Paris, 1806. In countries where the inquisition was not established, such as France, England, and Germany, the bishops acted as censors and licensers of books, which they examined or caused to be examined previous to printing, as to all matters concerning religion or morality. The censorship continued for a long time to belong to the ecclesiastical power, and even afterwards, when the civil power in various countries began to appoint royal censors to examine all kinds of works, the episcopal approbation was still required for all books which treated of religion or church discipline.

The Reformation greatly modified the censorship and reduced its powers, without however abolishing it; the power passed into other hands. In England the practice seems to have been to appoint licensers for the various branches of learning, but the bishops monopolized the principal part of the licensing power, as we find at the beginning of the reign of Charles I. in a petition of the printers and booksellers to the House of Commons, complaints against Bishop Laud that the licensing of books being wholly confined to him and his chaplains, he allowed books which favoured Popery to be published, but refused licensing those which were written against it. And Archbishop Abbot observed of Laud's licensing, 'it seemed as if we had an expurgatory press, though not an index like the Romanists, for the most religious truth was expurgated and suppressed in order to the false and secular interests of some of the clergy.' The system of previous licensing however did not always secure an author from subsequent responsibility. Thus Prynne's 'Histriomastix' was condemned in 1633 to be burnt by the hangman, for being a satire on the royal family and government, and the author to have his ears cut off, and to be imprisoned and heavily fined, although the book had actually been licensed, but it was alleged on the trial that the licenser had not read the whole of the work.

A decree of the Star Chamber concerning printing and licensing, dated 11th of July, 1637, was issued in order to establish a general system on the subject. The preamble refers to former decrees and ordinances for the better government and regulating of printers and printing, and particularly to an order of the 23rd of June, in the 28th year of Elizabeth, 'which orders and decrees have been found by experience to be defective in some particulars, and divers libellous, seditious, and mutinous books, have been unduly printed, and other books and papers without licence. The decree enacts among other things that 'no person or persons shall at any time print or cause to be printed any book or pamphlet whatsoever, unless the same book or pamphlet, and also all and every the titles, epistles, prefaces, proems, preambles, introductions, tables, dedications, and other matters and things whatsover thereunto annexed, or therewith imprinted, shall be first lawfully licensed and authorised only by such person and persons as are hereafter expressed, and by no other, and shall be also first entered into the register's book of the Company of Stationers, upon pain that every printer offending therein shall be for ever hereafter disabled to use or exercise the art or mystery of printing, and receive such further punishment as by this Court or the High Commission Court respectively, as the several causes shall require, shall be thought fitting.' It then goes on to provide that all books concerning the common laws of the realm shall have the special approbation of the Lord Chief Justices and the Lord Chief Baron for the time being, or one or more of them, or by their appointment; that all books of history or any other book of state affairs shall be licensed by the principal secretaries of state, or one of them or by their appointment; and that all books concerning heraldry, titles of honour and arms, or otherwise concerning the office of earl marshal, shall be licensed by the earl marshal, or by his appointment; 'and further that all other books, whether of divinity, physics, philosophy, poetry, or whatsoever, shall be allowed by the Lord Archbishop of Canterbury or Bishop of London for the time being, or by the chancellors or vice-chancellors of either of the universities of this realm, for such books that are to be printed within the limits of the universities respectively, not meddling either with books of the common law or matters of state. And it is further enacted that every person and persons, which by any decree of this court are or shall be appointed or authorised to license books or give warrant for imprinting thereof, as is aforesaid, shall have two several written copies of the same book, one of which shall be kept in the public registry of the respective licenser, to the end that he may be secure that the copy so licensed shall not be altered without his knowledge, and the other copy shall remain with the owner, and upon both the said copies he or they that shall allow the said book shall testify under his or their hand or hands, that there is nothing in the book contrary to the Christian faith and the doctrine and discipline of the Church of England, nor against the state or government, nor contrary to good life or good manners, or otherwise, as the nature and subject of the work shall require, which testimony shall be printed in the beginning of the book with the name of the licenser. All books coming from beyond the seas were to be reported by the merchant or consignee to the Archbishop of Canterbury or the Bishop of London, and to remain in custody of the custom-house officers until the Archbishop or Bishop sent one of their chaplains or some other learned man to be present with the master and wardens of the Company of Stationers or one of them, at the opening of the bale or package, for the purpose of examining the books therein contained. And if there is any seditious, schismatical, or offensive book found among them it was to be brought forthwith to the Archbishop of Canterbury or the Bishop of London, or to the High Commission Office, to be dealt with accordingly. All books, ballads, charts, and portraits were to bear the name of the printer or engraver as well as of the author or maker. All printers were to take out a licence. Their number was fixed and their names were published.

The war between Charles I. and the Parliament, and the abolition of the royal authority, did not affect the censorship, and the Long Parliament in the plenitude of its power maintained the practice just as the Star Chamber had done.

In March, 1642, an order of the Commons House of Parliament appointed by name certain stationers of London to search for any lying pamphlets scandalous to his majesty, or the proceedings of both or either House of Parliament, demolish and take away the printing-presses, and apprehend the printers or sellers.

In June, 1643, was issued an order of the Lords and Commons assembled in parliament for the regulating of printing, and for suppressing the great late abuses and frequent disorders in printing many false, scandalous, seditious, libellous, and unlicensed pamphlets, to the great defamation of religion and government. It enacts that no book, pamphlet, paper, nor part of any such book, pamphlet, or paper, shall from henceforth be printed, bound, stitched, or put to sale by any person or persons whatsoever, unless the same be first approved of and licensed under the hands of such person or persons as both or either of the Houses of Parliament shall appoint for the licensing of the same, and entered into the register-book of the Company of Stationers, according to antient custom. And further on it authorizes or requires the master and wardens of the said company, the gentleman usher of the House of Peers, the sergeant of the Commons' House and their deputies, together with the persons formerly appointed by the committee of the House of Commons for examination, to make from time to time diligent search in all places where they shall think meet, for all unlicensed printing-presses, and all presses any way employed in the printing of scandalous or unlicensed papers, pamphlets, books, &c., and to seize, deface, and destroy the same in the Common Hall of the said company.

It was in consequence of this order that John Milton wrote his 'Areopagitica; a Speech for the Liberty of unlicensed Printing,' addressed to the parliament of England, in which he shows that the system of licensing originated with the Papal Inquisition, and that it ought not to be adopted by a Protestant community: he exhibits its uselessness and injustice, and observes that the order of parliament is only a revival of the former order of the Star Chamber. Milton's disquisition is a piece of close reasoning and eloquently written, but it had no effect upon parliament, which continued to sanction the restraints upon the press, even after the abolition of royalty. A warrant of the Lord-General Fairfax, dated 9th of January, 1648, and addressed to 'Captain Richard Lawrence, Marshal-General of the Army under my command,' in virtue of an order of parliament, dated 5th of January, 1648, to put in execution the ordinances of parliament concerning scandalous and unlicensed pamphlets, and especially the ordinance of 28th September, 1642, and the order of the Lords and Commons, dated 14th June, 1643, for the regulating of printing. The marshal-general of the army is 'required and authorized to take into custody any person or persons who have offended or shall hereafter offend against the said ordinances, and inflict upon them such corporal punishments, and levy such penalties upon them for each offence, as is therein mentioned, and not discharge them till they have made full payment thereof, and received the said punishment accordingly.' And he is further authorized and required to make diligent search 'from time to time, in all places wherein he shall think meet, for all unlicensed printing-presses any way employed in printing scandalous and unlicensed papers, pamphlets, books, or ballads, and to search for such unlicensed books, papers, treatises, &c.'

The parliament of 1654 appointed a committee to watch all blasphemous publications, on whose reports several books, religious or controversial, were ordered to be burnt.

The parliament of 1656 appointed a committee to consider the way of suppressing private presses and regulating the press, and suppressing and preventing scandalous books and pamphlets. The Protector Cromwell enforced these restraints in order to prevent the agitation of political questions. In October, 1653, the council at Whitehall ordered that no person shall presume to publish in print any matter of public news or intelligence, without leave and approbation of the secretary of state. There appeared also an order of the protector and council against printing unlicensed and scandalous books and pamphlets, and for regulating printing. Cromwell however was disposed in general to rescue the victims of religious intolerance from the hands of their persecutors, the Independents and the Presbyterians.

After the Restoration, Roger Lestrange was appointed licenser of printing. He wrote in 1663, 'Considerations and Proposals in order to the Regulation of the Press.' Lestrange seems to have retained his office till the revolution of 1688, when he was succeeded by Fraser, who, it was said, was shortly after removed from his office for having allowed Dr. Walker's 'True Account of the Author of Eicon Basilike' to be printed. Edmund Bohun, a Suffolk justice, was appointed in Fraser's place. In a pamphlet printed in London in 1693, entitled 'Reasons humbly offered for the Liberty of Unlicensed Printing; to which is subjoined the just and true Character of Edmund Bohun, the Licenser of the Press, in a Letter from a Gentleman in the Country to a Member of Parliament,' there is a specimen of Bohun's licences: 'You are hereby allowed to print and vend a certain book, entitled . . . ., and for so doing this shall be your sufficient warrant. E. B.'

The act passed under Charles II., in 1662, which was, with few alterations, a copy of the Parliamentary ordinances concerning the licensing of printing, expired in 1679, but was revived by statute 1 Jac. II. c. 17, and continued till 1692. It was then continued for two years longer by statute 4 William and Mary, c. 24, and it expired in 1694, when the licensing system was finally abolished in England; but the question of its revival was repeatedly agitated in parliament, as we see by a paper dated 1704, entitled 'Reasons against restraining the Press,' which deprecates the intention of reviving the licensing system; and by a much later and bolder pamphlet dated 1729, styled, 'Letter to a Great Man concerning the Liberty of the Press.'

Under the old French monarchy, all works previous to being printed were to be examined by the royal censors; and if approved, were signed with their permission. The French censorship was originally in the hands of the bishops, for all matters concerning religion and ecclesiastical discipline. By degrees the bishops delegated this power to the faculty of theology, and the Parliament of Paris sanctioned the practice. The manuscripts were laid before the faculty, which appointed two doctors of divinity to examine them. The doctors made their report to the general assembly of the faculty, which approved or rejected the work. Prelates themselves were not exempt from this formality. The learned Cardinal Sadoleto, while Bishop of Carpentras, was refused permission to print a commentary which he had written on the Epistle of Paul to the Romans in 1532: Cardinal Saugain was likewise refused permission to publish a work in 1542. As at that time a number of heterodox books were pouring into France from abroad, the Parliament of Paris, by a decision of the year 1542, authorised the faculty of theology to examine all books imported from foreign countries. Towards the beginning of the following or seventeenth century, the great increase and accumulation of new books having induced the examining doctors to omit their reports to the assembly of the faculty, the assembly issued an order to the said examiners not to give their approbation to new works without mature consideration, under the penalty of suspension from their office. In 1624 the faculty itself being divided into parties on some matters of controversy, Dr. Duval, the leader of one of the parties, obtained the king's letters patent for himself and three of his colleagues, by which they obtained the exclusive authority of approving all books concerning religion and church discipline. The faculty remonstrated against this innovation, but the king maintained his appointment. After Duval's death, the faculty resumed its old powers; but in 1653, the controversy concerning grace having given birth to a multitude of polemical works, concerning which the faculty itself was divided in opinion, the chancellor Seguier took from it the censorship: and he created four censors, with an annual stipend, to examine all works without distinction. Before that time it appears that works unconnected with religion were examined by the Maîtres des Requêtes. But ever since 1653, the appointment of the censors rested with the chancellor. They were styled Royal Censors, and their number was gradually increased. They were distributed into seven classes, according to the nature of the works which they had to examine, namely, theology, jurisprudence, natural history and medicine, surgery, mathematics, history and belles lettres (which class had the greatest number of censors attached to it); and lastly, geography, navigation, travels, and engravings. No work could be printed or sold unless it was previously examined and approved by one of the Royal Censors. The lieutenant of police had under him a censor who examined all dramatic works, before they could be performed.

At the Revolution the censorship was abolished. The republican constitutions which were proclaimed in succession acknowledged the principle of the liberty of the press, but amidst the struggle of parties, that principle was often overlooked, and journals and other works obnoxious to the ruling faction of the day were seized, and the authors or editors imprisoned and transported. Throughout the whole period of the so-called French republic, liberty existed in name, but not in reality; and it was the experience of this that made people acquiesce in Bonaparte's dictatorship. After the revolution of Brumaire, when Bonaparte was proclaimed First Consul of the French Republic, with powers more extensive than those of most kings, the question of the press attracted his early attention. He said one day in the Council of State, that the character of the French nation required that the liberty of the press should be limited to works of a certain size; but that newspapers and pamphlets ought to be subject to the strict inspection of the police. No censorship was established by the Consular constitution, but the newspaper press was left at the mercy of the executive. By a decree of the 27th Nivose, 1800, the number of newspapers at Paris was fixed, and the editors were forbidden to insert any article 'derogatory of the respect due to the institutions of the country, the sovereignty of the people, and the glory of the French armies,' or offensive to the governments and nations which were the friends and allies of France, even if such articles should be extracted from foreign journals, under pain of immediate suppression. The Moniteur was announced to be the only official journal. The Ami des Lois was suppressed on the 3rd Prairial, 1800, by order of the Consuls on the report of Lucien Bonaparte, Minister of the Interior, for having thrown ridicule on the members of the Institute. Under such discipline the number of subscribers to the newspapers of Paris dwindled rapidly from 50,000 to less than 19,000, and the Moniteur inserted the statement as a subject of congratulation. The Minister of the Interior had the censorship of dramatic compositions before they could be brought on the stage.

Napoleon was not friendly to liberty of any kind, and still less to that of the press. He felt very sore at the gibes and sarcasms of the English journals, which he had translated to him; and he insisted that no word, however offensive, should be omitted. When the organic law was discussed in the Senate, which was to declare him Emperor, some one spoke of guarantees to be given to the nation, and mentioned the liberty of the press among the rest. Napoleon contented himself with appointing a committee in the Senate with the nominal office of protecting the liberty of the press, which was both a misnomer and a sinecure.

In 1806 there appeared an instance of renewed book-licensing. A drama of Collin d'Harleville, making part of the series of his works, bore the following licence: 'Seen and allowed to be printed and published, by decision of his Excellency the Senator Minister of the General Police, dated 9 Prairial, year XIII. By order of his Excellency the chief of the department of the liberty of the press, P. Lagarde.' The Journal of the Empire inserted this novel document in its columns; upon which the official Moniteur observed, in a tone of ill humour, that the emperor had been surprised to learn that an estimable writer like M. d'Harleville should need permission to publish a work bearing his name; that there existed no censorship in France; that any French citizen could publish any book that he thought proper, being responsible for its contents before the tribunals, and pursuant to a decree of his Majesty, if charged with any thing derogatory from the power of the emperor and the interests of the country.

In Napoleon's kingdom of Italy the censorship was likewise declared to be abolished, but on the day of the publication of a work two copies were to be deposited at the office of the Minister of the Interior. A commission, styled likewise 'of the liberty of the press,' examined the book and made its report to the Minister, who, if he saw reason, stopped the sale of the work, and ordered the author or printer to be arrested and tried. Those who wished to avoid such risks, were allowed to lay their MS. before the commission, which returned it with such corrections or suppressions as it thought advisable. This was called the facultative or optional censorship.

At last, in 1809-10, the project of a definitive law concerning the press in France became the subject of frequent discussions in the Council of State, in which Napoleon took a part. 'I conceive,' said he, 'the liberty of the press in a country where the government is acted upon by the influence of the public opinion, but our institutions do not call upon the people to meddle with political affairs; it is the business of the Senate, the Council of State, and the legislative body, to think, speak, and act for the people, and the liberty of the press would not be in harmony with our system, for the manifestation of the power of public opinion would only be productive of disturbance and confusion.' On the question of the censorship the more liberal councillors of state argued in favour of the optional censorship, by which authors who of their own accord laid their works before the censors, should be relieved from further responsibility after publication. 'Those councillors who were for a previous and obligatory censorship, such as Cambacérès, Molé, Pasquier, Portalis, and Regnier, maintained that writing for publication was a species of teaching, and that in a country like France, where public instruction was so organised and regulated as not to be permitted to spread any dangerous doctrine, it would be inconsistent to allow writers to assume uncontrolled the mission of teaching whatsoever they pleased. No mode of teaching or influencing the public mind ought to escape the vigilance of the authority of the state. Under every government, those who addressed publicly a certain number of persons were watched; *à fortiori*, those who by their writings addressed themselves to all men, ought to be watched also. It had been said erroneously that the right of publishing was a natural faculty; the art of printing is a social invention, and as such is subject, like all other inventions, to administrative regulations in order to prevent its being abused. Without the previous censorship, the suppression of a mischievous book after publication came too late.' (Sittings of the Council of State of the 11th and 25th of October, 1809, in Thibaudeau, *Histoire de la France et de Napoléon*, ch. 67.) Napoleon was not for the obligatory and previous censorship, because it might find itself placed in an awkward dilemma, especially with regard to certain books which appeared to have a sceptical or heterodox tendency. He preferred the optional censorship, leaving however to the proper authorities the power of stopping the printing or seizing the printed copies of any work which they thought dangerous. He was inexorable towards offences against the state. The decree of February, 1810, which was the result of these discussions, appointed a director-general of the press, with auditors, inspectors, and censors, under the control of the Minister of the Interior. The number of printers was to be fixed in every department; sixty was the number fixed for Paris: printers as well as booksellers were to take licences and swear fidelity to their country and the emperor. Printers were forbidden to print anything derogatory of the duties of subjects towards their sovereign, or of the interests of the state. Parties offending were to be brought before the courts, and punished according to the Penal Code; besides which the Minister of the Interior had the right of depriving the printer of his licence. Before setting up a work, the printer was to transmit the title of it, with the name of the author, if known, to the director-general, and likewise to the prefect of the department, declaring his intention to publish the work. The director-general could, if he chose, ask for the MS., and send it to one of the censors for examination. After the censor had made his report, the director would point out such alterations or suppressions in the text as he thought proper, and which became obligatory upon the author or printer, who however had the right of appealing to the Minister of the Interior, who forwarded the MS. to another censor, who made his report to the director-general, and the director-general, assisted by other censors, decided finally upon the matter.

Authors or printers had the option of submitting their MSS. to the examination of the censors previous to printing. But even after being examined, approved, and printed, a work could be seized and its sale stopped by the minister of police, who was however to forward it with his remarks, within twenty-four hours, to the Council of State, which judged finally upon it. A well-known instance of this occurred with regard to Madame de Staël's book on Germany, which was seized after having been examined and printed, and the whole edition was destroyed. 'Your book is not French, and we are not reduced to seek for models among the nations which you admire,' was the minister of police's (Savary's) reply to Madame de Staël's remonstrances on the subject.

Books printed abroad could not be imported into France without permission from the director-general.

The police had the censorship of dramatic works intended for the stage. Only one newspaper was allowed in each department, with the exception of Paris, subject to the approbation of the respective prefect. Such was the condition of the press in France during the latter years of Napoleon's empire.

At the first restoration of the Bourbons, in 1814, an article of the Charter of Louis XVIII. acknowledged that 'Frenchmen had the right of publishing their opinions by means of the press, conformably however to the laws enacted for the repression of any abuse of the liberty of the press.' Soon after, the Abbé de Montesquiou, Minister of the Interior, laid before the chambers the project of a law concerning the press, the effect of which would have been nearly to destroy its freedom. He proposed that all works of less than thirty sheets were to be subject to a previous censorship (*censure préalable*), excepting those in the dead or foreign languages, bishops' charges, pastoral letters, and catechisms and prayer-books, and memoirs of literary and scientific societies. This project was examined by a commission of the chamber, which rejected in its report the previous censorship. The article eight of the charter said that the law should *repress* the abuse of the liberty of the press, but the ministerial project by its previous censorship tended to *prevent* it by suppressing the liberty altogether. The discussion was warm. Montesquiou maintained that to prevent and to repress were synonymous. He at last agreed to exempt from the previous censorship all works of twenty sheets and above, instead of thirty. With this modification the bill passed both houses by considerable majorities. A council of twenty censors was appointed. The office of director-general of the press was retained. Every printer was obliged to give notice of each work that he intended to print, and to deposit two copies of it, when printed, at the director's office, before he published the work.

When Napoleon returned from Elba, in 1815, he did not enforce the previous censorship, because, said he, they had published whatever they pleased against him under the Bourbons, and the matter was now exhausted. The other regulations however concerning printing and publishing were maintained, and the press and the emperor were often at variance during the hundred days. The previous censorship was temporarily re-established and abolished again under the second restoration of Louis XVIII. After Charles X. came to the throne, he abolished the previous censorship altogether, and by so doing he gained a momentary popularity with the Parisians. But the press, and especially the newspaper press, did not show any great extent of gratitude for the boon, for it proved throughout his reign a sharp thorn in his side, as may be seen by the famous report of his ministers, upon which report the ordinances of July, 1830, were based. That report was attributed to M. Chantelauze, the keeper of the seals, but it was signed by all the ministers. It contains an able, an eloquent, and, in the main, a true exposition of the crafty and persevering course of conspiracy by which the press was constantly exciting or feeding a determined hostility towards the king and his government, casting suspicion upon and misrepresenting all their acts, even those which were evidently beneficial and liberal, because they proceeded from persons whom the press itself had rendered unpopular, appealing to the passions and prejudices of a susceptible and uninstructed multitude, and thus rendering, in fact, government impossible. This report is a very interesting historical document, and ought to be read by those who wish to form a dispassionate judgment of the press, and its powers for good and evil. 'At all times,' said the minister, 'the periodical press had been, as it was in its nature to be, an instrument of disorder and sedition.' Accordingly the first of the ordinances of Charles X., signed the 25th of July, suspended the liberty of the periodical press; no journal was to be henceforth published without a special authorization of the government, which was to be renewed every three months. All pamphlets or works under twenty sheets of letter-press were made subject to the same authorization. The ordonnances however were resisted, and the revolution of July was the result. The revised charter which was afterwards promulgated, 'Charte de 1830,' in its seventh article, says: 'Frenchmen have the right of publishing and printing their opinions, conformably to the laws. The censorship shall never be re-established.' New laws however were enacted to repress the abuses of the press, among which the law of the 9th of September, 1835, is, we believe, the latest. It embodies or refers to many of the former laws of the Empire and the Restoration. It specifies the crimes and misdemeanors committed by means of the press, and assigns the penalty to each. The proprietors of political journals are obliged to deposit a considerable sum in the treasury as a security for their good behaviour. One hundred thousand francs (four thousand pounds sterling) is the deposit required for a daily Paris newpaper, and one half the sum for a weekly paper.

There is a material difference, in all the constitutions which have been framed for France and for other countries on the model of France, between the abstract constitutional principle, such as liberty of the press, individual liberty, &c., and its application, as modified by the various codes of laws, which are chiefly those of Napoleon. However, the press is certainly more free in France than it was under Napoleon or the old monarchy, but it is still far from having attained the wide uncontrolled freedom of the press in England, which may be truly said to be the freest in the world. The surest method of convincing oneself of this would be to pick out two or three of the more ultra-liberal English or Irish papers and examine them according to the existing laws in France, which constitute what is called the 'Code de la Presse,' noticing how often they would be found to have offended against the provisions of that code, and what penalties they would have incurred for each offence. The penalties in the French code of the press are very severe.

The absolute monarchies of Europe, Russia, Austria, Prussia, and the Italian States retain the obligatory previous censorship of the press, which is derived from the very principle of their government, that of parental authority over their subjects. In some of the Italian States there is a double censorship; one by an ecclesiastical and the other by a political censor. But even then it happens sometimes that after a work has passed the censorship and obtained the 'imprimatur,' something obnoxious is discovered which had escaped the censor's penetration, and the book is seized and confiscated.

In the republics of Switzerland, the censorship existed before the organic changes which have taken place in most of the cantons since 1830. All previous censorship is now abolished, but the laws in some of the cantons are very restrictive of the liberty of the press, and especially of the newspaper press, on matters of religion. Generally speaking the press is freest in the Protestant cantons.

By the last Spanish constitution, of 1837, art. 11, 'all Spaniards may print and publish their thoughts freely, without previous censorship, but subject to the laws. The determination of offences by means of the press belongs exclusively to juries empannelled for that purpose.'

The constitution of Portugal establishes no previous censorship, but refers to the laws for repressing the abuses of the press.

By the constitution of the kingdom of Greece of 1827, 'the Hellenes have the right of publishing freely their thoughts by means of the press, abstaining however—1, from attacking the principles of the Christian religion; 2, offending decency and morality; 3, indulging in personal insult and calumny.'

The Swedish constitution of 1809, promulgated under King Charles XIII., enacts that the states of the kingdom in every new Diet shall appoint a committee of six members, well informed persons, among whom must be two jurists, for the purpose of maintaining the liberty of the press. The committee will examine all MSS. which shall be laid before it by any author or bookseller, and if the committee declares that the work is fit to be printed, the author and publisher are thenceforth discharged from all further responsibility. The Chancellor of Justice of the State is by right President of the Committee. But this is a voluntary and not an obligatory previous censorship. By a former resolution of the Diet of 1778, books of controversy which attack the established religion (the Lutheran or Augsburg Confession) or support the tenets of other communions, are excluded from the liberty of the press. Persons guilty of libel and other offences by means of the press are tried by a jury. By a law enacted by the Diet in 1812, a newspaper which insults or defames a foreign government friendly to Sweden, is liable to be suppressed by order of the chancellor, without any other formality. This has occurred repeatedly, but then the paper appears again the next day under a slightly altered title; for instance, the Argus is suppressed, but is continued under the title of Argus II. or Argus III.

The constitution of Norway proclaimed in the Storthing of Eidswold, November, 1814, enacts that no one shall be prosecuted for his printed writings, unless he wilfully and evidently manifests or encourages others to manifest disobedience to the laws, contempt for religion, morality, or the constitutional powers, or resistance to the constitutional authorities, or is guilty of defamation and libel against any one, in which case he shall be fined by the tribunals.

The constitution of the Netherlands of 1815, which is still in force in the kingdom of Holland, says, art. 227, 'the press being the fittest means to spread knowledge, every one has a right to make use of it to communicate his thoughts, without needing previous permission. But all authors, printers, editors, or publishers, are answerable for those writings which attack the rights either of society or of individuals.'

By Art. 18 of the constitution of Belgium the press is declared to be free; no censorship can ever be established. Authors, editors, and printers are not required to give security. Offences committed through the press are tried by the ordinary courts.

In Denmark, an ordinance of Christian VII., dated September, 1799, on the subject of the press, abolishes the previous censorship, but imposes severe penalties on those who offend through the press; death is the penalty for any person who shall excite rebellion or provoke a fundamental change in the constitution of the monarchy. Whoever censures or defames or excites hatred or contempt against the constitution of the kingdom and the government of the king, either on general grounds or on the occasion of any particular act, shall be banished for life, and if he returns without permission, shall be sent to hard work for life. Whoever shall censure or vilify the monarchical form of government in general shall be exiled from three to ten years. Any libel against the person and honour of the king, or any member of the Royal family, shall be punished with exile. Whoever publishes a work tending to deny the existence of God, or the immortality of the soul, or to cast censure or ridicule on the fundamental dogmas of the Christian religion, is to be banished likewise. Any one who shall attack or ridicule the tenets of the other Christian communions tolerated in the kingdom, shall be punished by a short imprisonment on bread and water. The same punishment is assigned to those who shall offend public morals by their writings. Any one defaming a foreign prince friendly to Denmark, or ascribing to his government any unjust or disgraceful act, without quoting any authority, shall be sent to hard work in a house of correction for a limited period.

The liberty of the German press, or the thing so called, varied in former times according to the spirit of the different governments. As long as the emperors of the house of Austria were under the influence of the Jesuits, they tried to establish certain rules in order to check the press equally all over the empire, and an imperial commission was appointed, which sat at Frankfort on the Main, to watch over the productions of a host of authors. The states of the empire however showed little deference to imperial orders; many of them allowed the press nearly complete freedom; and Saxony being foremost among them, the booksellers ceased to assemble at Frankfort, and chose Leipzig for the centre of their extensive trade, which it has remained ever since. King Frederick II. of Prussia granted liberty to the press 'because it amused him;' but he cautioned the editors of newspapers 'to act cum grano salis, and especially not to give offence to foreign states.' The censorship was abolished in Bavaria in 1803; in Hesse and Mecklenburg it existed only occasionally; and in Holstein the press had always been free; but these were exceptions, and in most of the Roman Catholic states, especially in Austria, the press was most arbitrarily checked. The great exertions of the German nation to put down the power of Napoleon and re-establish most of their petty princes on their thrones, seemed to deserve some reward, and the princes consequently promised, in Art. 18 of the Act of Confederation, 'that the diet should occupy itself in its first meeting with fixing general rules concerning the press in Germany.' The nation thought that such rules would be in favour of the liberty of the press, but it soon became manifest that they were greatly mistaken in forming such sanguine hopes. Several of the minor states however abolished the censorship; as Nassau in 1814, Würtemberg in 1815, and Saxe-Weimar in 1816. The political agitation of Europe after the downfall of Napoleon, and the desire of a new order of things, which seemed to take the same turn in Germany as in Spain and Italy, caused the German rulers to hold a congress at Karlsbad in 1819, by which the German periodical press was enslaved by the decision that all books or other printed publications under twenty sheets should be subjected to a censorship. The spirit which directed this censorship was most arbitrary and harsh, and led to collisions of the most dangerous kind between the representative bodies of the states and the rulers. Nor was the liberty of the press for books above twenty sheets respected, and political authors especially experienced many persecutions, while strangely enough religious matters might be treated with perfect freedom.

The French revolution in 1830 produced most salutary effects in Germany. The people rose in arms, demanding constitutional rights, and above all a free press, and the rulers were in some states compelled to grant their claims. In § 37 of the new constitution of the electorate of Hesse, it is said that the press and the book trade shall enjoy complete liberty, and that the censorship shall only exist in cases specified by the diet. Similar laws were made in the kingdoms of Saxony and Hanover, in Brunswick and most of the minor states. The most liberal regulations for the press were obtained by the chambers of the grand duchy of Baden, in December, 1831; but the fear of the French revolutionists having then subsided, the laws of Baden as to the press were declared by the diet, in 1832, to be contrary to the general law (the decree of Karlsbad of 1819), and the press in Baden was once more enslaved. On the 28th of June, 1832, the diet resolved that care should be taken to compel the editors of newspapers and other political productions to keep within proper limits in publishing the debates of the representative bodies, and the diet of 1836 declared that editors of newspapers and political writers should publish no accounts of such debates except those published in the government papers, or extracts from them. Since that time there has been a visible reaction against the freedom of the press, though the censorship is much more severe against political and historical publications than against other works. It was hoped that the present king of Prussia, who manifested very liberal sentiments when his kingdom was threatened with a French invasion, would grant a free press; but that fear having ceased in 1841, the king gave fresh orders to adhere strictly to the decree of Karlsbad, so that now only books above twenty sheets are exempt from the censorship. There are however plenty of means in Prussia, as well as in the rest of Germany, for preventing authors from publishing works of a tendency contrary to the views of its government; for nearly all men of scientific attainments being in the service of government, expose themselves to dangerous consequences unless they act as Frederick the Great recommended, 'cum grano salis.' A proof of the influence of the government in this respect is the strange change in the spirit of so many Prussian authors since the accession of the present king. Previous to this event the worship of the philosophy of Hegel was almost necessary for obtaining places under government: the present king however was known to be opposed to Hegel, and no sooner was he king than Hegel was abandoned by most of his disciples, and those who stuck to him were attacked without mercy. Great numbers of Prussian authors who were not known for their piety before the king's accession, became known for it after. The only country where the press was free, in spite of the decrees of the diet, was the duchy of Holstein, as mentioned above; and the most liberal German works were printed and issued by the publishers at Altona; but since the dissensions between the German and the Danish populations of the kingdom of Denmark, the periodical press in that duchy has been enslaved to such a degree that even suspicious music has not passed the scissors of the censors, as we read in one of the last numbers of the 'Hamburger Correspondent.'

In the political systems prevalent in Germany, censorship is one of the various functions of the police, a word which among the German theorists has a much larger meaning than we are accustomed to give to it. The direction of the censorship was accordingly in the hands of the ministers of police. The present king of Prussia however established an Ober-Censur-Behörde, or a commission charged with the direction of the censorship and the superintendence of the different censors in the provinces. A similar arrangement was lately made in Austria: the censorship was taken from the minister of police, and intrusted to a commission, as in Prussia, which is under the control of the minister of the interior.

(*Conversations-Lexicon*, *Supplement*, Art. *Pressfreiheit*; Lesur, *Annuaire*; Venturini, *Chronik des Neunzehnten Jahrhunderts*.)

The Constitutions of the various States composing the North American Union, admit the absolute liberty of the press. There is of course in each State a law of libel, sufficiently strict, concerning which it may be entertaining to read Cobbett's account of his own trial, entitled 'A Republican Judge,' under the assumed name of Peter Porcupine. In the slave States there are very severe laws against interfering by the press with the great question of slavery. It has been stated that abolitionist newspapers are seized at the post-office.

The republics of Spanish America likewise acknowledge the principle of the unfettered liberty of the press, however it may have been often violated in practice amidst the never ending factions and civil wars of those countries. The constitution of the Brazilian Empire establishes the freedom of the press without any censorship; but an author is liable to punishment in such cases as are provided by law.

(Beckman, *History of Inventions*; Burton, *Diary*; *Encyclopédie Méthodique*, section 'Jurisprudence,' art. 'Censure des Livres;' Thibaudeau, *Histoire de la France et de Napoleon Bonaparte*; Bacqua, *Codes de la Législation Française*, 1843; *Collection de Constitutions et Chartes*, by A. Dufau, etc. Paris, 1830; and the other works and pamphlets quoted in the course of this article.)

CENSUS OF 1841. In June, 1841, was taken the decennial census of Great Britain and Ireland, the results of which, when compared with other statistical returns, afford the means of examining the condition and prospects of the country. It is not proposed, in this article, to enter with any minuteness either upon the manner in which the census was taken, or upon the detailed results appearing in the reports of the commissioners; but it is intended to present a comparison of the increase and distribution of the population, with their means of employment, their command of the necessaries and conveniences of life, the growth of capital, the extension of trade and manufactures, and with other indications of the progress of society. If it shall appear that in all these respects the means of enjoyment have increased more rapidly than the population, this review of the national resources will be most encouraging; and may be more generally acceptable than a tedious examination of the specific results of the census itself. As the selection of the various subjects of comparison will be made without reference to any preconceived theory, the accuracy of the facts may be relied on; and it is hoped that no conclusions will be drawn from them which they do not fairly justify.

In several particulars, it will be necessary to advert to Great Britain and to Ireland separately; but it will be convenient, in the first place, to present a summary of the population of the United Kingdom in 1831 and in 1841, with calculations of the rate of increase per cent.

	1831.	1841.	Increase per cent.
England . . .	13,091,005	14,995,138	14·5
Wales	806,182	911,603	13
Scotland . . .	2,365,114	2,620,184	10·7
Army, navy, and registered seamen afloat	277,017	188,453	..
Persons travelling on the night of June 6	..	5,016	..
Islands in the British Seas . . .	103,107	124,040	19·6
Great Britain . .	16,643,028	18,844,434	13·2
Ireland	7,767,401	8,175,124	5·25
United Kingdom .	24,410,429	27,019,558	10·6

The Irish census commissioners (Report, p. xi.) enter into certain calculations, by which they raise the per centage of increase in the population of Ireland from 5·25, as actually shown in the returns, to nearly 12 per cent. If the same principles of calculation were applied to the population of Great Britain, the increase would also be greater; but it will be sufficient, for the purposes of this inquiry, if the entire population of the United Kingdom, during the ten years from 1831 to 1841, be assumed to have increased 12 per cent.

In judging of the condition of the people, the first point which may be investigated is their consumption of those articles which are used more or less in proportion to their means. Unhappily there are no means of estimating the quantities of bread and meat or other staples of food produced in this country; but the quantities of auxiliary articles of food and luxury imported from abroad for home consumption, or manufactured in this country, are fair indications of the means possessed by the people of enjoying the comforts of life. If the increase in the consumption of such articles be in a greater proportion than the increase of population, it may reasonably be inferred that their means of enjoyment have generally increased; or, in other words, that the people enjoyed more comforts in 1841 than in 1831, relatively to their numbers.

The quantities of several articles which paid duty for home consumption in the United Kingdom, in 1831 and 1841 respectively, and the rate of increase, will appear from the following table:—

		1831.	1841.	Rate per cent. of increase.
Butter . .	cwts.	121,193	251,255	106·4
Cheese . .	„	130,039	248,335	90·9
Cocoa . .	„	502,806	1,930,764	283·9
Coffee . .	lbs.	22,715,807	28,420,980	25·1
Tea . . .	„	29,997,055	36,396,078	21·3
Rice . . .	cwts.	140,100	245,887	75·5
Eggs . . .	No.	58,464,690	91,880,187	57·1
Tallow . .	cwts.	918,733	1,243,112	35·3
Soap (hard)	lbs.	108,956,030	156,008,290	43·1
Tobacco . .	„	19,333,840	22,308,385	14·2
Crown-glass .	cwt.	103,803	116,895	12·6
Plate-glass .	„	14,019	27,639	97·1
Bottle glass .	cwts.	288,760	499,581	73·0
Paper . .	lbs.	62,738,000	97,103,548	54·7

This list might be extended much further; but it will suffice to show that the consumption of these articles (restrained in some cases by too heavy a taxation) was enjoyed in a larger ratio than the increase of population, and that the comforts of the people must have been proportionately greater in 1841 than in 1831.

Concurrently with this increased consumption of articles of comfort and luxury, it is worthy of special notice that the use of intoxicating drinks had apparently decreased. We are not aware of any causes which encouraged the smuggling or adulteration of spirits in 1841 which did not exist in 1831; and yet it appears, from the returns, that the consumption of duty-paid spirits of all kinds, whether British or foreign, had decreased in that interval to the extent of 7·8 per cent. In the same period the consumption of all wines had increased only 3·9 per cent. The consumption of beer cannot be ascertained, but the quantity of hops that paid duty had fallen from 36,500,028 lbs. in 1831, to 30,504,108, or 19·6 per cent.; and of malt, from 40,334,987 bushels to 35,656,718, or 13·1 per cent. From these facts, however, no certain inference can be drawn, on account of the great varieties in the natural produce of these articles in different years, and of the free use of other ingredients by brewers.

Our view of the evidences of increased consumption may be closed by the notice of the three articles of timber, cotton, and wool, all of which are used solely in giving employment to productive industry. Taking all the different kinds of imported timber, there appears to have been an increase of 37·5 per cent. In cotton-wool there was an increase of 61·1 per cent.; and in sheep and lambs' wool imported, of 78·7 per cent.

The next subject of comparison may be the exports of British and Irish produce and manufactures from the United Kingdom, in 1831 and in 1841, from which the manufacturing and commercial condition of the country, and the employment of its people, at those periods, may be collected.

The quantities and declared value of some of the principal articles of export are exhibited in the following table:—

Exports from the United Kingdom.

		1831.		1841.		Increase per cent.	
		Quantities.	Declared value.	Quantities.	Declared value.	In the quantity.	In the declared value.
			£.		£.		
Apparel		——	790,293	——	1,217,975	——	54·1
Brass and Copper manufactures . .	cwts.	181,951	803,124	327,247	1,523,744	79·8	89·7
Cordage	,,	36,276	81,986	63,822	130,414	75·9	71·2
Cotton manufactures	yds.	421,385,303	12,163,513	751,125,624	14,985,810	78·2	23·2
Cotton twist and yarn	lbs.	63,821,440	3,975,019	123,226,519	7,266,986	93·0	82·8
Earthenware	pieces	37,028,897	461,090	53,150,903	600,759	43·5	30·3
Glass (entered by weight)		177,915	420,044	338,890	400,168	90·4	——
—— (entered at value)		——	9,580	——	21,768	——	127·2
Hardwares and cutlery	cwts.	336,194	1,622,429	353,348	1,623,961	5·1	0·09
Iron and steel (wrought or unwrought)	tons.	124,312	1,123,372	360,875	2,877,278	174·2	156·1
Leather	lbs.	1,314,931	246,410	2,623,075	332,573	99·4	34·9
Linen manufactures	yds.	69,233,892	2,400,043	90,321,761	3,200,467	30·4	33·3
—— thread, tapes, &c.	,,	——	61,661	——	147,088	——	138·5
—— yarn	lbs.	110,188	8,705	25,220,290	972,466	22788·4	11071·2
Machinery and mill-work		——	105,491	——	551,361	——	422·6
Silk manufactures		——	578,874	——	788,894	——	36·2
Tin and pewter wares		——	230,143	——	390,621	——	69·7
Wool, British	lbs.	3,494,275	173,105	8,471,235	555,620	142·4	220·9
Woollen and worsted yarn	„	1,592,455	158,111	4,903,291	552,148	207·9	249·2
——— manufactures	pieces	1,997,348	4,580,902	2,291,273	4,821,880	14·7	5·2
———————	yards	5,797,546	500,956	9,831,975	698,462	69·5	39·4
——— hosiery, &c.		——	150,555	——	228,391	——	51·7

On referring to the two last columns of this table, it appears that the value of the exports did not always increase in the same ratio as the quantities; but the total declared value of all British and Irish produce and manufactures exported in 1831 was 37,164,372*l.*; in 1841, 51,634,623*l.*; thus showing an aggregate increase of 38·9 per cent.

Another evidence of the increased commerce of the country is afforded by the returns of shipping. In 1831, 20,573 ships (British and foreign) engaged in the foreign and colonial trades, entered inwards; of which the total tonnage amounted to 3,241,927. In 1841 the number of ships had increased to 28,052, and the tonnage to 4,652,376; thus showing an increase of tonnage in the proportion of 43·5 per cent. In 1832, 119,283 ships were employed (including their repeated voyages) in the coasting trade, of which the tonnage amounted to 9,419,681. In 1841 the number of ships had increased to 146,127, and the tonnage to 11,417,991, showing an increase of 21·2 per cent. in the tonnage employed.

Thus far an increased prosperity can admit of no doubt. It is evident that consumption, production, and commerce all increased in a greater ratio than the population. But it may here be asserted that profits were low, and that, notwithstanding the outward signs of prosperity, the capital, available for further enterprises, was not increasing with corresponding rapidity. The evidences of accumulation cannot be of so distinct a character as those of consumption and production; but it may be asked in the outset, how could so vast an increase in the productive industry of the country, in the value of its exports, in its shipping and commerce, have been supported without prodigious additions to its capital? The best evidence of the quantity of capital in a country is its results. Without a sufficient quantity, production and consumption could not continue to increase: and as capital is likely to be applied to production and consumption as much at one period as at another, all that seems necessary for ascertaining the increase of capital, is to know the increase of its immediate results. If, in addition to the vast increase of production and consumption which could only have been supported by a proportionate amount of capital, we see the price of all public securities high, the interest of money low, and capital seeking investment in every speculative enterprise, and devoted to religious and charitable objects over the whole world, it is absurd to doubt the abundance of capital. But in addition to this indirect evidence of the increase of capital, there are other indications of its accumulation, of a more direct nature, a few of which may suffice:—

Notwithstanding the discouragement of insurance caused by a duty of 200 per cent., the sums insured against fire in the United Kingdom amounted in 1831 to 526,655,332*l.*, and in 1841 to 681,539,649*l.*; being an increase of 29·4 per cent. The accumulations annually made through the instrumentality of life assurance are known to be enormous, but no reasonable estimate can be made of their amount, nor any comparison of the rate of increase in the period of which we are treating. The most interesting evidence of accumulation is presented by the returns of savings' banks. In 1831 there were 429,503 depositors, whose deposits amounted to 13,719,495*l.*; in 1841 there were 841,204 depositors, and the amount of their deposits had increased to 24,474,689*l.*; so that, both in number and amount, the deposits may be said to have been doubled in this short period of ten years. The capital invested in railways in the same period may safely be estimated at upwards of 60,000,000*l.* (see 'First Report on Railways,' 1839, Appendix); and the sums authorised by Parliament to be raised for various public purposes—for roads, bridges, docks, canals, navigations, markets, lighting and improving towns, afford evidence of the abundance of capital which was constantly seeking investment, in addition to its customary employment in commerce and manufactures.

The returns of the assessment of property for the income tax will not present any comparison of the wealth of the country in 1831 and 1841; but very important results may be deduced from them, which must not be overlooked. The annual value of real property, as assessed to the property tax in 1815, was returned at 51,898,423*l.*; in 1842-3 it was returned at 95,284,497*l.* In Scotland the real property was assessed in 1811 at 5,972,523*l.*; in 1842-3 at 9,481,762*l.* (Parl. Paper 102 of 1845.) In the absence of any intermediate assessment a rough estimate only can be made of the increase in the value of real property between 1831 and 1841; but we are inclined to think it was not less than from 25 to 30 per cent. In 1815 the annual profits of trade in England and Wales were assessed at 35,028,051*l.* No similar account for 1842-3 has yet been published; but as the actual receipts by government amounted to 1,466,985*l.* at 2*l.* 18*s.* 4*d.* per cent., after exempting all profits under 150*l.* a year, the annual amount of all profits above 150*l.* a year may be fairly estimated at 50,153,333*l.*; and after adding a fifth, or 10,000,000*l.*, for profits under 150*l.*, the proportion of increase which accrued between 1831 and 1841 will not be overrated at 20 per cent.

The amount of capital upon which legacy duty had been paid in Great Britain, from 1797 to 1831 inclusive, was 741,648,197*l.*; in 1841 it amounted to 1,163,284,207*l.* Thus in this period of ten years legacy-duty had been paid upon a capital of 422,636,009*l.* 19*s.* 5*d.*, or considerably more than one-half of the aggregate amount upon which the duty had been paid in the thirty-four preceding years. In 1831 the produce of the stamp-duties upon probates of wills and letters of administration in the United Kingdom amounted to 918,667*l.*; in 1841 to 1,012,481*l.*, showing an increase of 10·2 per cent.

These various statements all confirm, more or less distinctly, the conclusion which had been suggested by less direct but not less conclusive evidence, viz., that the capital of the country appears to have increased in the period of ten years from 1831 to 1841, in a greater ratio than the population; and consequently that the funds necessary for the employment of labour and for maintaining the growing population in increased comfort, had multiplied more rapidly than the people for whose use they were available.

Having now compared the increase of national wealth with the increase of population, so far as the statistics of consumption, production, and accumulation afford such comparison; a confirmation of the results presented by our analysis is to be found in the Reports of the Census Commissioners, together with many singular facts illustrative of the state and destinies of our country. In following these however it will be necessary to consider Great Britain and Ireland separately.

The first point illustrative of the condition of the people is, that the increase in the number of inhabited houses in England and Wales since 1831 was two per cent. greater than that of the population. Too much reliance however must not be placed upon this bare statistical result, as the quality of the houses may be a more important matter than their positive number; but so far as it goes it is satisfactory. The misery and destitution which prevail in many parts of Great Britain are undeniable; squalid poverty and glittering wealth meet the eye in every street; but the apparent fact of an increased house accommodation should make men hesitate before they declare that poverty is spreading at one extremity of society while wealth is agglomerating at the other. Apart from this direct evidence that one of the most painful results of poverty, the overcrowding of many families into the same houses, though painfully prevalent in Liverpool and some other places, has not generally increased—it may be asked what better proof, amongst many, can be given of the general prosperity of the masses of the people than the application of so vast a capital to productive industry as must have been required for the building of 500,000 new houses in a space of ten years?

It is well known that the rate of increase of the population from 1831 to 1841 in England and Wales was apparently less than in the preceding ten years, by 1½ per cent.; and if the bare fact of numerical increase were taken as a test of national strength and prosperity, this fact might be deemed a symptom of decay. To this discouraging view, however, a complete answer is given by the commissioners, who ascribe the apparently diminished rate of increase wholly to emigration. 'The additional population which would be required in order to make the ratio of increase equal to that of the former decennial period would be 208,998, being 1½ per cent. on the population of 1831; and from returns which have been furnished from the Emigration Board, it appears that the total excess of emigration in the ten years ending 1841, compared with the ten years ending 1831, may be estimated at 282,322.' (See Preface, p. 11.) Thus, instead of attributing this apparent decrease to the pressure of poverty by which the natural growth of population was checked, we must ascribe it to a cause which is calculated to raise the wages of labour in this country, while it affords to the emigrants a wider field and, we trust, a larger reward for their industry.

Another fact of the highest importance is clearly proved, viz.—that the commerce and manufactures of Great Britain stone afford employment for the increasing population. While the increase upon the whole kingdom amounted, as already stated, to 13·2 per cent., the increase in the manufacturing and commercial counties was greatly above that proportion, and in the agricultural counties considerably below it. In Chester the increase was 18·3 per cent.; in Durham, 27·7; in Lancaster, 24·7; in Middlesex, 16; in Monmouth, 36·9; in Stafford, 24·3; in Warwick, 19·3; and in the West Riding of York, 18·2. In Buckingham the increase was only 6·4 per cent.; in Cumberland, 4·9; in Devon, 7·8; in Dorset, 9·9; in Essex, 8·6; in Hereford, 2·4; in Norfolk, 5·7; in Oxford, 6·2; in Suffolk, 6·3; in Westmoreland, 2·5; and in the North Riding of York, 7 per cent. It is useless therefore to discuss the relative importance of agriculture and manufactures in the abstract; for agricultural counties cannot support their own population; while the manufacturing and commercial counties find employment for their own natural increase and for the surplus of other counties which the land cannot maintain.

The relative increase of the agricultural and commercial population is shown by the following proportions per cent.:—

	Agricultural.	Commercial.	Miscellaneous.
1831	28	42	30
1841	22	46	32

But in 1831 the returns referred to families, and in 1841 to individuals; and as a greater number of children are employed in manufactures than in agriculture, the difference may have been slightly augmented by this form of enumeration.

A still more important point of comparison is the relative increase of different classes of occupation in the same period of 10 years from 1831 to 1841. A comparative return of the Commissioners (Preface, p. 21) includes males only aged 20 years and upwards, and exhibits the following results:—The number of occupiers and labourers in agriculture had decreased in that period from 1,251,751 to 1,215,264; but the Commissioners explain this result by supposing that numerous farm-servants had been returned in 1841 as domestic servants instead of as agricultural labourers. Persons engaged in commerce, trade, and manufacture had increased from 1,572,292 to 2,039,409 (or 29·7 per cent.): capitalists, bankers, professional and other educated men, from 216,263 to 286,175 (or 32·3 per cent.): labourers employed in labour not agricultural had *decreased* from 611,744 to 610,157: other males 20 years of age, except servants, had increased from 237,337 to 392,211: male servants 20 years of age and upwards had increased from 79,737 to 164,384, including, however, as already noticed, many farm-servants. For the purpose of instituting a just comparison of the relative increase of particular employments it must be understood that the total number of male persons 20 years of age and upwards (exclusive of army, navy, and merchant seamen) had increased, in this period of ten years, from 3,969,142 to 4,707,600 (or 18·6 per cent.). Making due allowance for the probable error in the return of agricultural labourers, we are forced to conclude that that class had either not increased at all or had increased in a very small degree; and that the class of labourers not agricultural had positively diminished: while capitalists, bankers, professional and other educated men, had increased 32·3 per cent.; persons engaged in trade and in manufactures 29·7 per cent.; and domestic servants 106 per cent., or allowing for farm-servants, say 90 per cent. Thus the two classes who earn the lowest wages were alone stationary or retrograde: the highest class in wealth and intelligence had increased 32·3 per cent.; and the domestic servants, whose numbers are a certain indication of the means of their employers, had increased 90 per cent. Nor must another important fact be omitted in connexion with the decrease in the class of labourers, viz. the immense numbers of Irish who notoriously perform the most laborious parts of industry. In Lancashire the persons born in Ireland formed, in 1841, 6·3 per cent. upon the whole population; in Cheshire, 3 per cent.; in Middlesex, 3·6 per cent.; in Ayrshire, 7·3; in Dumbartonshire, 11; and in Lanarkshire and Renfrewshire, upwards of 13 per cent. It would seem therefore that the class of British labourers are gradually raising themselves into a higher condition and more lucrative employments; and that the demand for the lowest description of labour, caused by their withdrawal from it, is supplied by their Irish brethren.

The number of female domestic servants increased in Great Britain from 670,491 in 1831, to 908,825 in 1841, or 35 per cent.

In concluding this statement of the industrial occupations of the people of Great Britain, it is gratifying to learn that the whole of the 'almspeople, pensioners, paupers, lunatics, and prisoners' amounted in 1841 to 1·1 per cent. only upon the population. It must be understood, however, that this statement does not include persons receiving parochial relief, unless they be resident in workhouses.

We may now pass to some of the most material facts disclosed by the census of Ireland. The constant migration of labourers from the agricultural counties of England to the manufacturing districts, and the extensive emigration of the last ten years, have been already noticed; and precisely the same circumstances are observable in Ireland. In the period from 1831 to 1841 no less a number than 403,459 persons left Ireland, either to settle in the populous towns of Great Britain or to emigrate to the British Colonies or the United States; while an extensive migration was taking place, within Ireland itself, to Dublin and to other commercial and manufacturing places.

The returns of house accommodation in Ireland present a very lamentable picture. The Commissioners have adopted a judicious classification by which the houses are distinguished under four classes, the last being that of the cabin or mud hut with one room, and the third class but one degree better. The following statement shows the proportion per cent. which the number of families in each class of accommodation bear to the total number of families:—

	1st Class.	2nd Class.	3rd Class.	4th Class.
Rural districts	1·2	15·3	40·	43·5
Civic districts	7·	22·4	33·9	36·7

The value of this classification is obvious, and if hereafter adopted in England it will render the statistics of house accommodation of considerably greater weight in estimating the social condition and habits of the people. A mud hut upon a common ought not to rank even, in the array of figures, with the mansions of wealthy cities.

Even in Ireland it appears that manufactures are attracting the agricultural population; for the number of families engaged in trade and manufactures have increased five per cent. since 1831; and the number employed in agriculture have diminished in a corresponding proportion.

The population have been divided by the commissioners into three great classes, nearly equivalent to the three ordinary grades of society: and the proportions of families appear as follow:—

	Rural.	Civic.
Vested means, professions, &c.	1·8	6·6
The direction of labour . .	28·3	50·
Their own manual labour . .	68·	36·4
Means not specified . . .	1·9	7·

The occupations of all individuals above 15 years of age are classified: 1st, as ministering to food; 2nd, as ministering to clothing; 3rd, as ministering to lodging, &c.; 4th, as ministering to health, education, &c.; and 5th, as unclassified or miscellaneous; each class bearing respectively the following proportions to the entire population, viz. 23·3; 11·; 2·; 17·; and 6·. But as no similar classification had ever been adopted before, no comparison is practicable with any preceding period.

The report of the Irish Census Commissioners abounds in highly interesting inquiries into the condition of the Irish people; but as they do not afford any comparison with the year 1831, the object which we had proposed cannot be carried any further with respect to that country.

This succinct view of the material progress of society, as far as it admits of elucidation by statistics, is certainly incomplete without a consideration of its advance or retrogression in religion, in morals, and in education; but those questions, far more important in themselves than any we have here discussed, are not so immediately connected with the results of the Census.

I.—Tables of Population, Occupation, &c.: Census, 1841.

1.—Total Population of each County in Great Britain, according to the Census taken 7th June, 1841; showing the per-centage on the Total Population employed in Commerce, Trade, and Manufacture, and in Agriculture.

ENGLAND.	Total Persons.	No. per Cent. engaged in Trade, Commerce, and Manufacture.	No. per Cent. engaged in Agriculture.
Bedford	107,936	13·3	13·8
Berks	161,147	10·2	13·2
Bucks	155,983	12·6	14·0
Cambridge	164,459	8·9	13·9
Chester	395,660	23·5	6·7
Cornwall	341,279	9·3	7·9
Cumberland	178,038	14·6	8·8
Derby	272,217	18·9	7·1
Devon	533,460	13·0	10·2
Dorset	175,043	11·1	10·9
Durham	324,284	13·9	4·4
Essex	344,979	9·3	14·8
Gloucester	431,383	15·1	7·2
Hereford	113,878	9·9	14·6
Hertford	157,207	12·8	12·8
Huntingdon	58,549	9·2	14·5
Kent	548,337	10·2	8·7
Lancaster	1,667,054	28·1	3·0
Leicester	215,867	19·2	7·9
Lincoln	362,602	9·6	15·9
Middlesex	1,576,636	20·0	1·1
Monmouth	134,355	13·1	6·5
Norfolk	412,664	11·8	12·2
Northampton	199,228	13·5	12·9
Northumberland	250,278	14·9	6·9
Nottingham	249,910	20·6	8·2
Oxford	161,643	10·7	12·9
Rutland	21,302	9·2	15·6
Salop	230,048	11·9	11·7
Somerset	435,982	13·0	10·2
Southampton	355,004	10·6	10·0
Stafford	510,504	18·7	5·7
Suffolk	315,073	10·0	13·9
Surrey	582,678	16·2	4·4
Sussex	299,753	9·7	11·9
Warwick	401,715	21·9	6·0
Westmoreland	56,454	13·8	11·6
Wilts	258,733	10·8	14·1
Worcester	233,336	16·7	10·1
York, East Riding	194,936	13·0	12·1
—— City, &c.	38,321	18·3	5·7
—— North Riding	204,122	11·6	13·8
—— West Riding	1,154,101	24·6	4·3
Total	14,995,138	16·9	7·7
WALES.			
Anglesey	50,891	8·1	15·2
Brecon	55,603	10·4	10·1
Cardigan	68,766	8·2	13·1
Carmarthen	106,326	8·5	13·7
Carnarvon	81,093	7·7	12·1
Denbigh	88,866	9·4	12·9
Flint	66,919	9·5	8·2
Glamorgan	171,188	14·0	5·9
Merioneth	39,332	8·1	14·4
Montgomery	69,219	10·9	14·8
Pembroke	88,044	9·0	10·8
Radnor	25,356	7·8	18·2
Total	911,603	9·9	11·4
SCOTLAND.			
Aberdeen	192,387	14·5	13·1
Argyll	97,371	6·4	13·6
Ayr	164,356	20·2	6·8
Banff	49,679	8·5	15·3
Berwick	34,438	10·5	17·9
Bute	15,740	11·8	9·0
Caithness	36,343	8·7	14·1
Clackmannan	19,155	16·4	5·0
Dumbarton	44,296	25·8	5·9
Dumfries	72,830	12·7	15·0
Edinburgh	225,454	19·7	3·4
Elgin, or Moray	35,012	10·1	14·5
Fife	140,140	21·9	7·2
Forfar	170,520	26·2	5·9
Haddington	35,886	9·9	17·2
Inverness	97,799	6·0	14·1
Kincardine	33,075	12·3	17·6
Kinross	8,763	20·5	11·8
Kirkcudbright	41,119	9·8	12·8
Lanark	426,972	27·2	3·1
Linlithgow	26,872	15·0	9·2
Nairn	9,217	8·5	17·2
Orkney and Shetland	61,065	7·6	10·2
Peebles	10,499	9·6	15·9
Perth	137,390	17·0	11·8
Renfrew	155,072	28·4	3·8
Ross and Cromarty	78,685	5·6	13·1
Roxburgh	46,025	16·2	14·2
Selkirk	7,990	17·2	11·3
Stirling	82,057	18·2	7·8
Sutherland	24,782	4·8	13·7
Wigtown	39,195	9·0	13·2
Total	2,620,184	18·1	8·8
Whereof—On Mainland	2,450,764	..	..
On Islands	169,420	..	..
Great Britain		16·5	7·9

2.—Number of Persons born in the County in which they resided; Number born in other Counties of the same Country; Number born in Scotland and Ireland and resident in England; Number born in England and Ireland and resident in Scotland; and Proportion of each in One Thousand Persons.

ENGLAND.	No. of Persons.	Proportion in 1000.
Born in the county	12,091,394	807
In other English counties	2,370,556	159
In Scotland	102,065	3
In Ireland	284,128	19
WALES.		
Born in the county	774,393	849
In other Welsh or in English counties	126,328	139
In Scotland	1,173	1
In Ireland	5,276	6
SCOTLAND.		
Born in the county	1,988,024	759
In other counties in Scotland	451,245	172
In England	37,766	14
In Ireland	126,321	48

3.—Number of Houses in Great Britain and Islands in the British Seas.

	Inhabited.	Uninhabited.	Building.
England	2,755,710	163,077	25,704
Wales	188,229	10,157	1,764
Scotland	508,852	24,026	2,646
Islands in the British Seas	19,190	869	220
Total	3,465,981	198,129	30,334

II.—SUMMARY of the OCCUPATIONS of PERSONS in GREAT BRITAIN.

CLASSES.	GREAT BRITAIN	ENGLAND.	WALES.	SCOTLAND.	ISLES in the BRITISH SEAS.
	Total of Persons.	Total of Persons.	Total of Persons.	Total of Persons.	Total of Persons.
Commerce, Trade, and Manufacture	3,110,376	2,529,073	90,133	473,581	17,589
Agriculture	1,499,278	1,157,816	103,632	229,337	8,493
Labourers*	761,868	620,492	53,430	84,573	3,373
Military	42,234	36,043	720	4,631	840
Naval, &c.	121,831	90,155	5,038	24,359	2,279
Professional	63,184	50,344	2,697	9,709	434
Other educated Persons following Miscellaneous Pursuits	142,836	120,788	3,090	18,099	859
Government Civil Service †	16,959	13,557	531	2,777	94
Parochial and other Officers ‡	25,275	21,443	682	3,085	65
Domestic Servants	1,165,233	935,832	63,216	158,650	7,535
Independent Persons so returned	511,440	421,995	23,978	58,291	7,176
Alms-people, &c.	199,069	168,376	7,830	21,690	1,173
Total of Persons enumerated as above	7,659,583	6,165,914	354,977	1,088,782	49,910
Residue of Population (including Children of all Ages)	10,996,398§	8,834,240*	556,626	1,531,402	74,130
Total population of Great Britain, exclusive of Army abroad, and Navy (including Convicts, Passengers, &c.) afloat	18,655,981	15,000,154	911,603	2,620,184	124,040

* This column includes Labourers whose employment is not otherwise specified, also Miners, Quarriers, Porters, Messengers, and other persons variously engaged in laborious occupations.

† Exclusive of many persons who have returned themselves simply as Clerks, Messengers, &c., and who are engaged also in Trade, &c.

‡ Exclusive of many persons who are likewise engaged in trade and professions.

§ These totals include 5,016 persons ascertained to have been travelling by railways and canals during the night of the 6th of June, 1841.

Number of persons employed in Textile Manufactures in Great Britain:—

Manufacture.	Persons employed.
Cotton	377,662
Hose	50,955
Lace	35,347
Wool and Worsted	167,296
Silk	83,773
Flax and Linen	85,213
	800,246

The age and sex of the above-mentioned 800,246 persons were as follows:—

	Aged Twenty years and upwards.	Under Twenty.	Total.
Males	344,121	109,260	453,381
Females	211,070	185,795	346,865
Total	555,191	245,055	800,246

Number of Persons employed in some other branches of manufacturing industry:—

Manufacture.	Persons employed.
Pottery, china, and earthenware	24,774
Glass and glass bottles	7,464
Gloves	9,225
Engines and machines	16,550

Number of persons employed in Mines:—

Coal	193,876
Iron	10,949
Copper	15,407
Lead	11,419
Tin	6,101
Manganese	275
Salt	268
Mine not specified	31,178

III.—AGES of PERSONS living in ENGLAND, WALES, and SCOTLAND.

ENGLAND.

	Males.	Females.
Under 5	981,722	995,855
5 to 10	891,985	894,908
10 „ 15	824,033	800,487
15 „ 20	731,899	757,487
20 „ 25	679,459	782,834
25 „ 30	573,785	635,750
30 „ 35	531,114	570,042
35 „ 40	408,723	424,841
40 „ 45	411,009	428,604
45 „ 50	294,250	305,724
50 „ 55	288,225	307,539
55 „ 60	176,512	188,408
60 „ 65	195,281	215,099
65 „ 70	112,319	129,185
70 „ 75	97,224	111,945
75 „ 80	51,545	59,301
80 „ 85	28,495	35,564
85 „ 90	9,180	12,462
90 „ 95	2,236	3,575
95 „100	442	799
100 & upwards	72	141
Not specified	33,877	11,201

WALES.

	Males.	Females.
Under 5	60,996	60,579
5 to 10	56,102	55,437
10 „ 15	51,681	49,961
15 „ 20	45,501	46,468
20 „ 25	40,055	42,828
25 „ 30	33,784	35,226
30 „ 35	30,604	31,209
35 „ 40	23,996	23,930
40 „ 45	22,292	23,102
45 „ 50	17,518	18,974
50 „ 55	17,331	19,132
55 „ 60	12,139	13,449
60 „ 65	12,689	15,204
65 „ 70	7,769	9,489
70 „ 75	6,283	8,058
75 „ 80	3,771	4,904
80 „ 85	2,453	3,699
85 „ 90	908	1,364
90 „ 95	242	463
95 „100	52	123
100 & upwards	10	26
Not specified	1,581	271

SCOTLAND.

	Males.	Females.
Under 5	173,794	168,99'
5 to 10	158,712	154,805
10 „ 15	150,832	146,052
15 „ 20	128,196	141,966
20 „ 25	113,397	141,074
25 „ 30	92,779	113,160
30 „ 35	85,434	102,053
35 „ 40	643,872	76,916
40 „ 45	66,707	79,219
45 „ 50	45,874	52,526
50 „ 55	45,000	56,343
55 „ 60	28,745	34,244
60 „ 65	33,451	43.086
65 „ 70	17,355	21,795
70 „ 75	16,151	21,244
75 „ 80	8,725	11,212
80 „ 85	5,620	8,144
85 „ 90	1,848	2,677
90 „ 95	593	858
95 „100	141	236
100 & upwards	45	59
Not specified	3,191	1,662

AGES of PERSONS in England, Wales, and Scotland, showing what would be the Number of Persons of the several specified Ages supposing the number of Males and Females whose ages were returned to have been Ten Thousand respectively.

	England.		Wales.		Scotland.	
	Males.	Females.	Males.	Females.	Males.	Females.
Under 5	1347	1300	1367	1307	1403	1228
5 to 10	1224	1168	1257	1196	1281	1124
10 „ 15	1130	1045	1158	1078	1218	1061
15 „ 20	1004	989	1020	1002	1035	1031
20 „ 30	1719	1851	1655	1683	1664	1847
30 „ 40	1289	1298	1224	1189	1217	1300
40 „ 50	967·5	958·6	892·3	907·5	908·9	957·0
50 „ 60	637·5	647·4	660·5	702·7	595·4	658·0
60 „ 70	421·9	449·4	458·5	532·6	410·2	471·3
70 „ 80	204·1	223·5	225·3	279·6	200·8	235·7
80 „ 90	51·6	62·6	75·3	109·2	60·2	78·6
90 „100	3·6	5·7	6·5	12·6	5·9	7·9
100 & upwards	·09	·18	·22	·56	0·3	0·4

IV.—POPULATION and OCCUPATIONS in IRELAND.

Counties and Towns.	Total No. of Persons.	Chiefly employed in		
		Agriculture.	Manufactures, Trade, &c.	Other Pursuits.
Antrim	276,188	27,174	20,239	3,497
Belfast Town	75,308	2,532	9,897	2,743
Carrickfergus	9,379	669	820	376
Armagh	232,393	24,260	15,966	2,949
Carlow	86,228	10,498	3,139	1,573
Cavan	243,158	31,887	8,338	2,367
Clare	286,394	37,834	7,445	3,702
Cork	773,398	97,723	22,397	13,175
—— City of	80,720	4,272	8,529	3,698
Donegal	296,448	38,147	12,761	2,991
Down	361,446	35,291	27,473	5,388
Drogheda Town	16,261	863	1,866	837
Dublin	140,047	12,867	6,971	6,927
—— City of	232,726	7,333	27,729	14,449
Fermanagh	156,481	20,665	6,127	1,862
Galway	422,923	58,609	10,809	5,237
—— Town of	17,275	780	1,969	964
Kerry	293,880	39,985	7,749	3,859
Kildare	114,488	12,517	3,385	4,436
Kilkenny	183,349	22,696	5,021	3,157
—— City of	19,071	1,118	1,899	914
King's	146,857	17,582	4,461	4,649
Leitrim	155,297	21,663	4,067	1,462
Limerick	281,638	35,878	6,718	4,061
—— City of	48,391	2,851	4,653	2,182
Londonderry	222,174	23,089	15,169	2,856
Longford	115,491	15,363	3,705	1,511
Louth	111,979	13,099	5,683	2,297
Mayo	388,887	56,605	10,029	4,276
Meath	183,828	23,978	6,043	2,716
Monaghan	200,442	26,809	8,087	2,038
Queen's	153,920	19,346	5,098	3,003
Roscommon	253,591	36,739	6,206	3,442
Sligo	180,886	24,960	5,454	2,419
Tipperary	435,553	52,805	13,512	3,253
Tyrone	312,956	37,276	16,923	3,138
Waterford	172,971	20,499	5,169	2,873
—— City of	23,216	1,136	2,832	1,379
Westmeath	141,300	18,090	4,860	2,743
Wexford	202,033	24,664	8,147	3,783
Wicklow	126,143	14,032	4,740	

PROVINCES:				
Leinster .	1,978,781	214,046	92,692	55,396
Munster .	2,396,161	292,988	78,989	43,182
Ulster .	2,386,373	267,799	141,801	30,205
Connaught .	1,418,859	199,360	38,534	17,800
Total .	8,175,124	974,188	352,016	156,583

V.—Population of Cities and Boroughs returning Members to Parliament.*

1.—ENGLAND.

	Total Persons.		Total Persons.
Abingdon . .	5,502	Honiton . . .	3,773
Alban's, St. . .	6,246	Horsham . .	5,574
Andover . .	4,997	Huddersfield . .	24,931
Arundel . .	2.583	Hull, Kingston-upon	65,670
Ashburton . .	3,841	Huntingdon . .	5,500
Ashton-under-Lyne .	22,514	Hythe . . .	8,939
Aylesbury . .	56,764	Ipswich . . .	24,660
Banbury . .	7,199	Ives, St. . .	8,645
Barnstaple . .	10,259	Kendal . . .	11,519
Bassetlaw (*see* Retford, East)		Kidderminster .	15,427
Bath City . .	52,346	King's Lynn . .	15,751
Bedford . . .	8,578	Knaresborough .	5,382
Berwick-upon-Tweed	12,578	Lambeth . .	197,412
Beverley . .	8,409	Lancaster . .	14,389
Bewdley . .	7,458	Launceston . .	6,070
Birmingham . .	181,116	Leeds . . .	151,063
Blackburn . .	86,186	Leicester . .	50,365
Bodmin . . .	5,901	Leominster . .	4,846
Bolton . . .	50,163	Lewes . . .	9,282
Boston . . .	14,618	Lichfield City .	6,587
Bradford . .	66,508	Lincoln City . .	13,411
Bridgnorth . .	1,931	Liskeard . .	4,226
Bridgewater . .	9,668	Liverpool . .	282,656
Bridport . .	7,166	London City‡ . .	120,702.
Brighton . .	48,567	Ludlow . . .	5,171
Bristol City . .	123,188	Lyme Regis . .	3,376
Buckingham . .	7,978	Lymington . .	4,926
Bury . . .	24,759	Macclesfield . .	32,528
Bury St. Edmunds .	12,168	Maidstone . .	16,920
Calne . . .	5,100	Maldon . . .	4,968
Cambridge City .	23,455	Malmesbury . .	6,674
†Cambridge University		Malton . . .	6,875
Canterbury City .	15,422	Manchester . .	240,367
Carlisle City . .	20,815	Marlborough . .	4,139
Chatham . .	17,903	Marlow, Great .	6,237
Cheltenham . .	31,207	Marylebone . .	287,465
Chester City . .	22,961	Midhurst . .	6,578
Chichester City .	8,084	Monmouth District, comprising	
Chippenham . .	6,606	Monmouth . .	5,822
Christchurch . .	6.634	Newport . .	10,271
Cirencester . .	5,840	Usk . . .	1,503
Clitheroe . .	11,324	Morpeth . .	7,160
Cockermouth . .	6,420	Newark-upon-Trent	10,218
Colchester . .	17,532	Newcastle-under-Line	10,038
Coventry City . .	30,179	Newcastle-upon-Tyne	69,430
Cricklade . .	34,381	Newport, Isle of Wight	6,330
Dartmouth . .	4,663	Northallerton . .	4,861
Derby . . .	32,407	Northampton . .	20,637
Devizes . . .	6,156	Norwich City . .	60,982
Devonport . .	40,559	Nottingham . .	51,441
Dorchester . .	5,402	Oldham . . .	60,109
Dover . . .	17,795	Oxford City . .	28,656
Droitwich . .	6,588	†Oxford University	
Dudley . . .	31,157	Penryn and Falmouth	12,160
Durham City . .	9,577	Peterborough City .	6,991
Evesham . .	4,245	Petersfield . .	5,201
Exeter City . .	37,231	Plymouth . .	35,040
Eye . . .	7,347	Pontefract . .	10,688
Falmouth (*see* Penryn)		Poole . . .	8,449
Finsbury . .	265,043	Portsmouth . .	49,214
Frome . . .	9,699	Preston . . .	50,332
Gateshead . .	19,843	Reading . . .	18,499
Gloucester City .	14,497	Reigate . . .	4,415
Grantham . .	8,786	Retford, East . .	44,132
Greenwich, &c. .	72,748	Richmond . .	4,300
Grimsby, Great .	6,698	Ripon . . .	5,927
Guildford . .	5,925	Rochdale . .	24,091
Halifax . . .	26,694	Rochester City .	11,949
Harwich . .	3,730	Rye . . .	7,667
Hastings . .	11,614	Salford . . .	66,624
Helstone . .	8,169	Salisbury . .	11,626
Hereford City .	11,367	Sandwich . .	11,194
Hertford . .	5,463	Scarborough . .	9,953
Shaftesbury . .	9,462	Wakefield . .	18,486
Sheffield . .	109,597	Wallingford . .	7,780
Shields, South .	22,942	Walsall . . .	19,554
Shoreham, New .	27,980	Wareham . .	6,646
Shrewsbury . .	17,688	Warrington . .	21,116
Southampton . .	27,490	Warwick . .	9,124
Southwark . .	142,620	Wells City . .	4,607
Stafford . .	9,149	Wenlock . .	19,774
Stamford . .	7,384	Westbury . .	7,454
Stockport . .	50,154	Westminster City .	219,930
Stoke-upon-Trent .	67,798	Weymouth and Melcombe Regis .	8,784
Stroud . . .	37,668		
Sudbury (since disfranch.)	5,728	Whitby . . .	9,862
Sunderland . .	52,818	Whitehaven . .	15,841
Tamworth . .	7,662	Wigan . . .	25,167
Taunton . .	12,306	Wilton . . .	8,057
Tavistock . .	6,075	Winchester City .	9,370
Tewkesbury . .	5,721	Windsor, New. .	9,062
Thetford . .	3,844	Wolverhampton .	92,943
Thirsk . . .	5,132	Woodstock . .	7,404
Tiverton . .	9,838	Worcester City .	26,306
Totness . .	4,240	Wycombe, Chipping	6,480
Tower Hamlets .	419,730	Yarmouth, Great .	27,550
Truro . . .	9,901	York City . .	30,152
Tynemouth & N. Shields	25,165		

2.—WALES.

Districts and Boroughs.

BEAUMARIS District. Amlwch, 3373; Beaumaris, 2680; Holyhead, 2974; Llangefni, 1348. Total, 10,375.

Brecon, 5317.

CARDIFF District. Cardiff, 9714; Cowbridge, 1,080; Llantrissent, 855. Total, 11,649.

CARDIGAN District. Aberystwith, 4975; Adpar, 1619; Cardigan, 3800; Lampeter, 902. Total, 11,296.

CARMARTHEN District. Carmarthen, 9403; Llanelly, 6818. Total, 16,221.

CARNARVON District. Bangor City, 5058; Carnarvon, 7843; Conway, 1828; Cricceith, 604; Nevin, 1656; Pwllheli, 2601. Total, 19,590.

DENBIGH District. Denbigh, 5228; Holt, 1058; Ruthin, 3271; Wrexham, 5831. Total, 15,388.

FLINT District. Asaph, St., City, 1701; Caergwyle, 755; Caerwys, 690; Flint, 3265; Holywell, 5864; Mold, 3557; Overton, 1662; Rhuddlan, 2782. Total, 20,276.

HAVERFORDWEST District. Fishguard, 1497; Haverfordwest, 5849; Narberth, 1286. Total, 8582.

Merthyr Tydvil, 42,917.

MONTGOMERY District. Llanfyllin, 1106; Llanidloes, 2742; Machynlleth, 1672; Montgomery, 1176; Newtown. 6535; Welshpool, 4670. Total, 17,901.

PEMBROKE District. Milford, 2377; Pembroke, 7212; Tenby, 2512; Wiston, 775. Total, 12,876.

RADNOR, NEW, District. Cefn-Llys, 26; Knighton, 1183; Knucklas, 270; Presteign, 1550; New Radnor, 2478; Raydrgwy, or Rhayader, 912. Total, 6419.

SWANSEA District. Aberavon, 3665; Kenfig, 462; Loughor, 573; Neath, 4967; Swansea, 22,982. Total, 32,649.

3.—SCOTLAND.

Parliamentary Cities, Burghs, and Districts of Burghs.

Aberdeen (city), 61,923; Dundee (burgh), 62,873; Edinburgh (city), 132,977; Glasgow (city), 255,650; Greenock (burgh), 35,645; Paisley (burgh), 47,695; Perth (city), 20,167.

Districts of Burghs.

ANDREWS, ST., District. Constituted as follows:—Andrews, St., 4449; Anstruther, Easter, 1008; Anstruther, Wester, 339; Crail, 1221; Cupar, 5137; Kilrenny, 1719; Pittenween, 1309. Total, 15,182.

AYR District. Ayr, 15,749; Campbeltown, 6782; Inverary, 1092; Irvine, 7313; Oban, 1398. Total, 32,334.

DUMFRIES District. Annan, 3321; Dumfries, 13,088; Kirkcudbright, 2588; Lockmaben, 931; Sanquhar, 1700. Total, 21,628.

ELGIN District. Banff, 5309; Cullen, 1564; Elgin, 5064; Inverury, 1679; Kintore, 465; Peterhead, 5759. Total, 19,840.

FALKIRK District. Airdrie, 12,408; Falkirk, 8208; Hamilton, 8689; Lanark, 4467; Linlithgow, 4009. Total, 37,776.

HADDINGTON District. Dunbar, 2978; Haddington, 3749; Jedburgh, 3277; Lauder, 1148; North Berwick, 1087. Total, 12,189.

---

* The inmates of public institutions are not included.

† The elective franchise of the Universities of Oxford and Cambridge is vested in the Doctors and Regent Masters of Arts in Convocation.

‡ The population of the several parishes and places forming the metropolis, within the limits adopted by the Registrar-General, was 1,873,676.

Inverness District. Forres, 3173; Fortrose, 955; Inverness, 11,568; Nairn, 2384. Total, 18,080.

Kilmarnock District. Dumbarton, 4391; Kilmarnock, 19,398; Renfrew, 2012; Rutherglen, 5623; Port Glasgow, 6943. Total, 38,367.

Kirkcaldy District. Burntisland, 1859; Dysart, 7057; Kinghorn, 1542; Kirkcaldy, 9778. Total, 20,236.

Leith District. Leith, 25,984; Portobello, 3588; Musselburgh, 6116. Total, 35,688.

Montrose District. Aberbrothwick, or Abroath, 14,568; Brechin, 5903; Forfar, 7981; Inverbervie, or Bervie, 864; Montrose, 14,252. Total, 43,568.

Stirling District. Culross, 587; Dunfermline, 13,296; Inverkeithing, 1827; Queensferry, 1233; Stirling, 10,701. Total, 27,644.

Wick District. Cromarty, 1936; Dingwall, 1732; Dornoch, 448; Kirkwall, 3046; Tain, 1872; Wick, 5522. Total, 14,556.

Wigtown District. Galloway, New, 430; Stranraer, 4878; Whithorn, 1513; Wigtown, 1860. Total, 8681.

4.—IRELAND.

Boroughs.	Total Persons.	Boroughs.	Total Persons.
Armagh	10,245	Enniskillen	5,686
Athlone	6,393	Galway	32,511
Bandon	8,275	Kilkenny	23,625
Belfast	63,625	Kinsale	6,918
Carlow	10,409	Limerick	65,296
Carrickfergus	9,379	Lisburn	7,524
Cashel	8,027	Londonderry	15,150
Clonmel	13,505	Mallow	6,851
Coleraine	6,255	New Ross	7.543
Cork	106,055	Newry	13,227
Downpatrick	4,866	Portarlington	3,106
Drogheda	19,260	Sligo	14,318
Dublin	238,531	Tralee	11,363
Dundalk	10,782	Waterford	29,288
Dungannan	3,801	Wexford	11.252
Dungarvan	12,382	Youghal	9,939
Ennis	9,318		

CENTRAL CRIMINAL COURT.—This is a court established in 1834, by 4 & 5 Wm. IV. c. 36, for the trial of treasons, murders, felonies, and misdemeanors committed within the city of London and county of Middlesex, and parts of Essex, Kent, and Surrey. By § 22 the court is authorized to try offences committed on the high seas and other places within the jurisdiction of the Admiralty of England. The Justices of the Peace are prohibited by the act from trying at their sessions persons charged with capital, and a variety of other offences, alleged to have been committed within the jurisdiction of the act. This jurisdiction comprises the whole of Middlesex; in Essex the parishes of Barking, East Ham, West Ham, Little Ilford, Low Layton, Walthamstow, Wanstead, Woodford, St. Mary, and Chingford; in Kent, Charlton, Lee, Lewisham, Greenwich, Woolwich, Eltham, Plumstead, St. Nicholas Deptford, that part of St. Paul Deptford which is within Kent, the liberty of Kidbrook, and the hamlet of Mottingham; in Surrey, the borough of Southwark, the parishes of Battersea, Bermondsey, Camberwell, Christchurch, Clapham, Lambeth, St. Mary Newington, Rotherhithe, Streatham, Barnes, Putney, that part of St. Paul Deptford which is within Surrey, Tooting Graveney, Wandsworth, Merton, Mortlake, Kew, Richmond, Wimbledon, the Clink Liberty, and the district of Lambeth palace.

The area and population of the different parts of the Central Criminal Court jurisdiction are as follows:—

	Sq. miles.	Population, 1841.
Middlesex	282	1,576,636
Essex (parts of)	53¾	36,609
Kent	30¾	101,719
Surrey	50¾	413,046
	417¼	2,128,010

For all purposes under the act the above district is considered as one county, and in all indictments and presentments the venue runs 'Central Criminal Court to wit.'

The judges of the Central Criminal Court are appointed by the act to be any two or more of the following persons: the lord mayor for the time being of the city of London, the lord chancellor or the lord keeper of the great seal, and all the judges for the time being of his Majesty's courts of King's Bench, Common Pleas, and the Exchequer, the chief judge and the two other judges in Bankruptcy, the judge of the Admiralty, the dean of the arches, the aldermen of the city of London, the recorder, the common serjeant, the judges of the sheriffs court of the city of London for the time being, and any person or persons who hath or shall have been lord chancellor, lord keeper, or a judge of any of his majesty's superior courts of Westminster, together with such others as his majesty, his heirs and successors, shall from time to time name and appoint by any general commission. The power of selecting the judges from so extensive a list renders it unnecessary to issue a commission every time the sessions are held, and the period of holding the sessions is not interrupted when the judges of the courts at Westminster are absent on circuit. The sessions are held twelve times a-year at the Old Bailey and in the New Court adjoining, and the judges are usually two of the common-law judges and the recorder of the city of London. Before the Central Criminal Court was established sessions were held at the Old Bailey eight times a-year for the trial of offences committed in Middlesex, and bills were returned by a grand jury sitting at Clerkenwell under the jurisdiction of the county magistrates. Offences committed at Southwark or Greenwich, both of which places may be regarded as parts of the metropolis, were, in the case of Southwark, tried at Guildford, Kingston, or Croydon, as it might happen, and from Greenwich an offender was sent for trial to Maidstone. From the great amount of population, the calendars were necessarily so heavy that a winter assize became necessary for parts of the Home Circuit; but it was still better to place the whole metropolitan district under one jurisdiction, and to have a jail delivery every four or five weeks.

Jurors are summoned by the sheriffs of the city of London and of the counties of Middlesex, Essex, Kent, and Surrey according to the parts of the district in which they reside. The juries are selected from London alone; or from Middlesex and the parts of counties which are within the limits of the act; or from both indiscriminately. Jurors from Essex, Kent, and Surrey, who have served upon any jury at the Central Criminal Court are exempted, for the ensuing twelve months, from serving upon any jury in any court (except the sessions of the peace) held in the county in which they reside.

The area over which the jurisdiction of the Central Criminal Court extends is about the 130th part of the area of England and Wales, but the population is between 1-7th and 1-8th of that of England and Wales. Nearly as many prisoners are annually tried at the Central Criminal Court as at all the county assize courts in England and Wales. In 1839 the number of persons tried at all the different courts were as follows:

	Number.	Proportion per cent.
County Quarter Sessions Courts	13,157	53·8
Circuit Assize Courts	3,557	14·6
Borough Courts	4,252	17·4
Central Criminal Court	3,483	14·2

The following is a statement of the number of persons convicted at the Central Criminal Court in the year 1844; specifying their offences and sentences:—arson, 1; bigamy, 13; burglary, 51; cattle stealing, 1; child stealing, 5; coining, 7; coin, feloniously uttering counterfeit, 5; curtilage breaking and larceny, 1; cutting and wounding, with intent to murder, &c., 16; embezzlement, 80; forging and uttering forged instruments, 38; horse stealing, 19; housebreaking and larceny, 30; larceny, larceny person and larceny servant, 1652; larceny in a dwelling-house above *5l.*, 72; letter, stealing from the post-office a, 2; letter, sending threatening, 3; manslaughter, 12; misdemeanor, 221; mould, having in possession a, 2; murder, 3; rape, 7; receiving stolen goods, 30; robbery, 21; sheep stealing, 5; ship, destroying at sea a, 1; ship, revolt on board a, 1; shooting at a person, with intent to murder, 2; threats, demanding money with, 3; unnatural crime, 1; warehouse breaking and larceny, 1; total, 2306.

Of which criminals there were sentenced—to death (of whom one was executed), 2; transportation for life, 22; for twenty years, 7; for fifteen years, 37; for fourteen years, 7; for twelve years, 3; for ten years, 194; for seven years, 256; total transported, 527. Imprisoned in Newgate and the Houses of Correction, for three years, 2; for two years, 39; for eighteen months, 27; for one year, 259; for nine months, 90; for eight months, 1; for six months, 417; for four months, 132; for three months, 406; for two months, 133; for six weeks, 8; for one month and under, 260; total, 1774. Fined, 2. Discharged on recognizance, 2. In 1843 the number sentenced was 2862.

CENTRANTHUS (from κέντρον a spur, and ἄνθος a flower), a genus of plants belonging to the natural order Valerianaceæ. It has a regular 5-lobed corolla with a spur, a single stamen, the fruit 1-celled, indehiscent, crowned with the limb of the calyx, expanded into a feathery pappus. The species are smooth herbs with undivided or pinnate leaves, and white or red flowers.

C. ruber, red-flowered spurred Valerian, red Valerian, has ovate-lanceolate leaves, spur much shorter than the tube of the corolla and twice as long as the germen. It is a native of Great Britain, in chalk-pits and on old walls. It has purple flowers, and attains a height of one or two feet. It has a sweet scent.

C. Calcitrapa has radical leaves ovate entire, the stem-leaves pinnatifid, the spur very short. It is a native of the coasts of the Mediterranean, and of the more temperate parts of France. It grows wild at Eltham in Kent, but there is little doubt of its being a naturalized plant there. The first species may have also been introduced, but it grows wild in many parts of Great Britain. Several other species are described, and some are grown in gardens. They are elegant border flowers, and will grow in any common soil, on walls or rock-work, and may be easily propagated by seed.

(Babington, *Manual of British Botany.*)

CENTU'MVIRI. [Judex, Judicium, P. C.]

CENTU'NCULUS, a genus of plants belonging to the natural order Primulaceæ. It has a 4-parted calyx, corolla with a subglobose inflated tube and patent 4-parted limb, 4 stamens inserted in the throat of the corolla, the capsule many-seeded, opening all round transversely. The only species of this genus, *C. minimus*, is a native of Great Britain. It is a very minute plant with a prostrate stem, the leaves alternate ovate acute, the flowers pale rose colour, subsessile, without glands at the base. It grows in damp, sandy, and gravelly places, and is known by the common name of Bastard Pimpernel. (Babington, *Manual of Brit. Bot.*)

CENTURION. A centurion in the Roman army was the commander of a centuria, a term which we cannot conceive to have originally signified anything except a hundred; but there is no ground for supposing that the word centuria contains the elements of the word 'viri,' men. The term centuria was also applied to a hundred jugera of land, and Varro (*L. L.* v. 35) observes that the name was kept after the centuria contained two hundred jugera. But a different explanation of this is given by Niebuhr.

A centuria, as a division of an army, signified a number of men under the command of a centurio. The form of the word centurio is the same as that of the word curio. Niebuhr has endeavoured to show that the centuria originally consisted of thirty men (*Roman History*, vol. i. 471, iii. 100; Eng. Transl.). When the Roman legion contained thirty manipuli and sixty centuries, the number of centurions would be sixty; but as the number of the legion was not a fixed number, we must suppose that the officer called a centurion had at various times a varying number of men under him.

The passage in Livy (xlii. c. 32, &c.) seems to show that the centurions were appointed by the military tribunes. But Polybius, in the fragment of his sixth book (c. 24), states that in his time twenty men were selected from the respective bodies of the hastati, principes, and triarii, who composed a legion: none were selected from the velites, or light troops, who were distributed among the hastati, principes, and triarii in just proportion. Polybius calls the Roman centurion *taxiarchus* (ταξίαρχος), which is a translation of the Latin phrase 'ordinem ducere.' There were two centurions to each of the divisions, or manipuli as the Romans called them, and he that was first chosen commanded the right of the manipulus, and the other the left. Each manipulus had its standards, which were carried by two of the bravest and strongest soldiers, who were appointed by the centurions. The centurion who was first chosen was called primipilus, and was a member of the general's council: he was the first centurion of the first manipulus of the triarii, and he had the care of the eagle.

The pay of the soldier in the infantry is stated by Polybius at two oboli a day, and double to the centurions. The obolus is a sixth part of the Attic drachma, or one-sixth part of 9¾*d.* This would therefore make the monthly pay of a centurion about 16*s.* a month.

The duties of the centurions were to command their several manipuli. They received their orders from the tribunes of the legion, who received theirs from the commander of the army, whom they visited every morning to receive their orders, which they then gave to the centurions. They also superintended the soldiers when they were engaged in the military works, such as castrametation. They had also to go round to inspect the watches; at least this is stated as among the duties in some passages of the Latin writers. The badge of office was a stick made of the stock of a vine (vitis).

The centurions had defensive armour, a shield, an iron helmet, with a crest placed transversely to distinguish them from the soldiers. They had also a mark (signum) on their helmet, probably to denote the centuria or cohort to which they belonged. (Vegetius, ii. 13; and the Notes of Stewechius.)

The granting of temporary leave from military service to the soldiers (vacatio), which is sometimes reckoned among the privileges of the centurions, was only an abuse that got established at a late period. It appears to be first mentioned in the beginning of the reign of Tiberius (Tacitus, *Ann.* i. 17). However the practice had become so far established that Otho thought it prudent to pay the centurions out of the imperial treasury (fiscus) such amounts as they had been in the habit of receiving from the soldiers on the account of the vacationes.

Under the empire it seems that the centurionships were generally given as a matter of favour and patronage.

The speech of the centurion Sp. Ligustinus in Livy (xlii. 34), presents a lively picture of the laborious services of a Roman soldier who had worked his way up to the rank of Primipilus.

CEPHALANTHE'RA, a genus of plants belonging to the natural order Orchidaceæ, and to the tribe Limodoreæ. It has a converging perianth, the lip interrupted, the basal division saccate, jointed to the recurved terminal one, the stigma transverse without a rostellum, the anthers terminal, erect, moveable, shortly and thickly stalked, 2-celled, the cells with imperfect septa, the column elongated, the germen sessile twisted. Three species of this genus are natives of Great Britain.

C. grandiflora, with ovate-lanceolate or ovate-pointed leaves, bracts longer than the glabrous germen, lips obtuse, included. It has white flowers, with the lips marked with several elevated longitudinal lines. It is found in dense woods, usually on a calcareous soil.

C. ensifolia, with lanceolate-pointed leaves, bracts much shorter than the glabrous germen, lips obtuse, included. The flowers are white, the lips marked with several elevated white lines and a yellow spot in front. It is a rare plant, and found in mountainous woods.

C. rubra has lanceolate, acute leaves, bracts longer than the downy germen, the lip acute, as long as the petal. The flowers are purple, the lip white with a purple margin, marked with numerous wavy longitudinal lines. A very rare plant in mountainous woods. (Babington, *Manual of Brit. Bot.*)

CEPHALA'SPIS, a singular genus of fossil Placoid Fishes, established by Agassiz on specimens from the old red sandstone of Herefordshire, Forfarshire, &c. The head covering is like the anterior part of a Trilobite. Cephalaspis Lyellii, C. Lloydii are British species.

CEPHALOTA'CEÆ, a natural order of exogenous plants. It consists of but one genus, and that of only one species, the *Cephalotus follicularis*, New Holland Pitcher Plant. It has the following essential character: calyx coloured, 6-parted, with a valvate æstivation; no corolla; stamens 12; those opposite the sepal shortest, inserted into the edge of a deep glandular perigynous disk; anthers with a thick granular connective, carpels six distinct, 1-seeded, ovate, erect; achenia membranous, opening by the ventral suture, surrounded by the persistent calyx and stamens; seed solitary (sometimes two), erect; embryo minute, in the base of the axis of a fleshy friable, somewhat oily, albumen. The *Cephalotus follicularis* has small white flowers, with a simple scape, bearing a compound terminal spike; the leaves are exstipulate, and have mingled amongst them operculate pitchers. This plant, according to Labillardière, is allied to Rosaceæ, and, according to Jussieu, to Crassulaceæ. Brown places the order between Crassulaceæ and Francoaceæ. Lindley points out its relations through the last order to Pittosporaceæ and Sarraceniaceæ, where the leaves of the plants are also converted into pitchers. He also places Dionæa in this order, and observes, that it differs little from Cephalotus except in the presence of petals, and in the syncarpous fruit, with the seeds collected upon a flat central placenta. [Dionæa, P. C.]

In cultivating the New Holland Pitcher Plant, it should be placed in turfy peat soil either in a box or pot. It should be kept rather moist, and this may be effected by placing the pots in pans of water. The plants are always the healthier for allowing moss to grow over the surface of the soil in which they are planted. They can only be increased by seed.

(Lindley, *Natural System*; Don, *Gardeners' Dictionary*.)

CE'PHALUS. [Gymnodontes, P. C. S.]

CERA'MIEÆ. [Water Plants, P. C.]

CERAMLAUT ISLANDS are a group of islands situated in the Indian Archipelago, near the eastern extremity of the large island of Ceram, between 3° 30′ and 4° S. lat., and between 130° 30′ and 131° 30′ E. long. The group consists of three larger islands, and an unknown number of smaller islands. The larger islands are called Great Keffing, Little Keffing, and Ceramlaut. All the islands belonging to this group lie on a coral bank, which extends to the eastern extremity of the island of Ceram. The depth of water on the banks varies between two and four fathoms, but near it the sea is unfathomable. In climate and productions the Ceramlaut Islands do not materially differ from the Moluccas, of which they are considered to constitute a portion. Many of these islands are well cultivated and very populous. The villages are large, and each of them constitutes an independent community, governed by a chief. These small states are continually quarrelling, and often at war, and the villages are fortified by walls of considerable height and thickness; and other walls have been erected to mark the respective boundaries. The inhabitants are Mohammedans, and almost every place contains a mosque.

The inhabitants of the Ceramlaut Islands, and those of the Goram Islands, a neighbouring group consisting of three rather large islands, Goram, Manowolko, and Salawako, are remarkable as constituting a link in the commercial intercourse of the world. By means of these alone the inhabitants of Papua or New Guinea export the produce of their country, and are supplied with those articles of foreign merchandise which are in demand among them. This commerce is very considerable. Each island has a district on the coast of Papua with which it carries on an exclusive commerce. If the inhabitants of another island went to visit it for commercial purposes it would be the cause of a war. The inhabitants of Papua, on their side, are also disinclined to enter into a commercial intercourse with any persons except those who commonly visit them. The number of vessels employed in this commerce is very considerable: from Enekka alone, a place in the island of Goram, twenty junks annually depart for the coast of Papua. Some of the chiefs of the islands have married natives of Papua, and have thus entered into a more close connexion with the inhabitants. It is also stated, that they have succeeded in introducing the Mohammedan religion at several places on that coast. The monopoly which the islanders claim of the trade with Papua is so strict that even European vessels find it necessary to engage some of them when they go to a harbour in Papua; for without their assistance it would be impossible to trade. The articles which are exported by them from Papua are slaves, nutmegs, tripang, tortoiseshell, and edible birds'-nests; and the imports consist of guns, gunpowder, small cannons, cotton-cloth, corals, Chinese goods, iron, hardware, and some smaller articles. The imported goods are sent by the islanders to Bali and Sumbauwa, or are fetched by the Bugies from Boni or Celebes, who carry them to Singapore, or to some other harbour in Celebes or Borneo which is visited by Chinese junks, in which manner they find their way to Canton and other Chinese ports.

The Ceramlaut, as well as the Goram Islands, are frequently visited by English and American whalers, which export a considerable quantity of nutmegs, mace, and cloves, which they obtain by barter for guns, gunpowder, cotton-cloth, and some other articles.

The Dutch consider these islands as forming a portion of their widely-spread dominions in the Indian Archipelago; but they have no settlement on them, nor does it appear that they ever had. From time to time however they send a vessel there to settle the disputes which have arisen between the small independent states, or to terminate their wars. It appears however that this is only done when the president of Banda is applied to by the natives for that purpose. The commercial intercourse between Banda and the Ceramlaut and Goram groups is very great. The agricultural produce of the islands finds a ready market at Banda. The inhabitants of Banda are almost exclusively occupied in the cultivation of the nutmeg-trees; and sago, oil, cocoa-nuts, live stock, wood, areca-nuts, and betel, are imported in large quantities. The islanders bring these articles to Banda in their own vessels, which however are not built by them, but bought on the Key Islands or in Bali. The larger praws are obtained in Bali.

(Kolff, *Reize door den weinig bekenden zuidelijken Molukschen Archipel.*)

CERA'STIUM (from κέρας, a horn), a genus of plants belonging to the natural order Caryophylleæ. It has a 5-parted calyx, 5 petals, all bifid; stamens, 10 or 5 or 4; styles, 5 or 4; the capsules tubular, opening at the end, with 10 teeth. This is an extensive genus, containing species which are common weeds in the temperate climates of most parts of the world. Don enumerates eighty-two species; of these nine are British.

C. alpinum, Alpine Mouse-ear Chickweed, has a hairy ascending stem, the leaves ovate, ovate-oblong, or lanceolate; the flowers few; the sepals bluntish, with membranous margins; bracts herbaceous, their margins often narrowly membranous; the capsules, at length, twice as long as the calyx. This plant is a native of the Pyrenees, the mountainous parts of Wales and Scotland, and of Melville Island. It is subject to great variations, and a number of varieties have been described by Brown, Bentham, and other botanists.

C. glomeratum has ovate leaves, acute lanceolate sepals, with a narrow membranous margin, and, as well as the herbaceous bracts, hairy throughout; the capsule cylindrical, ascending, twice as long as the calyx; fruitstalks about as long as the calyx. This is a common plant in fields and on banks, flowering from April to September. The other British species are *C. triviale*, common in fields; *C. semidecandrum*, found in dry places; *C. atrovirens*, inhabiting sandy places and rocks near the sea; *C. pumilum*, found only near Croydon in Surrey; *C. tetrandrum*, found at Tynemouth and Shetland; *C. latifolium*, a rare plant; and *C. arvense*, abundant in chalky and gravelly places.

A few of the species, as *C. tomentosum*, *C. grandiflorum*, and *C. Dahunicum*, are worth cultivating as border flowers. *C. latifolium*, *C. alpinum*, and *C. glaciale*, are adapted for growing on rock-work, or in small pots, when they should be placed in a mixture of loam, sand, and peat. They require the same general treatment as most hardy plants. The annual species may be propagated by sowing seed in an open border in the spring; the perennial, by dividing the plants at the root.

(Don, *Gardeners' Dictionary*; Babington, *Manual*.)

CERATI'TES, a subdivision of the Ammonitidæ, as proposed by Haan. It is peculiar to the Muschelkalk. [Goniatites, P. C.]

CERATOPHYLLUM. [Ceratophylleæ, P. C.]

CE'REBRUM. [Brain, P. C.]

CEREVI'SIÆ FERMENTUM, *Medical Properties of*. Yeast, barm, or zumin, has been known as long as fermented drinks, being the active or exciting agent by which they are formed out of saccharine juices. [Wine, P. C.] The intimate nature and mode of action of ferments have been studied with great care by Turpin, Cogniard Latour, Schwann, Liebig, M. Rousseau (*Comptes Rendus*, No. 17, April 24, 1843), and Bouchardat (*Comptes Rendus*, and *The Chemist*, vol. v. p. 401). These observers have established numerous differences in ferments; but it is to the common yeast of beer-brewers that the following observations apply. Its presence, or that of any gluten-like material, excites in saccharine fluids an intestine motion, by which, if there be sufficient yeast, the sugar is resolved into alcohol and carbonic acid. It is while this change is taking place that yeast is deemed most useful. It is employed both internally and externally. In the former case, the malt which supplied the saccharine principle has often been given along with or instead of it, under the name of malt or wort. It was highly commended by Dr. Macbride, in the treatment of scurvy, before the utility of lemon-juice was generally recognised; and some recent writers have given instances of its advantageous employment. The objection to its use is, that it generally increases the diarrhœa. But this is not invariably the case. It has been strongly recommended, by Dr. Stoker of Dublin, in typhus fever; and enemata made with it have proved useful against typhoid tympanites. All this is extremely probable, from the explanation given by Liebig of the manner in which ferments promote the digestive process. (*Animal Chemistry*.)

The yeast poultice is an excellent application to putrid and gangrenous ulcers, with offensive discharge and unhealthy granulations. It must be renewed every six hours. Its beneficial influence is not owing solely to the carbonic acid gas evolved, as the same good effects do not follow when a stream of carbonic acid gas is directed on the sores. Dr. Stephen Williams of the United States strongly recommends a poultice of fine malt and boiling beer, with yeast spread on the surface, applied frequently in the twenty-four hours. Under its use the offensive odour and discharge cease, the granulations become firm and healthy, and the healing process goes on steadily. It is expedient to continue its use for three or four days. (*American Journal of Medical Science*, May, 1832, p. 38.)

German yeast, which is in a dry state, and begins its action on being moistened with water, has the advantage over common yeast of being more rapid in its development and effects. When used it must be more frequently renewed.

CERTIORA'RI. By 5 & 6 Wm. IV. c. 33, it is enacted that no certiorari shall issue to remove indictments or presentments from inferior courts to the Court of King's Bench, at the instance of a prosecutor, without leave obtained from the court, as by a defendant. The act requires defendants, before obtaining a writ of certiorari, to enter into a recognizance in such sum and with such sureties as the Court of King's Bench, or one of the justices of the said court, shall by indorsement on the said writ order and direct. The object of the act is of course to prevent prosecutors from vexatiously removing cases out of the inferior courts.

CERUSE, from *Cerussa*, the Latin name for *white lead*, or *carbonate of lead*. [LEAD, P. C., p. 370.]

CERVUS E'LAPHUS (HARTSHORN), *Medical Properties of*. The hart or stag is too familiar to require any description. The antlers shed annually yield the part used in medicine, called *cornu cervinum*, the shavings or raspings of which are termed *rasua* or *ramenta*. These differ from the hollow horns of oxen, and approximate more to bones, from which they are distinguished by having less phosphate of lime and more gelatine. Merat-Guillot gives as the constituents; soluble cartilage (gelatine), 29·0; phosphate of lime, 57·5; carbonate of lime, 1·0; water and loss, 14·5. The gelatine is readily extracted by boiling water, and its abundance is such that one part to two of water, reduced by boiling to two-thirds or three-fourths, furnishes a consistent jelly. This is in general easily digestible, and suitable to convalescents. It may be flavoured with orange or lemon, and wine be added or withheld according to circumstances. This jelly mixed with equal parts of cow's milk is said by Dr. Thomson to be useful in irritations of the digestive organs of infants. The same good effect will often result from the addition of a small portion of lime water to the milk.

The phosphate of lime procured by incineration of hartshorn is ordered to be employed in preparing the Pulvis Antimonialis.

Hartshorn was formerly used as the source of ammonia; hence it was termed volatile spirit of hartshorn. [AMMONIA, P. C. S.]

CE'SARI, GIUSEPPE, a celebrated Italian painter, commonly called Il Cavaliere d'Arpino from the birth-place of his father, who was an obscure painter of votive tablets for the images of saints, a *Pittore de' Voti*, and settled in Rome, where Giuseppe, or Giuseppino, as he was also called, was born, about 1568. When only thirteen years old, and serving in a menial situation under the painters employed by Gregory XIII. in the loggie of the Vatican, Giuseppe painted some figures by stealth, which led Fra Ignazio Danti, the superintendent of the works, to introduce him to the pope, with whom he eventually became a great favourite, as he was also with four of his successors—Sixtus V., Clement VIII., Paul V., and Urban VIII. He thus enjoyed the highest patronage, and was a great popular favourite, which pleased him better, for more than half a century. He was made a knight of the order del Abito di Cristo by Clement VIII., and was decorated with the order of St. Michel by Henry IV. of France, on the occasion of Henry's marriage with Maria de' Medici. He visited Paris in the train of the Cardinal Pietro Aldobrandini, nephew of Clement VIII., archbishop of Ravenna, and ambassador of the pope at Paris.

Though Cesari's style is extremely superficial, and, with the exception of great animation of composition, does not display a single essential quality of art, even in a moderate degree, he so carried with him the public taste of Rome, that for many years he was without a rival. Annibal Carracci strove in vain to turn the current of public favour, and the rivalship of Michelangelo Caravaggio himself was of too temporary a nature, and rested upon too feeble a foundation, novelty, to have any permanent effect. Cesari survived them both upwards of thirty years. He died at Rome in 1640, and left a numerous school of imitators behind him; but with his life ended his influence also, for there was not a single painter of ability among his scholars; his own brother Bernardino, who was one of his assistants, died some years before him. During the life of Caravaggio, the scholars of that painter formed a strong party against Cesari, and a challenge passed between the two principals, but Cesari declined to cross swords with Caravaggio, as he was not a cavaliere. He however himself sent a challenge to Annibal Carracci, who on his part responded, that his weapon was the pencil, and he would contend with no other. The partisans of Cesari and Caravaggio were called respectively *Idealisti* and *Naturalisti*.

The works of Cesari, in fresco and in oil, are very numerous: the chief of them is the series in illustration of Roman history in the Conservatorio in the Capitol, commenced for Clement VIII., but not finished until many years after that pope's death. Cesari undertook to complete the paintings in four years, by the year 1600; he did not complete them however until after a lapse of forty years. They are executed with great spirit, but with an utter disregard of nature; the design is slight and incorrect; the extremities have little variety, and are merely indicated; the draperies also are undefined, the heads want character, and the colouring is flat. The horses, of which there are many in the battles, are better than the figures, yet they are heavy. Cesari was fond of and excelled in painting horses. Crowds of figures and horses, or general fulness of subjects, are distinguishing characteristics of his style. He must however have been a man of great ability and extraordinary energy, though his abilities were less solid than attractive, and his energies were wasted in the acquisition of a fleeting popular applause.

(Baglione, *Vite de' Pittori*, &c.)

CE'SPEDES, PABLO DE, painter, sculptor, and architect, the most learned artist and one of the most distinguished men of Spain, was born at Cordova in 1538, and was the son of Alonso de Céspedes and Olaya (Arroyo) his wife. After he had received as good a literary and scientific education at Cordova and at Alcalá de Henares as his country could afford, he went, in what year is not known, to Rome, where he devoted himself to the study of the arts, having already paid some attention to painting previously to his departure from Spain. In Rome Céspedes distinguished himself during the pontificate of Gregory XIII. by some frescoes in the churches of Araceli, and Trinità de' Monti, and acquired the friendship of Federigo Zuccaro, which, however, some consider to have been a misfortune.

His fame reached his native place, and having been appointed to a vacant canonry in the cathedral, he returned to Cordova in 1577 to fulfil the duties of his office. These duties however did not engross all his time; he persevered in painting, and also bestowed much study upon the history and theory of art, the fruits of which he made known in several valuable essays, the principal of which is a comparison between antient and modern art, published in 1604—'De la Comparacion de la Antigua y Moderna Pintura y Escultura.' He spent his holidays at Seville, where he collected a museum of antient works of art; but he did not visit that city after the year 1603. He died at Cordova in 1608, and was buried in the cathedral, and the following epitaph was engraved upon his tomb by order of the chapter of the cathedral:—'Paulus de Céspedes hujus almæ Ecclesiæ Porcionarius, Picturæ, Sculturæ, Architecturæ, omniumque Bonarum Artium, variarumque Linguarum peritissimus, hic situs est. Obiit anno Domini MDCVIII., Septimo Kalendas Sextilis.'

Céspedes was a distinguished Arabic scholar, and was acquainted with Greek and Hebrew. He wrote a history of the cathedral of Cordova; also an account of its martyrs; a poem on painting; a practical and theoretical treatise on perspective; a short treatise on the temple of Solomon; and a short paper upon the various methods of painting adopted by the antients. His treatise on perspective is lost; and the preservation of his poem, and the treatise on the antient methods of painting, is due to Pacheco, who has inserted them in his 'Arte de la Pintura.' Pacheco describes Céspedes as one of the greatest of the Spanish colourists, and the first master of chiaroscuro in the school of Seville. Ponz says of him, that had he had the fortune to have been as intimate with Raphael as he was with Federigo Zuccaro, he would have been one of the greatest painters of the world. He excelled chiefly in invention and composition, but was excellent also in all other departments of art. He always, as a rule, made a cartoon before painting a picture, of the same size as the intended picture. There are several of his works in the cathedrals of Seville and Cordova, and in the academy of San Fernando at Madrid.

Cean Bermudez has inserted in the fifth volume of his

Dictionary of Spanish Artists, about one hundred pages of fragments from the writings of Céspedes on painting, including the entire poem on painting, which contains 608 lines.

(Cean Bermudez, *Diccionario Historico*, &c.)

CE'SSIO BONO'RUM, in the law of Scotland, is the name given to a process by which, as by the insolvency system in England, the estate of an insolvent person who does not come within the operation of mercantile bankruptcy is attached and distributed among his creditors. The term is derived from the deed of cession, or the assignment by which, as the counterpart of the relief afforded to him from the immediate operations of his creditors, the insolvent conveys his whole property for their behoof. Both the nomenclature and the early practice of the system are taken from the Roman law. (*Dig.* 42, tit. 3, 'de cessione bonorum.') According to the more antient law, the person released from prison on a cessio bonorum was bound to wear a motley garment called the dyvour's habit. In later times this stigma became the penalty of fraud, and it was subsequently disused. Before the passing of the late act, the jurisdiction in the awarding of Cessio was entirely confined to the Court of Session, and the insolvent was required to have been a month in prison before he could sue out the process. By 6 & 7 Will. IV. c. 56, the system was remodelled. The process may now be sued out either in the Court of Session or in the sheriff's local court. It may be taken advantage of by any person who is in prison for civil debt, or against whom such a writ of imprisonment has issued. It proceeds on notice to the creditors, and an examination and surrender of the insolvent. Proceedings instituted in the Sheriff Court are liable to review in the Court of Session. Cessio bonorum exhibits, like the insolvency system in England, this important difference from mercantile bankruptcy, that the person who obtains the privilege is not discharged from his debts, but only from proceedings against his person for payment of past debts, his estate continuing to be liable to the operations of his creditors. In Scotland, however, the common law means of attaching a debtor's property are simple and effectual, and there does not appear to have been there the same inducement as in England to make the process for the distribution of the debtor's effects an instrument of their discovery. The Scottish system, moreover, cannot be used by the creditors as a means of compelling their debtor to distribute his estate. It is a privilege of the debtor, and being seldom resorted to except by persons in a state of destitution who are harassed by vindictive creditors, the improvement of the system has not been a matter of much interest either among lawyers or legislators. [BANKRUPT LAWS OF SCOTLAND, P. C.; BANKRUPTCY, P. C. S.]

CESTRA'CEÆ, or CESTRI'NÆ, a natural order of plants belonging to the class of monopetalous Exogens. It is nearly related to Solanaceæ, and forms a tribe of that order in Don's Gardeners' Dictionary, with the following characters: Limb of corolla plicate, valvate or induplicate in æstivation; calyx 5-toothed; corolla funnel-shaped, 5-lobed regular; tube elongated, limb usually spreading; stamens 5; anthers dehiscing lengthwise; ovarium seated on a cupulate disk; pericarp capsular or baccate; placentas adnate to the dissepiment; embryo nearly straight with a cylindrical radicle, and roundish leafy cotyledons. It embraces the genera Cestrum, Dunalia, Meyenia, Dartus, Vestia, Lessea, Fabiana, Laureria, Lamarkia. In the second edition of the 'Natural System' Dr. Lindley recognises the order Cestraceæ, and adds, 'I do not attempt to characterise this assemblage of plants, being uncertain what its real peculiarity is. According to Schlechtendahl, it has all the characters of Solanaceæ, except that the embryo is nearly straight, and the cotyledons foliaceous. To this however it is possible that the valvate æstivation of the corolla ought to be added; but I am by no means sure that the species of Periphragmos of the Flora Peruviana with winged seeds ought not to be included, although as they have an imbricated æstivation, and a tricarpellary fruit, they are placed in Polemoniaceæ. These plants, which are very different from most of Jussieu's Cantuas, especially C. quercifolia, have much the habit of Lycium as well as Vestia. If they really do belong to Polemoniaceæ, they must be considered a connecting link between that order and Cestraceæ.' The genera recognised by Lindley are Cestrum, Vestia, Lessea, Fabiana.

The genus *Cestrum* has a tubular calyx, terete very short, obsoletely 5-toothed; corolla funnel-shaped, with a long slender cylindrical tube; a roundish throat and a flat limb, with ovate equal segments; filaments the length of the tube; anthers enclosed, being roundish, 2-celled, many seeded. C. *venenatum* is a large woody bush, which grows at the Cape of Good Hope, in Houtinqua Land, and elsewhere. The flowers are arranged in axillary clusters; the corolla has a reddish tube and a white limb, and emits a perfume resembling Jasmine flowers. A decoction of the bark reduced to an extract by evaporation is employed by the Hottentots to poison their arrows. It is said to be a speedy poison, and is also employed to destroy wild beasts by mixing with their food. C. *macrophyllum* and C. *noctuum*, have similar properties. C. *Hediunda* and C. *lamifolium* are febrifuge, and are applied extensively as astringents in Peru. About fifty species of Cestrum have been described. They are all of them natives of North and South America, and the West India Islands, and are known by the common name of Bastard Jasmines. They are easily cultivated, and will grow in any rich light soil, and are easily propagated by cuttings, which should be placed under a hand-glass in heat. The species of the allied genera require the same treatment.

(Don, *Gardeners' Dictionary*; Lindley, *Flora Medica*; Lindley, *Natural System*.)

CESTUI QUE TRUST. [TRUST AND TRUSTEE, P. C.]

CETIOSA'URUS, a new genus of large fossil Saurians adopted by Professor Owen. It occurs in the Oolitic formations.

CETRA'RIA ISLANDICA—*Medical Properties of*. This lichen, commonly termed Iceland moss, though native of the higher mountains of the northern part of Britain, is procured mostly from Norway and Iceland, on the lava of the west coast of which latter country it abounds and attains a large size. It is imported through Hamburg. 'The thallus is erect, tufted, olive-brown, paler on one side, laciniated, channelled, and dentato-ciliate; the fertile lacinia very broad; apothecia brown, appressed, flat, with an elevated border.' (Hooper.) The apothecia are very rarely developed on the thallus in Britain, save on the mountains of Ben-na-bord in Aberdeenshire, and the imported specimens rarely have them, probably from being gathered in a young state; for this lichen is too important an article of food in northern countries to be allowed to grow to maturity. When dry, it has scarcely any odour, and the taste is bitter and unpleasant. The powder or flour is of a whitish grey.

The analysis of Berzelius gives as its constituents—starchy matter of a peculiar kind (*lichenin*), 44·6; bitter principle (*cetrarin*), 3·0; uncrystallizable sugar, 3·6; chlorophylle, 1·6; extractive matter, 7·0; gum, 3·7; bi-lichenates of potass and lime, along with phosphate of lime, 1·9; amylaceous fibrin, 36·2.

The bitter principle, or cetrarin, may be separated by digesting the lichen in cold water containing 1-16th of carbonate of potass (some affirm 1-300th to be sufficient) for twenty-four hours. The whole is then thrown upon a sieve, and the liquid drained off. This liquid, when evaporated, yields a white principle, extremely bitter, very soluble in alcohol, particularly when boiling, and æther; sparingly so in water, volatile oils, and creasote. This principle may also be separated by animal charcoal, according to Peretti. (*Annalen der Pharmacie*, vi. p. 344.) When this is removed, the starchy matter differs little from wheat-flour in nutritive properties, though Olasson asserts that a soup prepared with it is twice as nutritious as one made with flour. (Sparmann, *Voyage*, iii. p. 129, note.) Certain it is that the inhabitants of Norway, Lapland, and, above all, of Iceland, use it extensively as an alimentary substance, the latter regarding it as the gift of 'a bountiful Providence, which sends them bread out of very stones.' Dr. Henderson (*Tour in Iceland*) says that a porridge made of this lichen-flour is to a foreigner not only the most wholesome, but the most palatable, of all the articles of Icelandic diet. It is submitted to no other preparation than repeated steepings in cold water, drying, and powdering; after which it is either made into cakes or boiled in milk. Unless it be steeped, it is both offensively bitter, and also to many persons purgative; hence it has been called *lichen catharticus*. (Borrichius, *Act. Hafnien.*, 1671, p. 126.) Owing to its intensely bitter taste, Sir John Franklin, even when pressed by hunger, could not use it, though the tripe de roche suited well. (*First Journey to Shores of Polar Sea*, 4to., p. 413, 414.)

The excellence of Iceland moss depends upon its freshness and freedom from accidental impurities, which should be carefully removed before it is used. In its natural state, *i. e.* still containing the bitter principle, it is tonic, stomachic, febrifuge, demulcent, and nutritious. It has acquired a high reputation, not merely as an article of diet, but as a medicinal agent in consumption. To obtain benefit from it, the use of it must be persisted in for a long time. This constitutes at once a difficulty in the employment of it, and casts a doubt on the exact nature of the cases in which it is said to have proved serviceable. The unpleasantness of the bitter it contains renders it unpalatable to most persons, and also its heating qualities unfit it for those who have either much general fever, or a state of sub-acute inflammation of the stomach, a very frequent condition in genuine phthisis pulmonalis. Hence there is every reason for suspecting that in the instances where it has been used for a long time and proved beneficial, the disease was chronic bronchitis, in which bitters and demulcents are extremely useful. To disguise the disagreeable flavour many expedients have been had recourse to, such as uniting it with chocolate or cocoa, and flavouring it with orange-flower water, &c. (A full account of these may be found in Hufeland's *Journal*, August, 1824, p. 126, from the pen of Dr. Oppert. Many formulæ may be found in Geïger, *Pharmacopœia Universalis.*) The only form officinal in Britain is the decoction, which is frequently made the vehicle of medicinal agents. Cetrarin has been given in a separate form as a succedaneum for cinchona bark, and, like many other very bitter articles, is of considerable efficiency in agues. Many substitutes for Iceland moss have been proposed; one of the best of which is the Carrageen or Irish moss (*Fucus crispus*). This, when the brackish taste is lessened by repeated steepings in cold water, forms an excellent jelly, much relished by consumptive patients, and much cheaper than any other. The *Sticta pulmonacea*, or lung-wort, is of unquestionable efficacy in some cases of asthma. But none are so palatable or agreeable as the Ceylon moss (*Fucus amylaceus*). This can be procured not only from Ceylon, but abundantly from the east coast of Bengal. In the form of jelly, soup, lozenges, or other mode of preparation, it not only agrees better, but is more relished than any jelly, either animal or vegetable. It is to be hoped that it will become a regular article of commerce.

All the Iceland moss imported into Britain is not used for medicinal purposes; much was employed in baking ship-biscuits, as those into the composition of which it enters are said not to be attacked by worms, or suffer much from sea-water. In Saxony, in time of scarcity, it is advantageously added to wheaten flour. In some countries it is employed in brewings.

CHÆROPHYLLUM, a genus of plants belonging to the natural order Umbelliferæ, to the sub-order Campylospermæ, and the tribe Scandicineæ. It has an obsolete calyx, obcordate petals with an inflexed point, a fruit not beaked; carpels with five equal obtuse ridges, interstices with single vittæ. The species are annual, biennial, or perennial plants with decompound leaves. Many plants formerly placed in this genus are now referred to Anthriscus. The *Chærophyllum sylvestre* of Linnæus is now *Anthriscus sylvestris*. It has been used in medicine as a substitute for hemlock. The Chærophyllum sativum of Lamarck is the Anthriscus Cerefolium of Hoffman. It is the garden chervil of Great Britain, and is used in some places as a pot-herb. Three species of Chærophyllum are described by Babington in his recent 'Manual of British Botany.' *C. temulum* has a rough stem swelling beneath the joints, the leaves bipinnate, the leaflets ovate, oblong, pinnatifid, with obtuse mucronate segments, glabrous petals, styles equalling the stylopode. It is a common plant on hedge-banks in Great Britain, attaining a height of three or four feet. *C. aureum* and *C. aromaticum* have been described as natives of Scotland, but it is very doubtful as to whether they have not both been introduced.

(Babington, *Manual of British Botany*; Lindley, *Flora Medica.*)

CHAIN RULE. This is the name given to a rule of arithmetic by which when a succession of equivalents is given, the last of each being of the same kind as the first of the next, a relation of equivalence is established between numbers of the first and last kind mentioned. Thus if 3 horses be worth 7 cows, and 10 cows be worth 39 sheep, and 2 sheep be worth 53 geese, it can be found how many geese are worth, say 11 horses, or how many horses are worth 1000 geese. Such questions, and the mode still adopted of solving them, are found in the Hindu Lilivati [P. C.], and in the earliest European books on arithmetic and algebra. They involve a *chain* of equivalents, each link of which is joined to the preceding and following one by the same names, and the first name of the first link is the same as the second name of the last; whence the name *chain-rule*. The process applies with great practical use to questions in the arbitration of exchanges.

The process is nothing but that of composition of ratios; but it may be simply exhibited thus:—Let it be that

3 horses are worth 7 cows
10 cows „ 39 sheep
2 sheep „ 53 geese,
How many geese „ 11 horses?

From the first, 3×10 horses are worth 7×10 cows, which from the second, are worth 7×39 sheep: hence $2 \times 3 \times 10$ horses are worth $2 \times 7 \times 39$ sheep or $53 \times 7 \times 39$ geese. Hence $2 \times 3 \times 10 \times 11$ horses are worth $53 \times 7 \times 39 \times 11$ geese, or 11 horses are worth $53 \times 7 \times 39 \times 11 \div 2 \times 3 \times 10$ geese. By such reasoning the following rule is established:—divide the product of the numbers in the column which has no vacancy by the product of the numbers in the column which has a vacancy for the unknown quantity, and the quotient is the number with which the vacancy is to be filled up.

It is obvious that any multiplier which exists in both columns may be struck out before commencing the process: this is the peculiar advantage of the rule, namely, that it points out at once all the simplifications which can be introduced by division.

The common rule of three, and various other rules, may be brought under the chain rule; but an attempt is sometimes made to reduce under it every question the answer to which is found by dividing one product by another. This has been done in all times, from that of the Lilivati to the present. For example, if 7 men can reap 3 acres in 10 days, how long will it take 13 men to reap 19 acres? The answer is found no doubt by dividing $7 \times 19 \times 10$ by 13×3; but if we attempt to put these down in the chain form we have

10 days 3 acres
19 acres 13 men
7 men ? days

Now even if we grant that 10 days are, in the first clause, an equivalent for (being the time of reaping) 3 acres, and that 19 acres are in the second clause an equivalent for (or the work of) 13 men: we still find it impossible to make out in what sense the 7 men of the first clause are an equivalent to the unknown number of days in the second. But in truth the 10 days in the first clause are not absolutely and independently the time of doing the 3 acres, but only on condition that 7 men are employed; while in the second clause the 13 men are only the reapers of 19 acres on the supposition of some one definite but unknown time being allowed. The question is not therefore of the same class as that which was first proposed, in which each quantity mentioned was absolutely and unconditionally an equivalent in value to one of the others.

CHALI'COMYS, a genus of rodent Mammalia, allied to the beaver, from Eppelsheim, in tertiary beds.

CHAMBERS, GEORGE. This excellent painter of shipping was the son of a poor seaman of Whitby in Yorkshire, where he was born towards the close of the last century. After he had attended for a short time the free-school of his native town, he was sent, at the age of ten years, to sea in a small trading sloop, in which he served as cabin-boy for two years. He was afterwards bound apprentice to the master of a brig which traded in the Mediterranean and the Baltic seas. During this apprenticeship he gave evidence of that talent for which he was subsequently distinguished, by making sketches of various descriptions of shipping, for the amusement and gratification of the seamen. His master, Mr. Storr, appears to have been induced by these efforts to cancel his indentures, and Chambers worked his way home to Whitby in another vessel, with the determination of becoming a painter of ships. At Whitby he knew no better way of making himself acquainted with colours than by apprenticing himself to an old woman who kept a painter's shop. But at the same time that he was plodding his way through the business of a house-painter, he took lessons from an obscure drawing-master of Whitby, of the name of Bird, and applied what time he had to spare in painting small pictures of shipping, for which he found, at his humble prices, a ready market. He carried on this life for three years, when, being anxious to visit London, he again entered the seafaring life, and worked his way as a foremast-man in a trading vessel to the great metropolis.

In London, though very poor, he refused an offer of employment as a journeyman house-painter at thirty shillings per week, being bent upon painting shipping; and he shortly contrived to obtain considerable employment in the representation of ships. Having obtained however an introduction to Mr. Horner, that gentleman employed him for seven years on the great panorama of London at the Colosseum. At the completion of this work he was engaged as scene-painter at the Pavilion Theatre. While at this theatre some of his works attracted the notice of Vice-Admiral Lord Mark Kerr, who became Chambers's sincere patron, and procured him an introduction to King William IV. and Queen Adelaide, who appointed him their marine painter. He was ordered to attend at Windsor Castle with his portfolio of drawings, and the following account of his interview with the sailor-king and his queen is given in a memoir of Chambers which was published at Whitby. He was first ushered to Sir Herbert Taylor, the king's private secretary, who eased his mind by telling him that no ceremonious formalities would be required of him, and then introduced him to their majesties. They looked over his sketches for a choice of subjects: the king chose a stormy scene, which the queen objected to as too dismal, when the sailor-king observed, 'in the blunt phraseology of an old commodore, "Oh ma'am, we sailors like those boisterous scenes the best—eh! Mr. Chambers?"' The king chose a sea-fight, and the queen chose a calm coast scene near Dover. Chambers painted also a view of Greenwich Hospital for the queen, and the Opening of New London Bridge for the king.

He was now reaping the fruits of his persevering industry; he had given up his appointment as scene-painter to the Pavilion Theatre, and he was in a fair way of establishing fame and fortune together; but a constitution originally very weak, and much shattered by a seafaring life, was unable to bear the incessant application his ambitious mind subjected it to; and at that great and trying crisis—the transition from indigence, obscurity, and slavery, to honour and affluence—his remaining strength gave way, and he gradually fell into a disease which proved fatal to him: he died of aneurism of the aorta, in October, 1840, leaving a wife and three children.

Chambers's pictures are now beginning to be valued by collectors, though few appreciated them during his life time. He was a member of the Society of Painters in Water-Colours, in which style he drew with great elegance and effect. His chief productions however are his naval battles in oil, in which he was excellent, especially in the construction and rigging of his ships, though in his colouring there is an unnatural redness of effect pervading everything, the smoke in particular. There are in the hall of Greenwich Hospital three battles by Chambers: The Bombardment of Algiers by the squadron led by Viscount Exmouth, G.C.B., in 1816, presented in 1836 by the admiral's friends; Portobello taken by Admiral Vernon and Commodore Brown in 1739, presented in 1839 by E. H. Locker, Esq., commissioner; and a copy of West's picture of the destruction of the French fleet in the port of La Hogue by Vice-Admiral Sir George Rooke, Kt., in 1692.

(*Art-Union Journal*, December, 1840; *Catalogue of the Naval Gallery of Greenwich Hospital.*)

CHAMISSO, ADELBERT VON, a distinguished poet, naturalist, and traveller, was born on the 27th of January, 1781, in the château of Boncourt in Champagne. He belonged to a very ancient noble family of Lorraine. Until the outbreak of the French revolution the family lived quietly on their estate, and Adelbert's brother Charles was one of the pages of Louis XVI., to whom he remained faithful to the last, and for whom he risked his life on several occasions. In 1790 the château Boncourt was rased to the ground, whereupon the family of the Chamissos quitted France; and after having wandered about in the Netherlands and the south of Germany, they ultimately went to Berlin, in 1796, where, together with other French emigrants, they took up their permanent residence. As they had lost all their property, the whole family lived upon the little income which two of the sons made by painting miniature portraits. Adelbert however was extremely fortunate; the queen of Prussia made him one of her pages, and took great care of his education, which he received in one of the gymnasiums of Berlin. He made himself thoroughly acquainted with the German language and literature, and the spirit which pervades all his own literary productions shows that he became so completely Germanized that the peculiarities of the German mind, which are most foreign to the French, were in him most prominent. In 1798 he entered the Prussian army, and his parents accepting the offer of Napoleon, then First Consul, returned to France. Shortly after this he began writing poetry in German, and from 1804 to 1806 he edited a 'Musen-almanach,' conjointly with Varnhagen von Ense. After the peace of Tilsit Chamisso quitted the Prussian service, and in 1810 he returned to France, where his family had recovered a great part of their property. For a short time he was teacher in a school at Napoléonville; but his personal feelings and the friendships he had formed in Germany drew him back to that country. He now devoted himself almost entirely to the study of the natural sciences. In 1813 he wrote for the amusement of the children of a friend a little book called 'Peter Schlemil,' containing the story of a man who loses his shadow. This amusing little work, which has been translated into English and most other European languages, was first published in Germany by Chamisso's friend de la Motte Fouqué (1814), which has led some persons to look upon it as the production of Fouqué. A second edition accompanied by some lyric poems and ballads was published by the author himself in 1827. In 1814 Count Rumjanzow, chancellor of the Russian empire, prepared an exploring expedition round the world at his own expense. He invited Chamisso to accompany the expedition as naturalist, and the invitation was gladly accepted. In 1815 Chamisso embarked at Cronstadt under Captain Kotzebue; and returned thither in 1818. One of the main objects of the expedition had been the discovery of a north-east passage, in which the expedition failed; but in all other respects the discoveries were highly satisfactory. An account of the voyage was published by Kotzebue in two volumes, and Chamisso himself published 'Bemerkungen und Ansichten auf einer Reise um die Welt,' Weimar, 1821, 4to., which forms an indispensable supplement to Kotzebue's work, and contains a most faithful account of everything that came within the range of his personal observation. After his return from this voyage Chamisso again took up his residence at Berlin; the university conferred upon him the degree of doctor in philosophy; he became a member of the Royal Academy of Sciences, and soon after he received the appointment of inspector of the botanical gardens of the same city. While in this situation he wrote a botanical work, 'Uebersicht der in Norddeutschland vorkommenden nützlichsten und schädlichsten Gewächse, nebst Ansichten über das Pflanzenreich und Pflanzenkunde,' Berlin, 1827. These subjects however did not estrange him from the cultivation of poetry; for during the last ten years of his life he produced a great number of small poems, many of which, especially his popular legends and ballads, belong to the best productions of the kind in German literature. He died on the 21st of August, 1838, at Berlin. His poems were collected and published separately, Leipzig, 1831, in 1 vol. 8vo, and a second edition appeared in 1834. A collection of all his works, both in prose and in verse, was published at Leipzig in 4 vols. 8vo, 1836, and a second edition in 1842 in 6 vols. 12mo, the two last of which contain Chamisso's life and correspondence edited by J. E. Hitzig.

CHAMOMILE. [ANTHEMIS NOBILIS, P. C. S.]

CHANCELLOR of a CHURCH, or a DIOCESE, or a CATHEDRAL. [CHANCELLOR, P. C.]

CHANCELLOR of the DUCHY of LANCASTER. [CHANCELLOR, P. C.]

CHANCELLORS of the UNIVERSITIES of OXFORD and CAMBRIDGE. [CHANCELLOR, P. C.]

CHANCELLOR of the EXCHEQUER. [CHANCELLOR, P. C.]

CHANNING, WILLIAM ELLERY, D.D., was the son of an eminent merchant of Newport, Rhode Island, United States; and the grandson, through his mother we suppose, of William Ellery, whose name appears with those of the other delegates to the Congress of 1776 among the signatures to the Declaration of Independence, and whose life was extended to the year 1820, when he died at the age of ninety-two. Ellery, it is stated, kept up the practice of reading every morning a chapter or two of the Greek New Testament till he was upwards of ninety; and his mental powers in general remained vigorous almost to the last—a circumstance which he used himself to attribute to his perseverance in regularly exercising them. Channing was born at Newport in 1780 or 1781. He was educated at Harvard College, and his first views are said to have been directed to the medical profession; but he was eventually induced by the lectures or advice of the Hollis professor of divinity to enter the ministry in the Unitarian communion, which however was scarcely as yet distinguished in the United States by that name, and at any rate was not separated in respect of doctrine from what is commonly called orthodox Christianity by so clear a line as now. Soon after taking his degree, probably about the end of the century, he went to Virginia, and spent some time there as a teacher. But in 1803 he was appointed to the office in which he remained for the rest of his life, that of pastor of the Federal Street congregation in Boston. At this time he was considered to lean to what are called evangelical views; and several of the neighbouring clergymen of other persuasions used occasionally to preach from his pulpit. His own preaching early drew attention by its superior polish and eloquence; but not, it would appear, to any remarkable degree till he had officiated for some years, when his theology assumed a more decided character, and his congregation, having considerably increased, built him a larger church, and gave him a colleague, the Rev. Mr. Gannett. What first brought him into general notice in his own country were several sermons which he published during the war of 1812. These were followed by a number of papers in the 'Christian Disciple,' the 'Christian Examiner,' and perhaps other Boston reviews or magazines. In England however Dr. Channing's name was not much heard of till after the appearance of his 'Remarks on the Character and Writings of John Milton,' originally published in the form of a review of the 'Treatise of Christian Doctrine' in the Christian Examiner for 1826. In the same publication for 1829 appeared his 'Remarks on the Life and Character of Napoleon Bonaparte,' as a review of Scott's Life of Napoleon. In 1830 a collection of Channing's writings was published in a royal 8vo. volume at Boston, under the title of 'Reviews, Discourses, and Miscellanies.' He continued to produce occasional tracts, discourses, and other writings during the remainder of his life, of which several subsequent collections were formed, both in America and in England; but the most complete we believe is that published at Glasgow, in 6 vols. 8vo., of which the first five were brought out in 1840, with the sanction and assistance of Dr. Channing himself, and the sixth in 1844 under the authority of his son Mr. W. F. Channing. The subjects principally treated of, besides those already mentioned, are war, temperance, public education, the church, and especially the abolition of negro slavery, of which measure Channing was one of the warmest advocates, though he belonged, we are told, to no anti-slavery society, and even doubted the wisdom of these associations. His death took place at Burlington, Vermont, 2nd October, 1842.

Channing is one of the most striking writers America has produced; and his works, besides their attractions of style, are all animated by a pure and lofty moral spirit. His eloquence however, though often imposing, has not much nature or real fire; its splendour is mostly verbal; the thoughts are true and just, rather than new or profound; it is exciting on a first perusal, but will hardly bear a second. Nothing that he has written therefore has much chance of long retaining its reputation: there is too little in it of the spirit of life; too little of anything that can be called its own, and that is not to be found elsewhere. Both in its rhetorical character however and in its strain of sentiment, it was well calculated to produce an immediate effect. In a brief notice of Dr. Channing in the 'Gentleman's Magazine' for December, 1842, to which we have been indebted for most of the few facts we have been able to give, but which is rather a eulogy than a memoir, it is stated that his elocution was peculiar, and his gravity and solemnity in the pulpit greater than that of the generality of preachers. In early life, though small in stature and of a light frame, he was considered an athletic young man; but his health suffered from exposure or neglect when he was in Virginia, and was never afterwards so robust as it had been.

(*Gentleman's Magazine*; Dr. Channing, *Works.*)

CHANTREY, SIR FRANCIS, was born on the 7th of April, 1782, at Norton, in Derbyshire, where his father was a farmer. Chantrey's father wished to make an attorney of him, but he preferred being an artist, and his predilection was for carving. He was accordingly bound for three years to a carver at Sheffield; but during the time of his apprenticeship he found that it was a style of work which did not suit him, as, in the situation in which he was placed, its sphere was too circumscribed to admit of any great display of ingenuity, or an adequate gratification of a true love for art. He therefore turned his attention to modelling in clay; and he tried his fortune as a modeller, first in Dublin, then in Edinburgh, and lastly in London: the reason probably of his trying London last was an impression that in the great capital he would have so many more able rivals to compete with, and that his chance of success there was comparatively hopeless. In London, Nollekens was greatly instrumental in promoting Chantrey's fortunes. The young sculptor (he was then four and twenty) sent a bust of J. R. Smith to the exhibition of the Royal Academy, which, in the disposition of the works for exhibition, attracted the admiration of Nollekens, who said:—'It is a splendid work; let the man be known: remove one of my busts, and put this in its place.' Nollekens himself did all that was in his power to make him known: he recommended Chantrey upon all occasions when a bust was required. Chantrey however, having once found the opportunity of making himself known, required thenceforth no other recommendation than his busts to ensure himself full employment in that department of art. In 1816 he was chosen an Associate, and in 1818 a Member, of the Royal Academy. In the following year, 1819, he paid his first visit to Italy, where he was elected a member of the academies of Rome and Florence.

In the career of a uniformly successful artist there are few incidents to record: Chantrey's career for the last twenty years of his life, as a monumental sculptor, was unrivalled; beyond this sphere however he did not range. He was knighted by the queen in 1837, at which period he was already a sufferer from disease of the heart, and from this time he finished few works himself: their completion was entrusted to his able assistant Mr. Weekes. Of his poetic works, which are not many, few were executed from his own designs: the statue of Lady Louisa Russell, daughter of the late duke of Bedford, at Woburn Abbey, and the Sleeping Children, in the Cathedral of Lichfield, his best sepulchral monument, were both executed from the designs of Stothard: the first is a child on tiptoe, pressing a dove to her bosom; the second is a monument to two children of the late W. Robinson, Esq. There are also in Woburn Abbey two reliefs from Homer by Chantrey—the Parting of Hector and Andromache, and Penelope with the bow of Ulysses; but they are calculated rather to detract from his reputation, or, in other words, are evidence that poetic art was beyond his sphere. They are engraved in plates xxix. and xxx. of the 'Outline Engravings and descriptions of the Woburn Abbey Marbles.' Dr. Waagen terms them stiff and styleless productions; and he speaks still more severely of the statue of Lady Louisa Russell.

As a monumental sculptor Chantrey will rank high: some of his statues in this branch of art are among the finest specimens of their class. One of his very best works is the bronze statue of William Pitt, in Hanover Square, London. There are also marble statues by him, in Westminster Abbey, of Francis Horner, Sir T. S. Raffles, George Canning, Rev. E. F. Sutton, and Sir John Malcolm. Among his principal works are also statues of Washington, in the state-house at Boston, United States; Spencer Percival, in All Saints' Church, Northampton; James Watt, in the church of Aston, near Birmingham; Sir Edward Hyde East and Bishop Heber, at Calcutta; Canning, in the town-hall of Liverpool; Mountstuart Elphinstone and Sir Charles Forbes, at Bombay; Dr. Ryder, bishop of Lichfield and Coventry, in Lichfield Cathedral; and Dr. Bathurst, bishop of Norwich, in Norwich Cathedral. His busts are extremely numerous; his sitters were a large proportion of the persons of rank and distinction of his time. He executed also some equestrian statues in bronze, but few, and they are not of the highest merit; their postures are formal and want vigour: the horses are particularly inanimate in the body and limbs. His last work of this class, the Wellington testimonial, now placed before the new Royal Exchange, London, was executed nearly entirely by Mr. Weekes.

Though deservedly eminent in his style, and certainly one of the best sculptors of his time, Chantrey cannot be reckoned among great sculptors; his busts display no extraordinary powers of expression or of modelling, and the best of his statues are but simple draped figures in repose, well proportioned and well planted on their legs; but they are not superior to similar works by many sculptors of less renown. Chantrey's personal appearance was an index, not of what was, but of what was not to be found in his works; he was rather stout, and his countenance was broad and chiefly remarkable for good humour and jovialty, indicative of little poetry or imagination, and less sentiment. Whenever he had a commission which involved more than portraiture, he is said to have habitually had recourse to some friend more familiar with such subjects, for the design. In the treatment of his portraits however he always disposed the unpicturesque costume of the present day with the greatest judgment and with the least possible injury to the proportions of the human figure he never left them stiff or stony, as they are on many of the statues in St. Paul's Cathedral, executed by some of Chantrey's contemporaries and immediate predecessors.

Chantrey had no children or very near relations, and he left the reversion of a portion of his property, at the death or second marriage of his wife, to the disposal, under certain restrictions, of the president and council of the Royal Academy of Arts in London, for the promotion of British Fine Art in painting and sculpture, including an annuity of 300*l.* for the president and of 50*l.* for the secretary, payable on the 1st of January in every year. The interest of the residue is to be laid out in the purchase of works of Fine Art of the highest merit in painting and sculpture that can be obtained, either already executed or which may hereafter be executed by artists of any nation, provided such artists shall have actually resided in Great Britain during the executing and completing of such works; it being his express direction that no work of art shall be purchased unless it shall have been executed within the shores of Great Britain: and further, that in making such purchases, the works of the highest merit shall be chosen, solely with regard to their intrinsic merit, and a liberal price be paid, wholly at the discretion of the president and council of the Royal Academy. The president and council however will not be obliged to lay out annually the whole or any part of the annual sum at their disposal, which may be allowed to accumulate for not more than five years. All purchases must be bonâ fide purchases of finished works. The will expressly provides against commissioning any artist whatever to execute works; and all purchases must be publicly exhibited for at least one month, at the annual exhibition of the Royal Academy or elsewhere.

All these purchases are to be collected for the purpose of forming and establishing a 'Public National Collection of British Fine Art in Painting and Sculpture,' executed within the shores of Great Britain. The will provides also against any expenditure of these funds in the erection of a building to contain permanently the works thus purchased; it having been Chantrey's expectation that such building would be provided by the nation free of all charge upon his estate. In case of the complete dissolution of the Royal Academy, the trustees of the estate are empowered by the will to petition parliament to carry out the same object. The property devoted by Sir Francis Chantrey to this purpose is his residuary personal estate, over and above the property bequeathed to his wife, and all legacies; but he expresses a wish that at the decease of his wife all the property bequeathed to her should be by her devoted to the same purpose. Lady Chantrey however, so long as she remains a widow, has a life-interest in this residuary personal estate: its amount is not publicly known, but it is said to be about 2500*l.* per annum; it is vested in five trustees, including the president and treasurer of the Royal Academy. Chantrey left to his friend and principal assistant Allan Cunningham 2000*l.*, and, in a codicil, a life-annuity of 100*l.*, and, in case of his death, to his widow. He left also to his assistant Henry Weekes, 1000*l.*; provided in both cases that they continued in their offices as assistants, until the completion of his unfinished works, or such as it was necessary to finish. Allan Cunningham however did not survive Chantrey an entire year: Chantrey died on the 25th of November, 1841; Cunningham died on the 5th of November, 1842. Chantrey and Cunningham were great friends, and when Chantrey was building his mausoleum, he said to the poet that he would make the vault large enough to contain him also: 'No,' said Allan Cunningham, 'I should not like, even when I am dead, to be so shut up. I would far rather rest where the daisies will grow over my head.'

Chantrey was buried in a vault constructed by himself in the church of his native place, Norton in Derbyshire, and he bequeathed 200*l.* per annum to the clergyman of the place, so long as his tomb shall last, to instruct ten poor boys, and to pay annually 10*l.* to five poor men, and to five poor widows or unmarried women, selected by the clergyman, and being of the parish of Norton; the residue to be reserved by the clergyman for his own use in consideration of his trouble.

(*Art-Union Journal*, 1842; *Catalogues of the Exhibitions of the Royal Academy*; Waagen, *Künstler und Kunstwerke in England*.)

CHAPMAN, GEORGE, the earliest English translator of Homer, and known also as a prolific writer of dramas, was born in the year 1557. His birth-place is uncertain. Some have supposed him to have been a native of Hertfordshire, in which county, at Hitching-hill, he is known to have for some time resided. Wood believes him to have been of a Kentish family. The same writer asserts that he studied at Oxford, and that, although eminent in classics, he neglected philosophy, a fact which has been referred to as accounting for his want of an academical degree. Coming to London, he entered the ranks of the professional authors, and became an esteemed member of the best literary society, associating with Spenser, with Daniel, and with Shakspere, who was six or seven years his junior. He was patronised by Sir Thomas Walsingham and his son, by Henry Prince of Wales, and by Somerset the royal favourite. The death of the prince, and the fall of the minion, may be supposed to have had an unfavourable influence on his position; and even before these events Chapman, with Ben Jonson and Marston, had narrowly escaped severe punishment for satirical reflections on the Scotch, contained in their comedy of 'Eastward Ho!' But, although the particulars of Chapman's history are little known, it is understood that he held some place about court; and there is no evidence of his having ever laboured under those pecuniary distresses which mark so painfully the biography of some of his literary contemporaries. His personal character, too, appears to have been both respectable and amiable. Jonson declared to Drummond that he loved Chapman; and Anthony Wood asserts him to have been 'a person of most reverend aspect, religious and temperate, qualities rarely meeting in a poet.' He attained to a ripe old age, and died in London on the 12th of May, 1634. He was buried in the church-yard of St. Giles-in-the-fields, where his friend Inigo Jones erected a monument to his memory.

Chapman's published writings were numerous. Among his non-dramatic productions, the most valuable, as well as ambitious, was his famous translation of Homer into English fourteen-syllable verse. Seven books of his Iliad appeared in 1598; twelve books appeared in folio about 1600; and, after the accession of King James in 1603, there was published in folio the complete translation: 'The Iliads of Homer, Prince of Poets, never before in any language truly translated, with a comment upon some of his chief places, done according to the Greek by George Chapman.' Of this work a reprint has recently appeared, with introduction and notes, by Dr. W. Cooke Taylor, London, 1843, 2 vols. 12mo. The Odyssey, similarly translated, appeared in 1614, and was followed in the same year by the 'Battle of the Frogs and Mice,' and the Homeric Hymns and Epigrams. The following were Chapman's other non-dramatic works, original and translated:—1, 'The Shadow of Night, containing two Poeticall Hymnes,' 1594, 4to. 2, 'Ovid's Banquet of Sence,' 1595, 4to. 3, 'Hero and Leander, begun by Ch. Marlow, and finished by George Chapman,' 1606, 4to. 4, 'Euthymia Raptus, or the Tears of Peace,' 1609, 4to. 5, 'An Epicede, or Funeral Song, on the most disastrous Death of the High-born Prince of Men, Henry Prince of Wales,' 1612, 4to. 6, 'Andromeda Liberata, or the Nuptialls of Perseus and Andromeda,' 1614, 4to. 7, 'The Georgicks of Hesiod, by George Chapman, translated elaborately out of the Greek,' 1618, 4to. 8, 'Pro Vere Autumni Lacrymæ, to the Memorie of Sir Horatio Vere,' 1622, 4to. 9, 'A Justification of a strange action of Nero, &c.; also a Just Reproof of a Roman Smell-Feast, being the Fifth Satyre of Juvenall,' 1629, 4to.

The following are the titles of Chapman's plays, with the dates of their printing:—1, 'The Blind Beggar of Alexandria,' a comedy, 1598. 2, 'An Humourous Day's Mirth,' a comedy, 1599. 3, 'All Fools,' a comedy; and 4, 'Eastward Ho,' a comedy, 1605 (by Chapman, Jonson, and Marston); both reprinted in Dodsley's collection. 5, 'The Gentleman Usher,' a comedy, 1606; 6, 'Monsieur d'Olive,' a comedy, 1606; and 7, 'Bussy d'Ambois,' a tragedy, 1607; all the three reprinted in Dilke's Old English Plays. 8, 'Cæsar and Pompey,' a tragedy, 1607. 9, and 10, 'The Conspiracy and Tragedy of Byron,' two tragedies, 1608. 11, 'May Day,' a comedy, 1611; reprinted in Dilke's collection. 12. 'The Widow's Tears,' a comedy, 1612; reprinted in Dodsley's collection. 13, 'The Revenge of Bussy d'Ambois,' a tragedy, 1613, in Dilke's collection. 14, 'The Masque of the Inns of Court,' 1613. 15, 'Two Wise Men and all the rest Fools,' a comedy, 1619. 16, 'The Tragedy of Alphonsus, Emperor of Germany,' 1654. 17, 'Revenge for Honour,' a tragedy, 1654. 18 and 19, 'The Ball,' a comedy, and 'Chabot, Admiral of France,' a tragedy, both printed in 1639 as works of Chapman and Shirley, and reprinted in the modern edition of Shirley's works by Gifford, who pronounces Chapman to have plainly had the principal share in their composition.

Among the many speculations as to the authorship of the drama called 'The Two Noble Kinsmen,' in which Shakspere has been asserted to have assisted Fletcher, Mr. Knight, in his editions of the great poet's works, has conjectured that the parts attributed to him may really have been composed by Chapman.

Chapman's dramas, although works of much significance in the history of our old literature, are not the most valuable of his works. They are among the many productions of his time which were written by men tempted, through the fashion of the day, into a walk of composition for which they were but indifferently qualified. In comedy, which had been formed into a native school more completely than tragedy, Chapman adapts himself readily, and not without success, to the teaching of his juniors, especially Jonson and Fletcher; while he gives to the tone of his works not unfrequently an elevation of thought and a fulness of descriptive imagery which make some amends for the pervading stiffness of his portraiture of character and the forced and artificial turn of his incidents. In his tragic dramas he is, in point of plan and form, a semi-classic. He attempts at once to gratify the taste of his age and nation for the direct and vivid representation of dramatic horrors, and to maintain that tone of narrative declamation and of didactic reflection which Seneca had taught him, and to which his cast of mind made him naturally prone. The latter part of his 'Byron' is, as we venture to think, the best of his tragedies, and might better have deserved reprinting than the extravagant 'Bussy D'Ambois.' But Chapman's memory is best preserved, and his reputation as a poetical imaginer and thinker most fully vindicated, by his free translations from the Greek, and especially by his spirited and vigorous version of the Iliad. The late republication of this fine old poem is a judicious tribute to the improved taste of our time in poetical literature. His Iliad, like his plays, is deformed by many faults. It is as unequal as careless. Indeed, he himself, on completing the work, rewrote the first book entirely, and altered very much the other eleven that had previously been published. But his patience was not sufficient, either for correcting adequately what he had already written, or for carrying him carefully through the remainder of his task: the last twelve books were translated by him in less than fifteen weeks. And again, indolence and strong imagination concurred in tempting him to desert, in many places, the sense of his author, and to paint elaborately pictures for which Homer hardly gave him even the sketch. Yet for vigour of fancy, for a loose kind of faithfulness to the spirit of the original, for constant strength and frequent felicity of diction, the work is one of the finest poems which our language possesses. When Pope, who carefully read it, described it as a work which Homer might have written before arriving at years of discretion, his fastidious taste led him to do the old poet less justice than that which had been rendered by Waller, who confessed that he could never read Chapman's Iliad without a degree of rapture.

CHARGE, RENT. [RENT, P. C., p. 394.]

CHARI'SIUS, AURE'LIUS ARCA'DIUS, a Roman jurist, who is supposed to have lived about the time of Constantine the Great. It is certain that he lived at least after Modestinus, whom he quotes. Modestinus lived under the Emperor Alexander Severus (A.D. 222—235). Charisius was Magister Libellorum Supplicum, a keeper of petitions, as we learn from the title of an excerpt from his own writings. (*Dig.* 1, tit. 11.) He wrote a work, in one book, 'De Testibus;' a work, in one book, 'De Officio Praefecto Praetorio;' and a work, in one book, 'De Muneribus Civilibus' (*Index Florentinus*).

His writings contain some words that are perhaps not used by the earlier jurists, as 'regimenta,' 'incunctabile.' (*Dig.* 22, tit. 5, s. 21.) His style and the words that he uses clearly show him to be one of the latest of the Roman jurists. Cujacius says that Charisius was a Christian; but the proof is not given.

There are a few excerpts from the three works of Charisius in the *Digest*. [JUSTINIAN'S LEGISLATION, P. C.]

CHARLES X., King of France (CHARLES PHILIPPE, Comte d'Artois), born at Versailles, in October, 1757, was the youngest son of the Dauphin, grandson of Louis XV., and brother of Louis XVI. His title, as a junior member of the Royal family, was Comte d'Artois. The Duke de la Vauguyon was appointed tutor to him, as well as to his brothers, and he selected for their teachers several bishops and abbés.

Charles married, in the year 1773, Maria Theresa of Savoy, sister to the wife of his brother, afterwards Louis XVIII. His youth was dissipated and stormy, and he fought a duel with the Duke of Bourbon in consequence of a quarrel between them at the opera. When the disturbances which preceded the Revolution began, the Count d'Artois showed himself from the first opposed to concession, and he remained consistent in his opposition throughout the whole period of the Revolution, whilst his brother Louis, Count of Provence, afterwards Louis XVIII., seemed to court popularity, and took pains to please the Constitutional party. Charles was one of the first to emigrate: he left France in July, 1789, after the first popular insurrection and the destruction of the Bastille. He repaired to Turin, and from thence went to Vienna, and lastly to Pilnitz, where he attended the first congress of princes assembled to oppose the French revolution. After Louis XVI. had accepted the constitution in 1791, he invited the Count d'Artois to return to France, which he, in concert with his brother the Count of Provence, who had now joined him at Coblenz, refused to do, and they gave their reasons in a kind of manifesto. In consequence of this, the Legislative Assembly stopped his allowance on the civil list, and ordered the seizure of his property, in May, 1792. The war having broken out, the Count d'Artois assumed the command of a body of emigrants, who acted in concert with the Prussian and Austrian armies on the Rhine. After the execution of Louis XVI. the Count d'Artois repaired to Russia, where he received fair promises from Catherine, but no efficient assistance. He then made an attempt on the coast of Britanny, but soon after returned to England, and went to reside in Edinburgh, where he remained some years. In 1809 he rejoined his brother, who had assumed the title of Louis XVIII., at Hartwell. In 1814 he went to Germany to wait for the events. After Napoleon's abdication, he entered France with the title of Lieutenant-General of the Kingdom, and issued a proclamation to the French, in which he promised liberty and order, the reign of the law, the abolition of the conscription, and of the 'droits réunis,' and an entire forgetfulness of the past. He entered Paris on the 12th of April, 1814, attended by a body of national guards. The Senate acknowledged his authority, in expectation of the arrival of Louis XVIII. He told the Senate that his brother was determined to reign as a constitutional king, with two chambers, and to grant individual liberty and the liberty of the press. When Louis XVIII. arrived in Paris, the Count d'Artois, whose title was now that of 'Monsieur,' was made Colonel-General of the National Guards. In March, 1815, he was obliged to leave France with the king, in consequence of Bonaparte's return from Elba, but he went back after the battle of Waterloo. In February, 1820, he lost his second son, the Duke of Berry, in whom the hopes of the family were centred, by the hand of a fanatical assassin. His elder son, the Duke of Angoulême, who had married his cousin, the daughter of Louis XVI., was childless. The Duke de Berry left only one daughter, but several months after his death his widow was delivered of a son, who is the present Duke of Bordeaux.

Louis XVIII. died the 16th of September, 1824, and Charles X. was proclaimed king. On the 27th he made his entrance into Paris in the midst of acclamations. One of his first acts was an ordinance abolishing the censorship of the newspapers and other periodicals, which had been re-established by an ordinance of his predecessor in the previous month of August. This threw over him a momentary gleam of popularity, but there was a strong party, or rather a combination of parties, which disliked and mistrusted him from the first, and which in fact had all along looked upon the restoration of the Bourbon dynasty as a mere state of transition. All parties in France were acting at that time, and some of their more plain-speaking organs have since justly styled the period of the restoration as a 'fifteen years' comedy,' a comedy which however terminated in a tragedy. In April, 1825, a project of a law, or bill, was laid by ministers before the Chambers, against the guilt of sacrilege, awarding the penalty of death for the profanation of the consecrated host, and other severe penalties for the profanation of the sacred utensils, of churches, &c. The law was passed, but it had a bad effect on public opinion. By another law an annual sum of thirty millions of francs was charged on the national debt, to be distributed as an indemnity among the emigrants whose property had been confiscated. In April, 1826, a declaration signed by most of the archbishops and bishops of France was presented to the king, denouncing all attempts to subject the temporal authority of kings to the papal power, a principle always reprobated by the Gallican Church. In 1827 a law was passed against the slave-trade, which contained, against those engaged in it, the penalties of banishment, fines, and confiscation. In the same session a bill was presented by ministers concerning the 'police of the press,' by which no pamphlet of less than 21 sheets could be sold until five days after the prescribed copies had been deposited before the proper authorities. Editors of periodical papers were to declare the names of all the proprietors of the papers, and give security to a heavy amount. Under the third head of the bill, severe penalties were inflicted for offences of the press against the person of the king, the royal dignity, the religion of the state, and other communions acknowledged by the state, foreign sovereigns and princes, the courts of justice, &c. After a warm debate, ministers thought proper to withdraw their bill. This created a lively sensation in Paris. Soon after, at a grand review of the national guards, Charles X. was saluted by cries from the ranks, of 'Down with the Ministers,' 'Down with the Jesuits.' The king looking on some of the most clamorous, told them firmly, 'I am come here to receive homage, and not lessons.' He then disbanded the national guards. In June of that year the previous censorship of journals and other periodicals was re-established by an ordinance. In November the king dissolved the House of Deputies, and directed new elections to be proceeded with. He then took off again the censorship of the journals. By another ordinance he created seventy-six new peers. In January, 1828, a new ministry was formed. MM. Villele, Peyronnet, Corbière, &c. gave in their resignations, and were succeeded by Viscount Martignac, and Counts de la Ferronnays, Portalis, and others. This change was considered as a sort of concession to liberal principles. A commission was appointed, at the suggestion of the new ministry, to frame a project of municipal administration for all France. Another commission was formed to inquire into the discipline and method of education which prevailed in the 'petits Séminaires,' or colleges for clerical students, which were said to have fallen under the direction of disguised Jesuits, as the Society of the Jesuits was not authorised by the laws of France. For years past, this real or pretended fear of the Jesuits had become a favourite topic of declamation for the organs of the opposition. The political importance of the Jesuits was ludicrously exaggerated; many people, who really knew nothing about the Jesuits, fancied these mysterious beings to be lurking everywhere—about the court, in every college, in every department of the state: 'Down with the Jesuits' was the rallying cry of the day, as 'Down with the aristocrats' in the first Revolution.

The king's speech at the opening of the session of 1828 was conciliatory. A law was passed in the Chambers concerning newspapers and other periodicals, fixing the amount of security to be given by the proprietors, and enacting other regulations for the police of the press. The commission on the clerical seminaries having made its report, stating that seven or eight of those establishments were actually under the direction of members of the Society of Jesuits, the king issued an ordinance placing the establishments thus specified under the jurisdiction of the University, and ordering that in future no director or teacher should be admitted in any clerical seminary, unless he declared in writing that he did not belong to any of the religious congregations not legally established in France.

In 1829 an elaborate project of a new municipal law was laid before the Chambers by the Martignac ministry. Under Napoleon the communal or municipal councils were no longer elective; the emperor and the prefects appointed to all municipal offices, and the financial administration of the communes was regulated at Paris. It was a system of despotism extending to the smallest details. The ministers of Charles X. proposed to apply the elective system with a property qualification to the formation of the municipal councils, and to restore to them the administration of their local interests, their decisions however being subject to the sanction of the prefect. This was no small boon in favour of municipal liberty, but party spirit rejected it. The so-called liberals thought that it did not go far enough, the exclusive royalists that it went too far, and between them the bill was strangled, and ministers withdrew it. This was a fatal blow to the Martignac administration; it alienated the mind of the king, and made him resolve upon trying a ministry of decided royalists. This new ministry was appointed in August, 1829, after the Chambers had been prorogued. It consisted of Prince Polignac, MM. Montbel, Haussez, La Bourdonnaye, Guernon Rainville, and others. As soon as the new appointments were known, a loud outcry was set up by the newspapers, who seemed determined that the king should dismiss the obnoxious ministers. Associations were formed with the object of refusing to pay the taxes. Prosecutions were instituted by the king's attorneys against the more violent journals, but in several instances the courts acquitted the accused. Meantime the country was thriving, the new ministers were effecting retrenchments, and proposing a corresponding reduction of taxation.

On the 2nd of March, 1830, Charles X. opened the Chambers. He spoke of his friendly relations with the foreign powers, of the final emancipation of Greece, of the intended expedition against Algiers, and he lastly expressed his firm resolve to transmit to his successors the unimpaired rights of the crown, which, he said, constituted the best safeguard of the public liberties secured by the Charter. In reply to this speech, the address voted in the Chamber of Deputies, by a majority of forty, told the king plainly that his ministers had not the confidence of the representatives of the nation. The deputies who voted this address were 221 in number. The king, on receiving the address, said that he had a right to expect the support of both the Chambers, in order to fulfil all the good which he intended, but that his heart was grieved to find that the deputies of the departments declared that, on their part, this support did not exist. His resolutions however were immoveable. His ministers would let them know his intentions. The next day, the 19th of March, the Chamber was prorogued to the 1st of September, and some time after a dissolution was proclaimed, and new elections were made. During the spring incendiary fires broke out in Normandy and other provinces, and the sufferers were mostly small farmers and cottagers. Among those who were seized as guilty of incendiarism, the majority were women. Suspicions and mutual accusations were bandied about from one political party to the other concerning these fires, but no clue was obtained as to the real instigators. The new elections increased the opposition majority to nearly two-thirds of the number of deputies. Meantime news arrived of the conquest of Algiers; but the tidings were received surlily by the opposition. Every act of the ministry was reprobated. This state of things could not last. The king called together a council of ministers, in which it was resolved to give an extended interpretation to article 14 of the Charter, which gave the king the power 'of providing by ordinances for the safety of the state, and for the repression of any attempt against the dignity of the crown.' An ably written report was drawn up by the ministers and laid before the king, to serve as a preamble to the forthcoming ordinances. It dwelt especially on the factious spirit of the newspapers, which kept the public mind in a feverish state, without any plausible cause, and prejudiced it against the king's servants, not for any thing that they had done, but for what it insinuated that they might do. On the 25th of July the king issued several ordinances countersigned by his ministers. The first ordinance suspended the liberty of the periodical press. No journal or periodical was to be allowed to appear without the royal permission. No pamphlet of less than twenty sheets was to be published without the permission of the secretary of state for the Home department, or of the local prefect. Ordinance 2 dissolved the newly elected House of Deputies, which had not yet assembled. Ordinance 3 altered the system of election, reduced the number of the deputies from 430 to 258, and placed the new elections under the direct influence of the prefects. This last ordinance was decidedly an infraction of the constitution or Charter, for the king had no right to alter the law of election. The sequel is well known. Most of the editors of newspapers signed an energetic protest against the ordinances, and continued to publish as before, and the tribunal of first instance, and the tribunal of commerce, authorized them to do so. Then came the protest of a number of deputies, denouncing the ordinances as illegal, and proclaiming popular insurrection as a duty. Several master manufacturers turned out their men, and shut up their factories; and a mass of people took up arms. Meantime Charles remained quietly at St. Cloud, and merely sent Marshal Marmont to take the command of the garrison of the capital, which consisted of about 10,000 men, one-half of whom could not be depended upon. On the 27th of July the first encounter took place between the troops and the people. Next day an ordinance declared Paris to be in a state of siege, or in other words, under martial law. The fighting in the streets became more general. Many of the national guards joined the people, who hoisted the tri-coloured flag, in opposition to the white flag of the Bourbons. The Hôtel de Ville was taken and retaken. On the 29th the people attacked the Louvre and the Tuileries, the regiments of the line abandoned their post, and Marmont with the guards evacuated Paris. On the 30th a number of deputies and peers proclaimed the Duke of Orleans lieutenant-general of the kingdom, and Charles X. confirmed his nomination on the 1st of August. On the 2nd of August Charles X. abdicated the crown in favour of the Duke of Bordeaux, and set out for Cherbourg. The Chambers however would not recognise the claims of the Duke of Bordeaux, and elected the Duke of Orleans. From Cherbourg Charles X. sailed for England, and finally took up his residence at Holyrood House. He afterwards removed to Prague in Bohemia, where the Emperor of Austria gave him the use of the royal palace. In the autumn of 1836 he removed to Goritz in Styria, for the sake of a milder climate. He there rented the 'château' or mansion of Gräfenberg, but, soon after his arrival, he fell ill of the cholera, and died on the 6th of October, 1836. He died resigned and at peace with all the world. His body was embalmed and buried in the vaults of the Franciscan Convent of Goritz. His son, the Duke of Angoulême, who, as well as his grandson, the Duke of Bordeaux, had attended him in his last moments, did not assume the royal title, but went by the name of Count de Marnes. The Duke of Angoulême died at Goritz, in June, 1843. [FERDINAND VII., P. C.] The Duke of Bordeaux is now the only remaining male representative of the elder branch of the Bourbons.

(Capefigue, *Histoire de la Restauration*; Lesur, *Annuaire Historique* for 1824-30; Montbel, *Dernière Epoque de l'Histoire de Charles X.*)

CHARLES XIV. of Sweden, **CARL XIV. JOHAN** (JEAN BAPTISTE JULES BERNADOTTE), born at Pau in the Béarn, in January, 1764, was the second son of a lawyer of that town. He was educated in his paternal home till the age of seventeen, when one day he left it abruptly and enlisted as a volunteer in the regiment royal marine, in 1780. His first service was in the island of Corsica, where he remained two years. On his return to France, he rose gradually through his own good conduct to the rank of adjutant. He was doing garrison duty at Marseille in 1790, when the revolution began. Bernadotte had the good fortune to save his colonel, the Marquis d'Ambert, from the popular fury which was then excited against the nobles. Bernadotte was next promoted into the regiment of Anjou, and as the royalist officers emigrated in crowds, promotion became rapid for those who remained under their colours. Bernadotte was soon made a colonel, and when the war broke out against Austria and Prussia, he was sent to the army of the Rhine under General Custine, where he distinguished himself, was made chief of brigade, and afterwards became general of division in the army of Sambre et Meuse, under Kleber and Jourdan. He served in the well-contested campaigns of 1795-96, against the Austrian Generals Clairfait, Kray, and the Archduke Charles. At the beginning of 1797, he was ordered by the Directory to march with 20,000 men from the Rhine to Italy, to reinforce General Bonaparte. Bernadotte, after his first interview with Bonaparte, told some friends who were anxious to hear what he thought of the far-famed General of the Army of Italy: 'I have seen a young man of six or seven and twenty, who assumes the tone of a man of fifty, and this in my opinion bodes no good to the republic.' There might be mutual regard, but there was no sympathy between the two men. Bernadotte commanded the advanced guard in the campaign of 1797, and distinguished himself at the passage of the Tagliamento, and in the invasion of Carniola. After the preliminaries of peace were signed at Leoben, Bonaparte returned to Milan and left Bernadotte in command of the advanced posts in the Venetian province of Friuli. Bernadotte knew that one of the secret conditions of the peace which was then being negotiated, was the transfer of the Venetian territories to Austria, and when the democrats of Udine wanted to make a public display of their sentiments, he checked their useless ardour, and advised them to await quietly for the events. He received afterwards the thanks of the States of Friuli for his humanity and kindness towards the inhabitants of that country.

During the negotiations for the definitive peace, Bonaparte sent Bernadotte to Paris to present to the Directory the standards taken from the Austrians. On his return to head-quarters, in October, 1797, Bonaparte interrogated him concerning the disposition of the various parties towards himself. Bernadotte told him frankly that he must not depend upon any party, that the Directory were suspicious of him, that he could not expect any reinforcements in case of a new campaign against Austria, and that the wisest thing that he could do was to hasten to conclude peace with the emperor. Four days afterwards, Bonaparte signed the treaty of Campo-formio.

On leaving Italy, Bonaparte took away from Bernadotte one-half of the troops which he had brought with him from the Rhine, and ordered them back to France. Bernadotte, offended at this, requested of the Directory a command in the colonies, or if not to accept his resignation. The Directory appointed him ambassador at Vienna.

In his embassy at Vienna, Bernadotte assumed a conciliatory and temperate tone, so as not to wound the susceptibility of a court and nation as yet unaccustomed to republican forwardness. He made no outward display of the tri-coloured flag and cockade. This temperance being reported to the rulers at Paris, accompanied with insinuations about the ambassador's motives, the Directory ordered him to hoist the tri-coloured flag above the entrance of his hotel. This was done on the 13th of April, 1798, and the consequence was that a mob was gathered in front, clamouring against the offensive display. The rioters forced their way into the hotel and pulled down the flag. A servant of the embassy fired a pistol and wounded one of the people. This increased the fury of the rioters, who began to destroy the furniture of the apartments, when the military interfered and prevented further mischief. Bernadotte after this left Vienna, but after some diplomatic explanations the affair was hushed up. In the following August, 1798, Bernadotte married at Paris a younger sister of Joseph Bonaparte's wife, of the name of Clary. In the following year he was appointed Minister-at-War, at a time when the French armies were discouraged by reverses, and were in a state of great destitution. He exerted himself to re-establish confidence and discipline, and to protect the French frontiers, which were threatened by the allies. He furnished Massena with the means of resuming offensive operations, which led to the defeat of the Russians at Zürich. By one of those intrigues so frequent in the councils of the French Directory, Bernadotte was recalled from the war ministry; and he was living unemployed at Paris when Bonaparte arrived from Egypt. Bonaparte tried to cajole him into an acquiescence with his views previous to the revolution of Brumaire. Bernadotte however firmly refused to join him in upsetting the constitution of the republic, and would have opposed him by force, had the Directory so ordered him. A military man, he remained strictly within the line of military duty. Bonaparte knew this; and having become first consul, he gave Bernadotte the command of the army of the West, for the purpose of pacifying La Vendée and the other disturbed districts. After Napoleon's assumption of the empire, he made Bernadotte a marshal, and sent him, in 1804, to command the army which was stationed in Hanover. He there put a stop to the irregularities and arbitrary acts which had taken place in consequence of the military occupation, and contrived to provide for the wants of his soldiers without distressing the inhabitants. This was the beginning of the good reputation which he acquired in North Germany, and which afterwards contributed materially to raise him to the throne of Sweden. In 1805 Marshal Bernadotte left Hanover with his corps to join Napoleon's army against Austria. He was present at the battle of Austerlitz, where he broke through the centre of the Russians. In June, 1806, Napoleon created Bernadotte Prince of Pontecorvo, which he designated as 'an immediate fief of the imperial crown.' In the war against Prussia Bernadotte commanded the first corps. He had some altercation with Davoust about precedence, on the eve of the battle of Jena; he afterwards defeated the Prussians at Halle, and pursued Blücher as far as Lübeck, where he defeated him. He fought afterwards against the Russians, and was wounded just before the battle of Friedland. After the peace of Tilsit, Napoleon appointed him Commander-in-Chief in North Germany, from Embden to Lübeck, with orders to take possession of the Hanseatic towns; to exclude the English trade entirely all along that line, and to induce Denmark to make common cause with France. The English expedition against Copenhagen deranged, in part, Bonaparte's calculations. In March, 1808, Napoleon ordered Bernadotte to march into Denmark, and to invade Sweden in concert with the Danes, by passing over the ice. But the Danes were slow, the thaw came, the English cruizers appeared again in the Sound, and Bernadotte remained in Denmark. Part of the troops under him consisted of two Spanish divisions, one of which, under the Marquis la Romana, was stationed in the island of Fünen. The marquis, having learnt the invasion of Spain by the French, embarked his men on board the English fleet, and Bernadotte had just time to prevent the other division from following their example. In April, 1809, Bernadotte was ordered to join the army on the Danube, for the war against Austria. He took the command of the ninth corps, chiefly composed of Saxon troops. At the battle of Wagram, 5th of July, whilst opposed to the principal body of the Austrian army, he was deprived by Napoleon of his reserve division, which received another destination. The consequence was that he was obliged to fall back and evacuate the village of Deutsch Wagram. The following morning he expostulated in very strong words with Napoleon, on the order which had deprived him of his reserve, and exposed him to be crushed by superior forces. The battle was resumed, and, after another desperate contest and a fearful loss, was gained by the French. Bernadotte's corps alone lost six thousand men. An armistice being concluded, the marshal demanded his retirement and obtained it. Having returned to Paris, about the time when the English landed at Flushing, the minister of the interior and the minister-at-war urged Bernadotte to take the command of the troops hastily collected to oppose the enemy and protect Antwerp. He did so, but Napoleon soon after took away his command from him, and replaced him by Marshal Bessières. He was, or pretended to be, offended at some sentence of a proclamation which Bernadotte had addressed to his soldiers. The marshal was nettled, but the minister-at-war sent him back to the army at Vienna. There he had again a warm explanation with Napoleon, who reproached him with having granted an armistice to the Swedes. 'Why!' replied Bernadotte; 'the Swedes and the Poles are the only two nations in Europe that retain still some affection for your majesty.' 'What sentiment do the French feel for me, then?' asked Napoleon with bitterness. 'That of admiration, Sire, due to your astonishing success.' Napoleon seemed appeased. When he set out to return to Paris, he left Bernadotte in command at Vienna, till the ratification of the treaty of peace with Austria. At the beginning of 1810 Napoleon offered him the government-general of the Roman States. Bernadotte hesitated, but at last accepted, and began making his preparations.

Meantime important events had taken place in the North, in which Bernadotte was to act an unexpected part. Gustavus IV., King of Sweden, had been obliged to abdicate the crown in March, 1809, on account of his incapacity; and the States of Sweden had declared him and his descendants excluded for ever from the throne. His uncle, the Duke of Sudermania, assumed the government under the title of Charles XIII. Being childless, the States chose for prince royal and heir to the throne, Augustus of Holstein Augustenburg, brother of the reigning Prince of Augustenburg. But in less than a year Prince Augustus died suddenly, whilst reviewing some troops at Helsinborg, 26th of May, 1810. It was necessary to choose another heir to the crown of Sweden. Several candidates presented themselves; the brother of the deceased prince, and the King of Denmark, among others; but none of them seemed to suit the circumstances of Sweden. Sweden required a man of firmness, a good administrator, and of tried military abilities. Bernadotte had displayed all these qualities during his command in North Germany in 1808 and 1809. The people of Hamburg and the other Hanseatic towns spoke highly of his justice and moderation. He had behaved with kind regard towards the Swedish prisoners of war, and had readily granted an armistice on the first application of the Duke of Sudermania, afterwards Charles XIII., who on the present occasion cast his eyes upon him, and proposed to the Swedish Diet assembled at Oérebro in August, 1810, Marshal Bernadotte, Prince of Pontecorvo, as Prince Royal of Sweden. 'His majesty,' said the message, 'having consulted the Secret Committee, as well as the Council of State, on this important question, has met with a great majority in the first and a unanimity in the second of these bodies in favour of his proposal. The Prince of Pontecorvo being once entrusted with the future destinies of Sweden, his established military reputation, whilst ensuring the independence of the kingdom, will make him avoid useless wars for the mere sake of renown; his mature experience and energy of character will maintain order in the interior; and the love of justice and humanity which he has exhibited in hostile countries are a guarantee of his conduct towards the country which should adopt him; and lastly, the existence of his son will put an end to any further uncertainty concerning the succession to the crown.' Two Swedish officers had been sent to Paris to sound Bernadotte on the subject of his election. Bernadotte asked the Emperor Napoleon, who told him, that if he were elected by the free choice of the Swedes he (the emperor) would consent to his accepting the crown. 'I cannot assist you however in this,' added Napoleon, 'but let things take their own course.' It being rumoured however that the French minister at Stockholm supported the claims of the King of Denmark, Bernadotte frankly told Napoleon of this, who seemed to disbelieve it, and soon after recalled his minister. The Emperor Alexander, on his part, did not oppose Bernadotte's election, but rather approved of it. On the 21st of August, 1810, the Diet voted unanimously, and in the midst of acclamations, Jean Baptiste Jules Bernadotte, Prince of Pontecorvo, to be Prince Royal of Sweden and heir to the throne, on condition of his adopting the communion of Augsburg. Charles XIII., at the same time, formally adopted him as his son. A Swedish envoy carried these documents to Paris, with letters from the king to the new-elected prince and to the Emperor Napoleon, who both answered in the affirmative. Bernadotte however could not leave France without having received letters of emancipation, relieving him from his allegiance to the emperor. After waiting a month, Bernadotte complained to Napoleon of the delay, when the latter told him, that by a decision of his Secret Council, the letters of emancipation should only be delivered to him after he had signed an engagement never to wage war against France. Bernadotte said to him, with some warmth, that the condition was impossible; that by the very act of his election he was precluded from entering into any engagement towards a power foreign to Sweden, and that nothing remained for him but to renounce the proffered dignity. Napoleon mused for a moment, then said, hurriedly, 'Well, go! let our destinies be accomplished.' He then reverted to the continental system, and said that Sweden must conform itself to it. Bernadotte observed, that he must have time to examine things on the spot, to make out the feelings of the Swedes, and make himself acquainted with their interests. 'How long do you require?' cried out Napoleon. 'Till next May,' said the prince. This was at the beginning of October. 'I grant you this delay,' replied Napoleon; 'but then declare yourself, either friend or enemy.' Bernadotte hastened to leave France, but did not think himself safe until he had crossed the Sound. The day of his departure from Paris, Napoleon told Duroc that he wished that Bernadotte had refused; but that Bernadotte did not like him; that they had never understood one another: and that it was now too late.

The Prince Royal was met at Elsinor by several Swedish high dignitaries, and the Archbishop of Upsal among the rest. He told that prelate that he had been in his youth instructed in the reformed religion, which was professed by many in his native Béarn, that he had since conversed in Germany with protestant clergymen on religious subjects, and that he now declared that he believed in the doctrine contained in the Confession of Augsburg, such as it was presented by the Princes and States of Germany to the Emperor Charles V. On the 20th of October he landed at Helsinborg, and he entered Stockholm on the 2nd of November, amidst the salutes of the artillery. On the 5th he attended the Assembly of the States, in which Charles XIII. presided. He addressed the King and the States in succession, declaring his intention to live entirely for the good of his adopted country. 'Brought up in the camp,' he thus concluded, 'I have been familiar with war, and am acquainted with all its calamities; no conquest can console a country for the blood of its children shed in a foreign land. Peace is the only glorious object of a wise and enlightened government. It is not the extent of a country, but its laws, its commerce, its industry, and above all its national spirit, that constitute its strength. Sweden has of late experienced great losses, but the honour of the Swedish name remains unscathed. We have still a land sufficient for our wants and iron to defend ourselves.' Two days after, dispatches came from Napoleon, demanding in the most imperious tone that Sweden should declare immediately war against England. The winter was setting in, precluding all hopes of assistance from England in case of an attack by the French troops through Denmark. In this emergency the King declared war against England, but his situation was well understood by the British Cabinet, and the result was a state of non-intercourse rather than hostilities. But Napoleon did not stop here; he demanded a draft of Swedish sailors for the French fleet, a body of Swedish troops for the French army, the introduction of French custom-house officers at Gothenburg, and lastly the formation of a Northern Confederation consisting of Sweden, Denmark, and the Duchy of Warsaw, under the protection of France. All these demands were respectfully but firmly refused; but the Prince Royal became convinced, that with such a man as Napoleon, Sweden could not remain at peace and retain its independence as a nation. He wrote several letters to Napoleon, explaining the delicate and painful position in which he found himself. Sweden could not live without maritime trade. After three months, Napoleon answered by fresh demands of hostilities against Great Britain, and of a rigorous exclusion of all English or colonial goods. Meantime, French privateers in the Baltic and Northern Seas seized the Swedish vessels, whilst the French authorities confiscated the Swedish ships in the German ports, and marched their crews into France to serve in Napoleon's dockyards. Napoleon treated poor Sweden as an enemy. The year 1811 was a dreadful period for Sweden and the Prince Royal in particular, and his health was affected by his anxiety. At last a fresh act of violence of Napoleon put an end to all uncertainty. In January, 1812, French troops invaded Swedish Pomerania and the island of Rügen, arrested the public functionaries, who were sent to the prisons of Hamburg, and replaced them by Frenchmen, disarmed two Swedish regiments which had been surprised under the appearance of peace, and sent the men prisoners into France, and sequestrated all public property and all Swedish vessels in the port of Stralsund. All Sweden was roused at the news. The Prince Royal wrote a strong remonstrance to Napoleon upon this wanton outrage against the rights of Sweden as a nation. Charles XIII. sent an envoy to Petersburg to conclude an alliance with the Emperor Alexander, which was signed on the 24th of March; and from that time, the Prince Royal, having renewed friendly relations with England, exerted himself to promote peace between Russia and England, and Russia and Turkey. All this was well known at Paris, while Napoleon was preparing his gigantic expedition against Russia. It was a very bold step for Sweden thus to throw the gauntlet at the great conqueror, but the step was taken with the courage of despair, for Napoleon would not let any nation live independent. Those who have talked of Bernadotte's treason, as they call it, of his taking advantage of Bonaparte's Russian disasters to give him an inglorious blow, forget dates and misrepresent circumstances. They have confounded the treaty of Petersburg in March, with the treaty of Abo, in August, 1812. Sweden had chosen her part, forced to it by Napoleon's outrageous injustice, long before the breaking out of the Russian war. After that war had begun, and about the middle of August, the Prince Royal repaired to Abo in Finland, to have an interview with the Emperor Alexander, who was delighted with his manner and conversation. It was then agreed that Sweden should take an active part in the war by landing an army in North Germany, which would be joined by a corps of Russians. At the same time it was stipulated that Norway should be detached from Denmark, a power closely and pertinaciously allied with the common enemy Napoleon, and be annexed to the crown of Sweden in compensation for the loss of Finland. The accession of Great Britain to the treaty was solicited, and after a time obtained. The treaty was signed at Abo, 18th of August. The Prince Royal having reviewed a body of 35,000 Russians who were to be placed immediately at his disposal, told Alexander, 'They are very fine troops, and you can ill spare them just now. Send them instead to Riga, to reinforce Wittgenstein, who has great difficulty in defending himself against Macdonald and Victor. If the French succeed there, they will march on Petersburg.' 'That is very handsome of you,' said Alexander; 'but how will you obtain possession of Norway?' 'If you succeed,' said the Prince, 'you will keep your promise. If you succumb, Europe is enslaved, all crowns will be withered by subjection to Napoleon. Better then go and till a field than reign under that condition.' The troops were sent across the Gulf of Finland to Wittgenstein, just in time to save Riga and Petersburg. The Prince Royal, after his return to Stockholm, kept up a familiar correspondence with Alexander during the whole of the memorable Russian campaign, gave him the best advice, and supported his spirits. After the French retreat from Moscow, the Swedish cabinet signified to the French chargé d'affaires at Stockholm, that all diplomatic relations with France had ceased, and sent him his passports. This was resented in a note by Maret, Napoleon's secretary for foreign affairs, to which the Prince Royal replied by an eloquent letter addressed to Napoleon, in March, 1813, which was afterwards printed and circulated throughout Germany. He told him that the lessons of history reject the idea of universal monarchy; that his continental system deprived nations of the exercise of their natural faculties, of mutual commerce, mutual intercourse, mutual friendship and assistance; that every nation had a right to govern itself by its own laws and its own will; and that Sweden in particular could not exist without maritime commerce. Napoleon is said to have denied at St. Helena having received this letter, but it was read to the Council of State at Stockholm, a copy of it was deposited in the archives, and the original was sent to Paris by a courier named Dusable, who delivered it to one of Napoleon's aides-de-camp on duty, and Napoleon was so enraged at its contents, that he ordered the poor courier to be shut up in Vincennes, where he remained for a considerable time. (Touchard Lafosse, *Histoire de Charles XIV.* livre iii. ch. 5.)

In May the Prince Royal landed at Stralsund with about 25,000 Swedes, and advanced towards the Elbe. Soon after, an armistice having been concluded between the Russians and the French, the Prince Royal had an interview with the Emperor Alexander and the King of Prussia, at Trachenberg in Silesia. He laid before them a plan of operations for the various allied armies during the ensuing campaign, pointing to Leipzig as their ultimate place of meeting. When hostilities began again, the Prince Royal at the head of the army called 'of the North,' which consisted of Swedes, Russians, and Prussians, protected Berlin against the advance of the French under Oudinot, whom he repulsed at Gross Beeren, and he afterwards defeated Ney at Dennewitz, 6th of September, which saved Berlin a second time, and drove the French upon the left bank of the Elbe. Napoleon began his retreat from Dresden upon Leipzig, whither the movements of the allies were converging, and there he sustained his signal defeat, which decided the evacuation of Germany by the French. The Prince Royal contributed greatly to the success of that battle on the 18th of October, and the following day he forced his way into the town, where he met in the great square the Emperor Alexander and the King of Prussia, according to the agreement of Trachenberg.

Leaving to others the pursuit of the French to the Rhine, the Prince Royal turned towards the north to attack Davoust and his allies the Danes on the lower Elbe. He defeated the Danes, who demanded an armistice, and then blockaded Davoust in Hamburg. On the 14th January, 1814, a treaty was concluded at Kiel between Denmark and Sweden, by which the former power gave up Norway to the crown of Sweden, and joined the coalition. The Prince Royal then hastened to the Rhine, and fixed his head-quarters at Cologne and afterwards at Liege, from whence he urged the Emperor Alexander to make peace with France, having the Rhine, the Alps, and the Pyrenees for its boundaries. He wrote in the same strain to the Swedish minister at the Congress of Chatillon, and he also advised Napoleon, through an indirect channel, to make peace, or he would lose his crown. He himself would take no part in the campaign in France in 1814. He always strongly opposed the idea of any dismemberment of France, or of forcing any particular dynasty upon the French. 'Let Germany and Holland be free,' he said, 'and let the French choose their own government.' And the Emperor Alexander coincided with him. But Napoleon, by rejecting all proposals, hurried on his own fall. The Prince Royal's paramount duties however were towards his adopted country, Sweden, which expected a compensation for all her past sufferings and her present exertions for the common cause. He went to Paris, incognito, to confer with Alexander on the subject of Norway, as Denmark seemed little inclined to fulfil the treaty of Kiel. The emperor, faithful to his word, obtained the sanction of all the allies, and placed at the disposal of the Prince Royal his troops in North Germany. The Prince then set off for Brussels, where he collected his Swedish troops, and marched them back to the shores of the Baltic.

Christian Frederic, Prince of Denmark, had hoisted in Norway the flag of independence. The Norwegians, he said, were freed from their allegiance to the crown of Denmark, but they were not bound by the conditions of the treaty of Kiel. He assembled a sort of diet at Eiswold, the majority of the members of which consisted of officers and other salaried individuals. This assembly framed a liberal consti tution, and elected Christian for their king, who soon after dissolved the assembly. The King of Denmark sent commissaries to summon Christian to fulfil the treaty of Kiel, but little attention was paid to this formality. Four commissioners, of England, Russia, Prussia, and Austria, came to remonstrate in favour of the same treaty, but they obtained only evasive answers. A Swedish army and fleet were then put in motion against Christian. King Charles XIII. and the Prince Royal commanded in person. After some trifling actions on the frontier, the Swedes entered Norway; an armistice was concluded, and the Storthing, or general assembly of Norway, being convoked, required Christian to renounce the authority with which he had been intrusted by the nation. Christian abdicated and returned to Copenhagen. The Storthing then entered into communication with the Swedish commissioners, and after some deliberation, elected unanimously Charles XIII. of Sweden to be king of the kingdom of Norway, and Carl Johan as prince royal. The king and prince on their part swore to the constitution of Norway as voted by the Storthing. Norway remained much more free than when a mere dependency of Denmark, as it had been for three centuries. The Prince Royal entered Christiania in the midst of acclamations, and received the oath of allegiance of the deputies to Charles XIII. in November, 1814. The Scandinavian peninsula was now united under one sceptre, and 'no more Dovre' was the common word of union, meaning that the natural boundary of the Dovrefeld, or mountains between the two countries, was no longer a political barrier.

In July, 1817, Prince Oscar, son of the Prince Royal, attained his majority, which was celebrated by a public and affecting solemnity. This young prince, who had followed his father to Sweden in 1810, had been educated as a Swede in every respect. At the end of that year Charles XIII. fell ill, and on the 5th of the following February, 1818, he expired, happy in the choice of his adopted son. Carl XIV., Johan, was immediately proclaimed, both in Sweden and in Norway, and was in due time acknowledged by all the princes of Europe. Even the deposed Gustavus wrote him a letter of congratulation from Switzerland. The new king was crowned at Stockholm, in May, by the archbishop of Upsal, and afterwards at Drontheim in September, by the Bishop of Aggerhus, with unusual splendour.

The twenty-six years of the reign of Charles XIV. have been for Sweden and Norway a period of peace and internal improvement. Every branch of the administration, the finances, the navy, the army, the roads and canals, public instruction, all have been improved. The great canal of Gothia, which joins the Baltic to the Northern Sea, was opened in 1832. Agriculture has made great progress. Sweden, which was obliged to import large supplies of corn, now produces enough for itself, and even exports corn. The breed of horses has been greatly improved; the public debt has been reduced almost to nothing; the taxes are collected with little or no expense. Sweden has more than 2500 merchant ships, exclusive of coasting vessels, which is double what she had in 1810. For other details we must refer to the works quoted at the end of this article. It may be easily supposed that the military service in all its branches received the especial attention of Charles John. In his speech on the opening of the Swedish Diet, in January, 1840, he recapitulated with honest satisfaction all that had been done for the country under his reign.

The attachment between Alexander of Russia and Charles John lasted till the death of Alexander, whose successor Nicholas, the present emperor, wrote to the King of Sweden, 'I look upon the continuation of your friendly sentiments as one of the most valuable legacies left me by my brother.'

Charles John had completed his eightieth year when he was seized by an illness, in January, 1844, which brought him to the grave on the 8th of March following. His son, Oscar I., succeeded him. Upon the whole, the life of Charles John Bernadotte is one of the most instructive biographies of our own times; it affords subject for serious reflection, and is a useful comment on the history of Napoleon.

(Touchard-Lafosse, *Histoire de Charles XIV. Jean, Roi de Suède et de Norvège*; F. Schmidt, *La Suède sous Charles XIV. Jean*; Daumont, *Voyage en Suède*; Laing's *Tour in Sweden*; Count Biörnstjerna, *On the Moral State and Political Union of Sweden and Norway, in answer to Mr. Laing's Statements*.)

CHARNOCK, STEPHEN, a nonconformist, was known in his lifetime as an active and eloquent theologian, and is now remembered for the merit of writings not published till after his death. He was born in London, in 1628. At one time he was senior proctor in the University of Oxford; and afterwards he became a preacher in Dublin. Being ejected thence by the Act of Uniformity, he held for fifteen years the charge of a dissenting congregation in London, where he died in 1680. His printed works are the following:—'Several Discourses of the Existence and Attributes of God,' 1682, fol.; 'Works,' 1684, 2 vols. fol.; 'Two Discourses,' 1699, 8vo.

CHARITABLE USES. [USES, CHARITABLE AND SUPERSTITIOUS, P. C.]

CHARITIES. [TRUST AND TRUSTEE, P. C., p. 322.]

CHARTER. This word is from the Latin *charta*, a word of uncertain origin: the Greek form of the word is *chartes* (χάρτης). Charta appears to have signified writing-material made of papyrus. The term was afterwards applied not only to the materials for writing, but to the writing itself, as to a letter or the leaf of a book. In English law it was used to denote any public instrument, deed, or writing, being written evidence of things done between man and man, and standing as a perpetual record. (Bracton, lib. 2, c. 26.) Among the Saxons such instruments were known as *gewrite*, or writings.

Charters are divided into—1, Charters of the crown; 2, Charters of private persons.

1. Royal charters were used at a very early period, for grants of privileges, exemptions, lands, honours, pardon, and other benefits that the crown had to confer; and thus the term became restricted to such instruments as conferred some right or franchise. These instruments did not differ in form from letters patent, being usually addressed by the king to all his subjects, and exposed to open view, with the great seal pendent at the bottom; but such as contained grants of particular kinds were distinguished by the name of charters. Thus, as giving was the object of a charter, the term became very popular, and was used in a more extended sense, to denote laws of a popular character.

Whatever may have been the prerogatives and legislative authority of the kings of England, it is certain that from the earliest times there were many rights and liberties which by the law of the land belonged to the people. As these were often restrained and violated, nothing was more acceptable to the nation than a formal recognition of them by the crown: and the popular name of charter was applied to those written laws by which the kings from time to time confirmed or enlarged the liberties of the people. Such laws were regarded not only as concessions from the king, but as contracts between man and man—between the king and his subjects; while, at the same time, they were promulgated as the legislative acts of the sovereign authority in the state.

The charter of William the Conqueror, for observing the laws throughout England, was in the nature of a public law. It settled the religion of the state, and provided for its peace and government, for the administration of justice, the punishment of criminals, and the regulation of markets; it confirmed the titles to lands, and the exemption of the tenants in chief of the crown from all unjust exaction and from tallage. The words are those of a lawgiver appointing and commanding; '*statuimus*,' '*volumus et firmiter precipimus*,' '*interdicimus*,' '*decretum est*,' are the expressions by which matters are ordered or prohibited. (*Fœdera Rec. Comm. Ed.*, vol. i. p. 1.)

The charters of liberties granted by Henry I., Stephen, Henry II., John, Henry III., and Edward I., are all, more or less, in the nature of public laws, either making new provisions, or confirming, enlarging, and explaining existing laws, and relate to the freedom and good government of the people, and all the most important interests of the country. Some of them are still regarded as authoritative declarations of the rights and privileges which the people of England have enjoyed for centuries.* So valid and binding were the royal charters considered, that in the 37 Henry III. (A.D. 1253), in the presence of the king, several of the first nobles, 'and other estates of the realm of England,' the archbishop and bishops, excommunicated and accursed all who should violate or change 'the church's liberties or the antient approved customs of the realm, and chiefly the liberties contained in the charters of the common liberties and of the forest, granted by our lord the king.' In those times no sanction more solemn could have been given to the authority of any law. It was intended chiefly as a check upon the king himself, whose power had been restrained by the popular concessions made in the charters of liberties, but it was also directed against all his subjects who should violate the liberties of the people. [Magna Charta, P. C.]

---

* They are printed at length in the first volume of the 'Statutes of the Realm,' published by the Record Commissioners. With the exception of one charter in the 25th Edward I., they are all in the Latin language. In the Tower of London there are charter rolls of all royal charters from 1199 to 1483; and in the Rolls Chapel from 1483 to 1516. A part of these rolls has been published by the Record Commissioners

These charter-laws, though often expressed to have been made by the advice of the king's council, implied an absolute legislative power vested in the crown; and as royal prerogative became restrained and the public liberties enlarged, legislation by charter was gradually superseded by the statutes and ordinances made in parliament. During the reigns of Henry III. and Edward I. laws were promulgated in both forms; but since that time statutes and ordinances have been the only records of legislation—not differing materially, at first, either in form or in the nature of the authority from which they emanated, from the charters of earlier reigns, but gradually assuming their present character as acts agreed to by the entire legislature.

But notwithstanding the discontinuance of the practice of promulgating general laws by royal charter to bind the whole kingdom, the exercise of prerogative, by means of charters, has partaken of a legislative character throughout the entire history of the British government. Some of the most antient and important of these were charters to boroughs and municipal bodies, conferring immunities and franchises, of which the greatest was that of sending representatives to parliament. There are still extant municipal charters of the Saxon kings, and of the Norman kings after the Conquest, conferring various rights upon the inhabitants of boroughs, of which an exclusive jurisdiction was always one; but the first charter of incorporation to any municipal body appears to have been granted in 1439, in the reign of Henry VI., to Kingston-upon-Hull; although, in the absence of prior charters, it has been usual to presume that charters confirming existing usages had been lost.

But though the king's charters have conferred upon boroughs the right of sending members to parliament, it was held in several cases, by the House of Commons, that the right of voting by the common law could not be varied by charters from the crown. (Glanville's *Reports*, p. 47, 63, 70.) Between the reigns of Henry VIII. and Charles II. no less than 180 members were added to the House of Commons by royal charter, the last borough upon which that right was conferred, in this manner, having been Newark, in 1673. Several of these were antient boroughs which had ceased to send members, and whose rights were thus restored by charter; while some towns, expressly created boroughs by charter, did not send members to parliament for centuries afterwards, as Queenborough for example, to which a charter was granted in 1368, but which did not return members until 1578. Hence it has been argued that, notwithstanding the practice of later reigns, the charter of the crown alone was not sufficient in law to entitle a *town* to send members to parliament, although expressly created a borough, to which, by the common law, the right of sending members was incident. (Merewether and Stephen's *History of Boroughs and Municipal Corporations*, Introduction, and pp. 664, 1256, 1774, &c.) This view derives confirmation from the acknowledged law that the crown was unable, by charter, to exempt a borough from returning members, since that right was always held to be exercised for the benefit of the whole realm, and not for the advantage of the particular place. (Coke, 4th Inst. 49.) Upon these grounds a charter of exemption to the citizens of York was declared void by act of parliament, 29 Henry VI. c. 3. But as parliamentary representation has, at length, been comprehensively arranged for the whole kingdom by the Reform Act, the legal effect of royal charters upon the elective franchise has become a question merely of historical interest. The peculiar rights of corporations have also been determined by the Municipal Corporations Act; but a power has been reserved to the crown, with the advice of the Privy Council, to grant charters of incorporation to other towns, upon the petition of the inhabitants, and to extend to them the provisions of the Municipal Corporations Act (5 & 6 Will. IV. c. 76, § 141.)

Charters were formerly granted by the crown, which established monopolies in the buying, selling, making, working, or using certain things; an injurious practice, contrary to the antient and fundamental laws of the realm, which was abolished by act 21 James I. c. 3. [Monopoly, P. C.]

The crown has ever exercised, and still retains, the prerogative of incorporating universities, colleges, companies, and other public bodies, and of granting them, by charter, powers and privileges not inconsistent with the law of the land. But as the most considerable bodies ordinarily require powers which no authority but that of parliament is able to confer, such corporations as the East India Company and the Bank of England, which were originally established by royal charter, have long since derived their extraordinary privileges from acts of parliament, as well as other public companies which have been incorporated in the first instance by statute.

But the largest powers now conferred by royal charter are those connected with the colonies and foreign possessions of the crown. Whenever a new country is obtained by conquest or treaty, the crown possesses an exclusive prerogative power over it, and by royal charters may establish its laws and the form of its government; may erect courts of justice, of civil and criminal jurisdiction, and otherwise provide for its municipal order, for the raising its revenue, and the regulation of its commerce. (Chitty *On Prerogatives*, c. iii.) This power of the crown however is always subject to the ultimate control of parliament; and even if deputed to a legislative assembly, or other local government, possessing rights and liberties defined by charter, the crown cannot recall the charter, and govern by any laws inconsistent with its provisions, or at variance with the common law.

2. Charters of private persons are the title-deeds of lands, many of which are the antient grants of feudal lords to their tenants. These pass with the land as incident thereto, and belong to him who has the inheritance; or, if the land be conveyed to another and his heirs, the charters belong to the feoffee. A charter of the crown, granted at the suit of the grantee, is construed most beneficially for the crown, and against the party; but a private charter is construed most strongly against the grantor.

(Introduction to *Rotuli Chartarum*, 1837; Fleta, lib. iii. c. 14; Comyn's *Digest*, tit. Charters; Coke, 1*st Inst.* 6 *a*, 7 *a*; 2*nd Inst.* 77; Cowel, *Law Dictionary*; Blackstone and Stephen's *Commentaries*; Preface to *Statutes of the Realm*, &c.)

CHARTER-PARTY. [Ships, P. C.]

CHARTISTS, the name given to a political party in this country, who propose extensive alterations in the representative system, as the most direct means of attaining social improvement, and whose views are developed in a document called the 'People's Charter.' The principal points of this proposed charter are, universal suffrage, vote by ballot, annual parliaments, the division of the country into equal electoral districts, the abolition of property qualification in members and paying them for their services. The principles of the charter and the means of carrying them into effect have also been embodied in the form of a bill. It was prepared in 1838 by six members of the House of Commons and six members of the London Working Men's Association; and the following are the most important of its enactments:—I. The preparers of the Bill allege the low state of public feeling as an apology for not admitting women to the franchise, and it is therefore only provided that every male inhabitant be entitled to vote for the election of a member of the Commons' House of Parliament, subject however to the following conditions:—1. That he be a native of these realms, or a foreigner who has lived in this country upwards of two years, and been naturalized. 2. That he be twenty-one years of age. 3. That he be not proved insane when the lists of voters are revised. 4. That he be not convicted of felony within six months from and after the passing of this act. 5. That his electoral rights be not suspended for bribery at elections, or for personation, or for forgery of election certificates, according to the penalties of this act. II. That the United Kingdom be divided into 300 electoral districts, so as to give uniform constituencies of about 20,000 voters each. III. That the votes be taken by ballot. IV. That a new parliament be elected annually; that the elections take place on the same day in all the districts: and that electors vote only for the representative of the district in which they are registered. V. That no other qualification be required for members than the choice of the electors. VI. That every member be paid 500*l.* a year out of the public treasury for his legislative services; and that a register be kept of the daily attendance of each member.

There is nothing new in the principles or details of the People's Charter. They have, either separately, or some one or other of them in conjunction, been a prominent subject of discussion at various intervals within the last seventy years. In 1780 the Duke of Richmond introduced a bill into the House of Lords for annual parliaments and universal suffrage. In the same year the electors of Westminster appointed a committee to take into consideration the election of members of the House of Commons, and in their report they recommended the identical points which now constitute the main features of what is called the People's Charter. The Society of the Friends of the People, established in 1792, three years afterwards published a declaration which recommended a very large extension of the suffrage. In seasons of national distress, the amendment of the representative system has always been warmly taken up by the people of this country.

In 1831 the wishes of a large mass of the middle classes were realized by the passing of the Reform Act. A season of political repose, and, as it happened also, of commercial prosperity, followed the excitement which preceded the passing of that measure. A victory had been gained, and the people waited for the benefits which they were to derive from it. In the next period of distress which arose, the amended state of the representative system and the advantages which it had brought were narrowly scanned; and the consequence was, the gradual formation of a party who were dissatisfied with its arrangements, and sought to attain the ends of political and social good by a more extensive change. This is briefly the origin of Chartism and of the People's Charter. The middle classes were, however, well satisfied on the whole with the overthrow of the rotten boroughs and the enfranchisement of the large towns, and therefore the Chartists stood alone, and began to regard them with a feeling of hostility. Chartists were sometimes found, as in all other parties, ready to assist the party which differed most widely from them, with the object of thwarting the political objects which the middle classes had at heart. In 1838 they had become a large party and embraced a great number of the working classes employed otherwise than in agriculture. The number of signatures attached to the petition presented at the commencement of the session of 1839 in favour of the People's Charter was upwards of one million and a quarter. Unfortunately the idea began to be entertained amongst a certain class of the Chartists that physical force might be justifiably resorted to if necessary for obtaining political changes; and the party became divided into the Physical Force Chartists and the Moral Force Chartists. The former became implicated in disturbances which took place at various times in several parts of the country; and many persons of this class never having had correct views respecting the wages of labour, it appeared as if they had adopted the cry of 'a fair day's wages for a fair day's work' as an additional point of the People's Charter. The disturbances in 1842 in the midland and northern counties were to some extent encouraged by the less intelligent of the Physical Force Chartists. At the close of 1841 however an attempt was made to combine the middle classes with the Chartists in their attempt to obtain an extension of the suffrage. Early in 1842 a Complete Suffrage Union was formed at Birmingham; and in April of the same year a conference, consisting of eighty-seven delegates, was assembled at Birmingham, which sat for four days; three of which were spent in agreeing upon a basis of union between the middle and working classes, and the last day in adopting plans of practical organization. The six points of the People's Charter were adopted by the conference, and the details were left for settlement to a future conference. It was resolved also at this conference to establish a National Complete Suffrage Union. The proposed National Conference commenced its meetings in December, 1842, and was attended by 374 delegates. Here a rupture took place between the Chartists and the Complete Suffrage party, and the latter were outvoted on the question of adopting the People's Charter instead of the Complete Suffrage Bill. The minority however proceeded to act upon their views as developed in the Complete Suffrage Bill. This bill does not contain any disqualifying clauses. In other respects it differs from the People's Charter only in matters of detail. These are the only two plans connected with the extension of the franchise which are at present supported by any large class in this country. The Chartists and the Complete Suffragists are only nominally distinct parties; but the former may be characterised as possessing a greater hold on the working classes than the Complete Suffragists, whose ranks are chiefly recruited from the middle classes: their objects however are so similar, that they may at any time unite without any sacrifice of principle.

CHASING OF METALS. The process termed chasing, or enchasing, as applied to working in metals, so far resembles a kind of stamping as to admit of the two processes being described here together.

Metallic goods are generally made in one of three ways—by casting in moulds, by forging or turning in masses, or by pressing or stamping out of thin sheets. The last of these three has been greatly developed at Birmingham within the last few years. Either the entire article receives its form from the sheet by stamping, or, when roughly formed, it receives an ornamental device by a sort of fine punches. For the latter variety of work, steel blocks, punches, or bosses, are provided, each one presenting at the end a definite form, such as curved, angular, square, &c.; and these are fixed or held with the finished end uppermost. The article to be ornamented, which is always of a thin hollow kind, is placed face uppermost on the punch; a pattern or design is drawn on the face of the article, and the adjustment is so made that the punch beneath shall follow the course of the lines in the device. A fine hammer is then employed to strike the piece of thin metal; the effect of which is, that the metal is forced upwards in a fine burr or protuberance at every place where there is a punch beneath it. By shifting the piece of metal so that different parts of its lower surface may in succession be brought over the punch, and by changing the form of the punch when necessary, a protuberant design or pattern in relief is formed on the article of metal.

But a more extensive kind of manufacture is that in which the article receives its form by being stamped or pressed from a plain piece of sheet metal. The hammer, the swage, the roller, the stamp, and the lathe, are all employed to effect this, according to the thickness of the metal and the nature of the article to be made from it. When vessels and hollow articles are fashioned out of thin sheet-metal by the hammer, it constitutes *brazing:* the metal is rested upon bosses or steel supports of different kinds, and hammered on the upper surface till it assumes the requisite curvatures. The swage is a peculiar kind of gauge or pattern which gives the requisite form to the sheet metal by pressure rather than by percussion. Let us suppose (as a familiar mode of illustrating its action) that a pair of scissors has the two blades so curved that the convexity of the one may fit into or correspond with the concavity of the other; if these blades were nearly closed, and a thin piece of metal were drawn between them, it would be forced into a curved form similar to that presented by the blades. The arrangement of the different parts of the swage is so managed as to lead to some such result as that here indicated. The beadings and hollows on the edges of dish-covers and similar articles are produced by means of swages.

Many articles, such as large plain hollow vessels, are brought into form mainly by rollers. Tinsmiths often employ three rollers to bring their tin to the proper form for tubes and cylindrical vessels. There are two rollers placed nearly in contact, and in the same horizontal level with another above them, equidistant from both; all are capable of revolving, and if a piece of tinned iron be drawn between them, it will be forced to conform to the size and shape of the cavity existing between the upper and the two lower rollers: by varying the sizes and mutual distances of the rollers, different curvatures of the tin may be produced.

The lathe is employed in rather a singular way, in the production of various kinds of articles from thin sheet-metal, principally from soft white yielding alloys of tin and other metals. A flat circular disc of metal can by this means be brought to the shape of a box, a cup, a hemisphere, or any one among numerous fanciful forms. The disc is attached to a lathe provided with a boss or block of the required shape, and a blunt tool is pressed against it while revolving; the soft and ductile metal yields to the pressure and conforms to the shape of the boss against which it is placed. By little and little the workman effects the transformation of the flat piece of metal to a shape which it could not assume unless it were soft and ductile.

The most important however of these modes of working sheet-metal is by stamping. In this process the thin metal is suddenly and very forcibly compressed between two steel dies or stamps, each of which is engraved with a pattern or device. One die is fixed on a stand with its face uppermost, while the other is fixed face downwards to the lower end of a heavy hammer or weight. The thin piece of metal is placed on the lower die; the hammer with the upper die is raised by a rope and pulley to a considerable height; and on this being allowed suddenly to fall, the upper die forcibly compresses the thin piece of metal which lies between it and the lower, compelling it to assume alternate convexities and concavities according to the pattern. Each die is an exact counterpart or reverse of the other, like the two halves of a swage, so that the metal cannot conform to the convexity of the one without falling into the concavity of the other; and it is by this double action that the result is produced. Spoons, forks, and trinkets in numberless variety are produced by stamping between two dies modified in various ways according to the particular object in view.

This mode of stamping requires as many dies as there are different patterns. Dr. Ure, in illustration of the heavy stock which the manufacturers at Birmingham are thus forced to keep by them, and of a difference in this respect between them and the French manufacturers, remarks: 'M. Parquin, the greatest manufacturer of plated goods in Paris (or France, for this business is monopolized by the capital), who makes to the value of 700,000 francs per annum, out of the 1,500,000 which he says is the whole internal consumption of the kingdom, states that the internal consumption of the United Kingdom amounts to 30,000,000, or twenty times that of France. He adds that our common laminated copper costs 26 sous the pound, while theirs costs 34. Their plated goods are fashioned not in general with stamps, but by the pressure of tools upon wood moulds in the turning-lathe, which is a great economy of capital to the manufacturer. There are factories at Birmingham which possess a heavy stock of 300,000 different die-moulds.' This 'pressure of tools upon wood moulds in the turning-lathe' corresponds with one of processes above described.

For different applications of the above processes to manufactures, see Button, P. C., and Coining, P. C. For the mode of making the dies, Die-Sinking, P. C. S.; and for stamping in connection with electro-gilding and silvering, Electro-Metallurgy, P. C. S.

CHATHAM ISLANDS are a group of islands situated in the Pacific, east of New Zealand, between 43° 40′ and 45° 20′ S. lat., and 176° and 177° 20′ W. long. They consist of one large island, two of moderate extent, and several smaller islands. The largest is called Warekauri, and is in the form of a hammer with a short handle. The northern part, which represents the iron portion of the hammer, is about forty-eight miles long from east to west: that which extends from it southward does not much exceed thirty-six miles in length. Dieffenbach, by a rough computation, gives the area at 477 nautical miles, or 305,280 acres, of which however 57,600 acres at least are water, being lakes, lagoons, &c., so that the land is not more than 247,680 acres.

The southern shores of the southern peninsula of the island are lined with rocky cliffs, but the remainder terminates in a low sandy beach, with the exception of a few headlands along the northern coast, which are formed by low rocky masses. The country rises gradually from the beach for one or two miles, when it extends on an undulating level. The central part of the island is occupied by a large lake, called Te Wanga, which is about twenty-five miles long, and between six and seven broad. It is surrounded by hills, either wooded or boggy. On its eastern side it is separated from the sea by low sandhills about a hundred yards broad, and at one place the intervening hills disappear, and between the lake and the sea there is only a low sandy beach, which in 1842 was washed away by the sea, so that since that time the lake has become a portion of the ocean, if the opening has not again been filled up. Before that event the water of the lake was slightly brackish, which was ascribed to infiltration of sea-water; otherwise it must have been fresh, as two large streams empty themselves into the southern part of the lake.

The surface of the tract which lies west of the northern part of the Te Wanga lake is diversified by a considerable number of hills of a pyramidal shape, and consisting of basalt. None of these hills are more than 800 feet in height. In their vicinity the soil is very fertile, being in its natural state covered with a vegetation of fern and trees, mixed together, and appearing like oases in the surrounding bog. The intervening tracts are covered with bog, which however does not appear to be deep, and it is supposed that if they were drained they would be productive, and fit for grain or pasturage. Wherever the superfluous water has been carried off by a natural outlet, a rich vegetation of fern and New Zealand flax (*Phormium tenax*) has sprung up, which gives additional firmness to the soil by the decayed leaves, and yields a rich harvest to the native planter. This is particularly the case on the low hills above the sea-shore, which are well watered, and extend over the beach like a verdant zone. Where these hills are sandy, the decayed leaves from the trees have formed a light black soil, which the natives prefer for agriculture. In this part several lakes occur at the back of the low hills which run parallel to the coast. They are surrounded by gently sloping hills, but have generally an outlet for their waters into the sea. In the interior of the northern tract, east of the lake of Te Wanga, there is an extensive tract of dry soil of considerable fertility, which is well wooded, but near the sea it is covered with sand, and this is also the case with the narrow band of land that separates the lake from the sea. The best portion of the island is that south of the lake, which has an undulating surface, is not so boggy as the rest, and is either covered with an open forest of moderate sized trees, or with high fern, in which case the land can be brought under cultivation with little labour. The soil is very fertile, and the vegetation is vigorous. The winds which sweep over these islands are not violent enough to injure vegetation, and it is only in a few exposed places that stunted shrubs appear.

On the western side of the island is a large bay, called Waitanga Bay, where there are five harbours behind some projecting headlands. On the southern shores of the bay is Waitanga harbour, which has excellent anchorage in between five and twelve fathoms. Though open to the north-west, the swell of the sea is broken by the projecting peninsula, which lies north of the bay and by a reef. This harbour receives the largest river in the island, the Mangatu, which comes from some hills on the south; though its whole course does not exceed twelve miles, it is navigable for boats for about three miles from its mouth, even at low-water, as the depth is often twelve feet, though the channel is narrow: but it has a bar across its mouth, which is passable for boats only at high-water. On the northern side of Waitanga Bay are four harbours, not far from one another, called, from east to west, Wangatchi, Wangamoe, Wangaroa, and Pohanta. The third named is frequently visited by vessels, and affords complete protection against all winds. The three others are not much known, but reported to be good. The northern shore of the island is much exposed, but contains a sheltered bay six miles from the north-eastern extremity of the island, called Kaïngaroa, which is stated to have good anchorage in from ten to twelve fathoms water. There are no harbours on the eastern and southern coast except at Oïnga, the south-eastern headland of the island, where the hills offer some protection against wind and sea: this place is frequently visited by whalers.

The climate is very mild. In winter (from May to July) the thermometer never rises above 60°, nor descends below 45°, after eight o'clock in the morning. The air is always moist and cool, but never misty, the vapour being carried off by the constant breezes. Even during the winter the sky is generally cloudless, and of the deepest blue; but there is no want of rain. In winter at least there are showers for a few hours every week. The prevailing winds are north-east and south-west. The climate appears very favourable to Europeans.

The natives cultivate potatoes, different kinds of turnips, cabbages, taro (*Arum esculentum*), some tobacco, and abundance of pumpkins, which form a great part of their food. There are several kinds of trees, which are of the species found in New Zealand: the karaka-tree (*Corynocarpus laevigatus*) forms the largest part of the forest. No kind of quadruped occurs, except the Norwegian rat. Birds are numerous: in the lakes and on the sea-shores are ducks, snipes, plovers, curlews, and redbills; in the forests the mocking-bird, a little green parroquet, the mako-mako, a singing-bird, and the large New Zealand pigeon. Fish is very abundant. Both the spermaceti and black whales are seen in great numbers off the shore, and visit the east coast, especially in June and the following months.

These islands were discovered in 1791 by Broughton, of his Majesty's ship Chatham, who took possession of them in the name of the king. They were afterwards frequently visited by whalers, and in 1840 a whaling-station was established at Oïnga. Broughton found them inhabited by a people belonging to the Malay race. They are not so tall, muscular, and well proportioned as the New Zealanders. They have often short necks, thick heads, and, when young, prominent paunches; the forehead is often low and sloping, the cheekbones prominent, the eyes narrow, and the nose flat and clumsy. All have black glossy hair, which is sometimes curly. Their complexion is darker than that of the New Zealanders. Broughton estimated the population at 1200 individuals; but Dieffenbach thinks that in 1840 not more than ninety of the aboriginal inhabitants were found there. The reduction of their number is to be ascribed to the state of slavery and degradation to which they have been subjected by two tribes of the New Zealanders. As the Chatham Islands are only about 450 marine miles distant from Port Nicholson in Cook's Strait, two New Zealand chiefs visited the Chatham

Islands in whaling vessels. They soon saw that it would not be difficult to take possession of the islands, and to reduce the inhabitants to slavery. As their tribes had been driven from their original possessions by their more warlike or more powerful neighbours, they induced them to go to the Chatham Islands, and effected their emigration by hiring a British brig for that purpose, which carried them over in two trips. The aborigines were reduced to slavery without opposition, and divided among the New Zealand tribes, as well as the land. The number of the New Zealanders who thus settled in the Chatham Islands is stated to have been eight hundred: and, by means of the labour of their slaves, a portion of Warekauri was soon brought into cultivation, so that they could furnish supplies for the three or more vessels which annually resort to the island. The aborigines possessed neither dogs nor pigs; the New Zealanders introduced dogs, together with potatoes and different kinds of seeds. A part of Warekauri has been purchased from the chiefs by British citizens, and the island is considered an appendage of the colony of New Zealand.

South-east of Warekauri lies Rangi-haute, or Pitt's Island, which is about twelve miles long and eight broad. It consists principally of a hill of moderate elevation, having a flat top, whose declivities terminate near the coast. It has no harbour, and is stated to be inhabited by a small number of aboriginal natives. The other islands are mere rocks, and only frequented by sea-birds.

(Dieffenbach's 'Account of the Chatham Islands,' in *London Geographical Journal*, vol. xi.)

CHAUDET, ANTOINE DENIS, a celebrated French sculptor, born at Paris, in 1763. He was the pupil of Stouf, and in 1784 he obtained the grand prize of the Academy for sculpture, by a bas-relief of Joseph sold by his Brethren. He studied some time in Rome, and returned to Paris in 1789, when he was elected an Agréé of the Academy of Painting and Sculpture, of which he became later a member and professor of sculpture. He was made a member of the Institute in 1805, and took part in the preparation of the Dictionary of the French Academy; he edited the 'Dictionnaire de la Langue des Beaux Arts.' He died in 1810.

There are several excellent works by Chaudet in public buildings of Paris, but one of his chief performances, the colossal bronze statue of Napoleon in the heroic or Roman costume, which stood on the column of the Place Vendôme, was melted down in 1814 by the government of Louis XVIII., and the metal was used to form part of the horse of Henry IV. on the Pont Neuf. The present statue in Napoleon's own costume, by Seurre, was fixed on the column in May, 1833, in place of the fleur-de-lis and flag-staff, which were originally substituted for the statue by Chaudet. Chaudet was likewise a painter of considerable merit; and his widow also, Madame Chaudet, distinguished herself as a *genre* and portrait painter.

(Gabet, *Dictionnaire des Artistes*, &c.)

CHEADLE. [Staffordshire, P. C.]

CHEIRACA'NTHUS, a genus of fossil fishes from the old red sandstone of Gamrie in Forfarshire and the Orkneys. (Agassiz.)

CHEIRANTHUS. [Wall-Flowers, P. C.]

CHEIRO'LEPIS, a genus of fossil fishes from the old red sandstone of the Orkney Islands and Morayshire. The scales are very minute. (Agassiz.)

CHEIROTHE'RIUM. The foot-prints on the red sandstone of Hildburghausen were referred by Kaup to a mammiferous animal under the above title. To the same origin many similar remains in England have been referred. Professor Owen is of opinion that the animal was reptilian, and that it may be regarded as identical with the Labyrinthodon, of the same formations, of which the teeth are very characteristic. The animal was probably a Batrachian Reptile. The footprints occur with ripple marks, and what are called rain marks, on the flaggy red standstones of the Mersey.

CHE'LIFER, a genus of *Arachnidæ* remarkable for the resemblance which the species composing it bear to scorpions. Hence Lamarck styled the order in which he placed them 'les faux scorpions,' associating them with *Galeodes*. The mandibles of *Chelifer* are short, with didactylous extremities. The palpi are two, very long, and fine-pointed, resembling arms, and having claws at their extremities. The maxillæ are connivent, and two in number. The eyes are two in the *Chelifers* proper, as distinguished by Hermann from the species of the genus *Obisium* of Leach, which have four; they are placed at the sides of the thorax. The body is ovate, anteriorly acute, and depressed. The feet are eight.

These curious animals are very small and resemble miniature scorpions deprived of their tails. They run fast, moving backwards, forwards, and often sideways like crabs. They live under stones, in crevices of rocks by the sea-side, under bark of trees, and in houses among old papers and old furniture. They feed upon insects. They are found in all parts of Europe.

CHE'LODUS, a genus of fossil Mammalia proposed by Kaup. It is of the rodent type, allied to the beaver and porcupine, and occurs in tertiary beds at Eppelsheim, near Mayence.

CHEMISTRY. It can hardly have escaped the notice of even the most casual observer of the progress of science in general, that the advance of chemical knowledge within the last few years has been much greater than has ever previously been made in an equal time.

This observation applies with peculiar force to the discoveries which have been effected in the chemistry of organic bodies, whether neutral, acid, or alkaline in their nature: and therefore, in addition to the statements contained in the volumes of the Penny Cyclopædia, there is now presented a nearly unbroken view of the properties and analyses of the organic bodies alluded to.

For the facts connected with this part of the subject we are chiefly indebted to the elaborate work of Liebig on Organic Chemistry, and any one who will refer to it cannot fail to observe how necessarily incomplete must be the account which we can give in the space to which we are limited.

Although this supplement contains so large a proportion of organic chemistry, we trust it will be found that other material points, in so vast and important a field as that of the science treated of, have not been neglected.

Acetal, a compound first formed by Döbereiner, and called by him oxygenated æther. To prepare it, put into a tall wide-mouthed bottle about an inch of alcohol, and suspend over it some watch-glasses containing precipitated platina (platina black) moistened with water, and near the surface of the alcohol.

After the bottle has been left for some months in a warm place, it is found to contain an acid liquid consisting of acetal, aldehyde, acetic acid, and acetic æther. It is to be saturated by the addition of chalk, and to be repeatedly treated with chloride of calcium, till it is no longer moistened, and as soon as the boiling-point rises to 202° the product is pure acetal, possessing the following properties:—It is a thin colourless liquid, of a pungent æthereal odour: its density is 0·823, and its boiling-point 204°. It is soluble in seven parts of water, and miscible with alcohol in all proportions. When mixed with an alcoholic solution of potash, it gradually absorbs oxygen from the air, and gives rise to aldehyde-resin.

Its formula is $C^8 H^9 O^3$, and may be regarded as a compound of æther and aldehyde. It is composed of

Eight equivalents of Carbon . $6 \times 8 = 48$
Nine equivalents of Hydrogen $1 \times 9 = 9$
Three equivalents of Oxygen . $8 \times 3 = 24$
—
Equivalent . . 81

Acetone, *Pyroacetic Spirit*, is obtained by the decomposition of acetic acid. It is best prepared by heating dry acetate of lead gradually to redness in a coated glass retort, to which a receiver is adapted and kept cool. Carbonic acid gas is evolved, and in the receiver there condenses a volatile product contaminated with tar. This, which is the crude acetone, is to be saturated by the addition of an alkali, and then rectified from chloride of calcium in a water-bath; acetone is also formed, with other products, when acetic acid in vapour is passed through a red-hot iron tube.

The properties of acetone are, that it is a colourless limpid liquid; its odour is peculiar, penetrating, and somewhat aromatic; its specific gravity is 0·792; it boils at 132°, and the density of its vapour is 2·019. It mixes in all proportions with alcohol, æther, and oil of turpentine. It is very inflammable, and is not affected by exposure to the air. It is composed of

Three equivalents of Carbon . $6 \times 3 = 18$
Three equivalents of Hydrogen $1 \times 3 = 3$
One equivalent of Oxygen . 8
—
Equivalent . . 29

Its formula is $C^3 H^3 O$, and results from the separation of acetic acid into acetone and carbonic acid. Acetone may also be obtained by distilling sugar, starch, or gum, with eight times their weight of lime.

Aconitina, a vegetable alkali which exists in aconite

(*Aconitum Napellus*) in combination with an acid which has been called *aconitic acid.* It crystallizes from a solution in dilute alcohol in white grains; it is also often obtained in the state of a vitreous, transparent, compact mass. It is inodorous, but it is intensely bitter and acrid. It is extremely poisonous; 1-50th of a grain is sufficient to kill a sparrow in a few minutes, and a tenth of a grain instantly. It dilates the pupil. It is very slightly soluble in cold water, unalterable in the air, very fusible, and not volatile; its alkaline reaction is very distinctly marked; it requires 50 parts of boiling water to dissolve it, and the solution does not become turbid on cooling; it is very soluble in alcohol and in æther.

The salts of aconitina which have been hitherto examined do not crystallize, but dry in the state of a bitter gummy mass, which is acrid and very poisonous.

Fuming nitric acid dissolves it without colour; concentrated sulphuric acid colours it at first yellow and then reddish violet. The solution is precipitated in abundant white flocculi by infusion of galls; it is not precipitated by solution of platina, but tincture of iodine gives with it a kermes-coloured precipitate. It is employed in medicine, and directions are given for its preparation in the London Pharmacopœia. It does not appear to have been analysed.

Æthers, Silicic. These compounds have recently been obtained by M. Ebelman by the following process:—Cautiously pour absolute alcohol into chloride of silicium, and a vivid reaction takes place, with an abundant disengagement of hydrochloric acid gas, and a considerable reduction of temperature; when the weight of the alcohol added rather exceeds that of the chloride of silicium, no further disengagement of gas is perceived, and the liquor becomes sensibly warm. When subjected to distillation, hydrochloric æther first passes over, and afterwards the greater part of the liquid distils between 320° and 340° Fahrenheit; the latter product is to be set aside and the distillation continued, until it terminates at above 570° Fahrenheit: there remains a mere trace of silica in the retort.

The product obtained between 320° and 338° being rectified until its boiling-point became fixed between 323° and 325°, a colourless liquid was obtained, possessing a penetrating and æthereal odour, a strong hot taste, and a density of 0·932. Water does not combine with it, but decomposes it very slowly, with a deposit of silica; it is perfectly neutral to test-papers; alcohol and æther combine with it in all proportions; the alcoholic solutions of the alkalis decompose it rapidly, and the acids separate from it gelatinous silica. When a few drops are thrown upon red-hot platina, combustion occurs with a white flame, and silica is deposited in the state of impalpable powder. The density of its vapour is 7·18.

By analysis it appears to consist of

One equivalent of Silica or Silicic Acid .	16
One equivalent of Oxide of Ethyl or Æther ..	37
Equivalent	53

Its symbol is, SiO C^4H^5O.

On receiving in separate portions the product distilled between 338° and 570°, the carbon and hydrogen were constantly found to be in the same proportion in the æther, but that of the silica was increased with the temperature; the liquid distilled at above 570° is colourless, has a weak smell, and a taste different from the æther above described. Its density is 1·035. The action of water and the alkalis upon this compound is similar to that upon the æther already mentioned. Analysis indicates that it contains twice as much silica as the foregoing, and that its formula is 2SiO, C^4H^5O.

The above-described æthers are extremely curious compounds, owing to the volatilization of the silica in combination with ethyl, an effect produced only besides by fluorine.

Albumen, Animal and Vegetable. The composition of animal albumen has been ascertained by Mülder; the results do not greatly differ from those which have already been given, except that the proportions of the very small quantity of phosphorus and sulphur which it contains are stated. One hundred parts consist of

Carbon . . .	54·84
Hydrogen . . .	7·09
Oxygen . . .	21·23
Azote . . .	15·83
Phosphorus . . .	0·33
Sulphur . . .	0·68
	100·

The phosphorus and sulphur, though small in quantity, have been considered as in chemical combination, and the formula of albumen has been stated to be C^{400} H^{310} O^{120} N^{50} PS^2; so complex a constitution is, however, highly improbable.

Vegetable albumen is composed of

Carbon . . .	55·01
Hydrogen . . .	7·23
Oxygen, sulphur, and phosphorus	21·84
Azote . . .	15·92
	100·

Alcarsin and **Alcargen.** [Cacodyl, in Chemistry, P. C. S.]

Aldehyde, or Hydrated Oxide of Acetyl, the hypothetical base of acetic acid. When the vapour of alcohol or æther is passed through a red-hot tube, aldehyde is one of the products. It may be procured also by mixing 6 parts of sulphuric acid, 4 of spirit, and 4 of water, to which mixture is to be added 6 parts of powdered binoxide of manganese, contained in a large retort, with a cooled receiver adapted to it: by a gentle heat about 6 parts are to be distilled; the product is to be twice distilled from an equal weight of chloride of calcium, and then to be mixed with twice its volume of æther, and saturated with dry ammoniacal gas; by these means a white crystalline compound is obtained, which is to be dried by exposure to the air. This is to be distilled from a water-bath with a mixture of equal parts of sulphuric acid and water. When rectified at a temperature not exceeding 87°, the aldehyde is obtained in a state of purity.

The properties of aldehyde are—that it is a limpid colourless liquid, having an æthereal and suffocating smell; its specific gravity is 0·790; it boils at 72° Fahrenheit, and mixes in all proportions with water, alcohol, and æther; it is neutral to test-paper: but when exposed to oxygen it is partly converted into acetic acid. Its formula is $C^4H^4O^2$, or AeO+HO; or it consists of

Four equivalents of Carbon .	6 × 4 = 24
Four equivalents of Hydrogen .	1 × 4 = 4
Two equivalents of Oxygen .	8 × 2 = 16
Equivalent . .	44

Its name is derived from *alcohol dehydrogenatus*, it being equal to 2 equivalents of alcohol when deprived of 2 equivalents of hydrogen.

When combined with ammonia, *aldehyde-ammonia* is formed, which, as already noticed, is a crystalline body; when heated with potash, a brown resin-like substance is produced called *aldehyde-resin.* When long kept it is apt to undergo two isomeric modifications, one called *elaldehyde*, which is liquid, and the other *metaldehyde*, a solid compound. Aldehyde combines with and dissolves phosphorus, sulphur, and iodine; by chlorine and bromine it is decomposed, yielding hydrochloric or hydrobromic acid, and some oleaginous products which contain chlorine and bromine; dilute nitric acid, by imparting oxygen, converts it into acetic acid.

Aldehydic Acid is obtained by dissolving oxide of silver in aldehyde, and decomposing the solution by means of hydrosulphuric acid. An acid liquid is obtained which is very readily decomposed; its formula is $C^4H^3O^2+HO$; it appears to contain the elements of acetic acid minus an equivalent of oxygen.

Alizarin. [Madder, P. C.]

Allotoin, Allantoic Acid. This substance exists in the allantoic liquid of cows, and has since been obtained by Liebig and Woehler artificially by treating uric acid with binoxide of lead: one part of the acid is to be boiled in two parts of water, and the binoxide of lead is to be added in small portions at a time, as long as it continues to alter in colour; the solution is to be filtered and evaporated until crystals begin to form at the surface; the crystals obtained on the cooling of the liquor are to be purified by repeated crystallization. It may also be procured from the allantoic liquid of cows by evaporating it with a gentle heat to one-fourth of its volume. The crystals obtained on cooling, are to be treated with animal charcoal, and are then pure.

The properties of allantoin are—that it has the form of brilliant colourless crystals derived from the rhomboid, with a vitreous appearance. It is insipid, does not act upon vegetable colours, dissolves in 160 parts of cold water, and in much less when boiling. It is soluble in nitric acid, and decomposes by boiling in it without evolving nitric oxide; it dissolves, when heated, in the carbonated alkalis, and crystallizes unaltered from their solutions; but when boiled in caustic potash it is decomposed into ammonia and oxalic acid, which combine. By analysis allantoin appears to be composed of

Four equivalents of Carbon	6 × 4 =	24
Three equivalents of Hydrogen	1 × 3 =	3
Two equivalents of Azote	14 × 2 =	28
Three equivalents of Oxygen	8 × 3 =	24
	Equivalent	79

Its formula is $C^4 H^3 N^2 O^3$.

ALLOXAN. This substance is obtained by the action of nitric acid on uric acid in the following manner: Add, by small portions at a time, 1 part of uric acid to 4 parts of nitric acid of specific gravity 1·41 or 1·5; the uric acid dissolves with effervescence and the disengagement of heat, which must be moderated by cooling the vessel. Small white granular brilliant crystals are gradually formed, and the liquor soon becomes a mass of them; this is to be allowed to drain in a funnel, and then dried on a porous brick; they are to be purified by repeated crystallization from solution in boiling water.

When alloxan crystallizes from a solution which is not saturated, the crystals have the form of an octohedron with a rhombic base, and they are colourless, transparent, very brilliant, often an inch in diameter; they are very efflorescent, and lose 25 per cent. = 6 equivalents of water. When a hot saturated solution of alloxan is made to crystallize, anhydrous alloxan is obtained in oblique rhombic prisms.

Alloxan is very soluble in water; it possesses a disagreeable smell, and a somewhat astringent saline taste. It reddens vegetable colours, and renders the epidermis purple. The alkalis decompose it with the formation of alloxanic acid, and when heated to ebullition with an alkali it is converted into urea and mesoxalic acid; it is converted into alloxantin by sulphuretted hydrogen; when subjected to the combined action of an alkali and a protosalt of iron, an indigo blue liquor is produced.

It contains

Eight equivalents of Carbon	6 × 8 =	48
Four equivalents of Hydrogen	1 × 4 =	4
Two equivalents of Azote	14 × 2 =	28
Ten equivalents of Oxygen	8 × 10 =	80
	Equivalent	160

Its formula is $C^8 H^4 N^2 O^{10}$.

ALLOXANIC ACID. This is produced by the action of the alkalis upon alloxan, and when sulphuric acid is added to alloxanate of barytes, the acid remains in solution, which is very sour, and by evaporation yields crystals in needles radiating from a common centre. It neutralizes bases perfectly, and decomposes the carbonates; when neutralized by ammonia it gives a white precipitate in solution of silver, which becomes yellow by ebullition, and afterwards black with effervescence. It dissolves zinc with the evolution of hydrogen gas.

It is composed of

Four equivalents of Carbon	6 × 4 =	24
One equivalent of Hydrogen	=	1
One equivalent of Azote	=	14
Four equivalents of Oxygen	8 × 4 =	32
	Equivalent	71

Its formula is $C^4 H NO^4$.

ALLOXANTIN. This substance was first observed by Dr. Prout during the decomposition of uric acid by nitric acid. It may be obtained from alloxan; but the best method appears to be that of boiling uric acid in 52 parts of water, and then adding a little nitric acid until it is perfectly dissolved; the solution is then to be evaporated to two-thirds; in a day or two alloxantin is deposited in crystals, which are to be purified by re-crystallization. The crystals are colourless, and in the form of oblique four-sided prisms; they become red when exposed in the air to ammonia; they are hard, fragile, easily reduced to powder, and may be heated to 212° without losing weight; but at 302° they lose 3 equivalents, or 15·4 per cent. of water.

Alloxantin is slightly soluble in cold, but more soluble in hot water; the solution reddens litmus; when heated in a solution of chlorine, it is converted into alloxan; with the salts of silver it produces a black precipitate of metallic silver. The alkalis decompose it; barytes water produces a violet precipitate, which is destroyed by heat.

It is composed of

Eight equivalents of Carbon	6 × 8 =	48
Ten equivalents of Oxygen	8 × 10 =	80
Five equivalents of Hydrogen	1 × 5 =	5
Two equivalents of Azote	14 × 2 =	28
	Equivalent	161

Its formula is $C^8 O^{10} H^5 N^2$.

ALUMINA. The compounds of this substance with the alkalis have been called *aluminates*, this earth, or rather metallic oxide, being assumed to act the part of an acid in such combinations; and nature presents us with compounds in which it is combined with the alkaline earths, lime and magnesia.

Lately, however, a crystalline and definite aluminate of potash has been formed: it may be prepared either by dissolving alumina, precipitated by carbonate of ammonia, in potash, or by fusing in a silver crucible anhydrous alumina with excess of potash. If the solution, obtained in either mode, be evaporated under the receiver of an air-pump, it will, when sufficiently concentrated, readily deposit hard brilliant crystals of aluminate of potash: this salt always retains some alkaline solution, and may be crystallized a second time.

Aluminate of potash is white, very soluble in water, but insoluble in alcohol; it has a caustic taste and an alkaline reaction; a certain quantity of water decomposes it, precipitates alumina nearly pure, and retains in solution a very alkaline aluminate.

One hundred parts of this salt, previously dried in vacuo, yielded—

Alumina . . .	40·6
Potash . . .	37·5
Water . . .	21·2
	99·3

It appears therefore to be a teraluminate of potash, consisting of

Three equivalents of Alumina	18 × 3 =	54 or	41·8
One equivalent of Potash .	=	48	37·2
Three equivalents of Water .	9 × 3 =	27	21
	Equivalent	129	100

Aluminate of soda may be formed in the same way as aluminate of potash, but it crystallizes less readily.

AMMELIDE is prepared by dissolving ammeline, melam, or melamine, in concentrated sulphuric acid, and treating the solution with alcohol; the precipitated ammelide is to be washed with cold water till all adhering acid is removed; it must then be purified by dissolving in nitric acid and precipitating by carbonate of ammonia.

The properties of ammelide are—that it is a white powder, insoluble in water, alcohol, and æther, but dissolved by the alkalis and the powerful acids; with nitric acid it forms a crystalline compound which is decomposed by water; when long exposed to the action of nitric acid or of sulphuric acid diluted and boiling, it is completely decomposed into ammonia and cyanuric acid. When nitrate of silver in slight excess and afterwards ammonia are added to a hot and saturated solution of ammelide in nitric acid, a white flocculent precipitate is formed: this consists of ammelide in which two equivalents of water are replaced by two equivalents of oxide of silver. This compound is insoluble in water, blackens by exposure to the light, and dissolves in nitric acid.

The formula of ammelide is $C^{12} H^9 N^9 O^6$.

AMMELINE. This substance may be obtained by more than one process: when melam is dissolved in boiling dilute hydrochloric acid, there are obtained by evaporation crystals of hydrochlorate of ammeline and of melamine, which are to be dissolved in boiling water. When ammonia is added to the solution, a precipitate of ammeline is obtained, which is to be washed.

The properties of ammeline are, that it is of a splendid white colour, and is composed of very fine silky needles; it is insoluble in water, alcohol, and æther, but soluble in the caustic alkalis. When subjected to dry distillation there are produced ammonia, mellon, and a crystalline sublimate. It dissolves in acids, and yields crystallizable salts, especially with nitric acid, with which it forms large laminæ or long quadrangular prisms. It is however a weak basis, combining only with strong acids, and never with organic acids. When fused with hydrate of potash, ammeline is converted into ammonia and cyanate of potash.

Its formula is $C^6 H^5 N^5 O^2$.

AMIDES AND AMIDOGEN. Under **AMMONIUM**, P.C., we have mentioned the supposed existence of a substance so called, derived from ammonia, possessing metallic properties, and consisting of 4 equivalents of hydrogen and 1 equivalent of azote. It has also been supposed that another compound exists, though it has never been isolated, which consists of 2 equivalents of hydrogen and 1 equivalent of azote; this is imagined to exist in certain compounds called *amides*, and as being their base is termed *amidogen*, so that ammonia, on becoming ammonium, gains 1 equivalent of hydrogen, while in becoming amidogen, it loses 2 equivalents of the same element. When potassium is heated in ammoniacal gas, the metal is converted into a fusible green matter, which appears to contain the amide of potassium, an equivalent quantity of hydrogen being disengaged during its formation.

Amides are also produced by the abstraction of the elements of water from compounds of the oxygen acids and ammonia; thus, when anhydrous sulphuric acid in vapour is mixed with ammoniacal gas, a saline substance is produced, which, when dissolved in water, does not give the usual indications of containing sulphuric acid, nor does it contain ammonia, but it is supposed to be what is termed a *sulphamide*, containing water, and the changes which occur appear to be these:—The sulphuric acid yields one of its 3 equivalents of oxygen to combine with one of the 3 equivalents of hydrogen which the ammonia contains, and these consequently form an equivalent of water; then there remains a compound of 1 equivalent of sulphur + 2 equivalents of oxygen, and a compound of 1 equivalent of azote + 2 equivalents of hydrogen, constituting amidogen, and this uniting with the compound of sulphur and 2 equivalents of oxygen yields sulphamide, represented by NH^2, $SO^2 + HO$, which, differently arranged, represent an equivalent of anhydrous sulphate of ammonia, or NH^3, SO^3.

In the same way, when oxalate of ammonia is heated, the acid losing an equivalent of oxygen and the ammonia an equivalent of hydrogen, there is produced what is termed *oxamide*. [Oxamide, P. C.]

Thus:—

Oxalate of Ammonia . . $NH^3\ C^2\ O^3+2HO$
Subtract the elements of Oxamide $NH^2\ C^2\ O^2$

There are left $H \quad O\ +2HO$

Amygdalin, a substance obtained from bitter almonds after the fixed oil has been expressed. Its properties are—that it has the form of small, white, pearly, crystalline plates, which are inodorous and nearly tasteless. Amygdalin is decomposed by heat, exhaling a peculiar odour and leaving a bulky coal. It is very soluble in water, both hot and cold; a hot solution deposits brilliant prismatic crystals in cooling, which contain water. When heated with dilute nitric acid, or with a mixture of dilute sulphuric acid and binoxide of manganese, it is resolved into ammonia, bitter almond oil, and benzoic, formic, and carbonic acids.

It consists of

Forty equivalents of Carbon	6 × 40 =	240
Twenty-seven equivs. of Hydrogen	1 × 27 =	27
Twenty-two equivalents of Oxygen	8 × 22 =	176
One equivalent of Azote	=	14
	Equivalent	457

Its formula is $C^6\ H^{27}\ O^{22}\ N$.

Antiarin, the poisonous principle of the *upas antiar*. It forms small pearly crystals, soluble in 27 parts of boiling water, and also in alcohol, but scarcely in æther; it cannot be sublimed without decomposition. Introduced into a wound it rapidly brings on vomiting, convulsions, and death.

It consists of

Fourteen equivalents of Carbon	6 × 14 =	84
Ten equivalents of Hydrogen	1 × 10 =	10
Five equivalents of Oxygen	8 × 5 =	40
	Equivalent	134

Its formula is $C^{14}\ H^{10}\ O^5$.

Apiin, the name given by its discoverer, M. Braconnot, to the peculiar principle of parsley, obtained from it by solution in water. In cold water and alcohol it is nearly insoluble, but dissolves readily in either of them when heated, the solutions obtained gelatinizing as they cool. The solution has a yellow colour. Apiin is soluble in the alkalis and in lime-water; the solutions are yellow, and when an acid is added, apiin is precipitated in a gelatinous state. When it is boiled with dilute acids, apiin undergoes a peculiar modification. If a small quantity of sulphuric acid be added to a boiling solution of apiin, it soon becomes turbid, and is converted into a thick yellowish fluid. On filtration after cooling, and saturation of the acid with chalk, a small quantity of sugar remains in solution; the portion precipitated becomes of a yellowish white colour after washing and drying, and weighs but little less than the apiin submitted to experiment: it is neutral, inodorous, insipid, and insoluble in cold water, but it dissolves in boiling water or alcohol; the solutions do not gelatinize on cooling, but precipitate in white opaque flocculi.

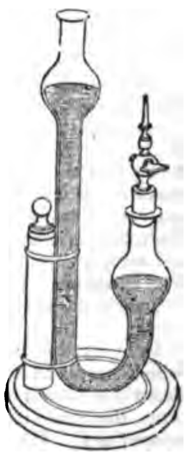
Apiin dissolves in concentrated sulphuric and hydrochloric acids, and is precipitated from them by water in the state above described: M. Braconnot inclines to the opinion that this is pure apiin, and that that which gelatinizes is a compound of apiin with one of the substances which the acids convert into sugar, an operation after which the apiin is exhibited in its proper character. Apiin produces a characteristic action with protosulphate of iron, producing with it a blood-red colour, which is so intense that about 16 grains of it dissolved in five gallons of water visibly colour it. The apiin which does not gelatinize produces the same effect: a solution of it in boiling water gives a blood-red precipitate with a solution of the salt of iron. With nitric acid apiin yields carbazotic acid and some traces of oxalic acid.

Apophyllic Acid is obtained from *cotarnina* [Chemistry, P. C. S., p. 342], and is not formed with certainty. It crystallizes with or without water; in the latter case the crystals have the form of rhombic octohedrons, which are colourless: the cleavage faces have a pearly lustre resembling apophyllite, and hence the name bestowed on this acid. The crystals lose water, when heated, even under water, and become white without altering their form: they contain 9 per cent. of water, and are but little soluble in water. A saturated boiling solution yields long prismatic crystals on cooling, which do not effloresce; the acid which crystallizes from a solution that has not been boiled, has the cubo-octohedral form, and contains water.

This acid has a slightly acid and astringent taste; it reddens litmus-paper, and it is insoluble in alcohol and in æther. The salts which it forms with bases are soluble: the ammoniacal salt crystallizes in tables, and is very soluble; the salt of silver, formed by double decomposition, is after a certain time deposited in stellated crystals, which gradually increase in size; they explode at a moderate heat with the same violence as oxalate of silver; the residue is as black as charcoal, and after combustion leaves metallic silver. It has not been analyzed owing to the small quantity hitherto obtained by M. Wöhler, its discoverer.

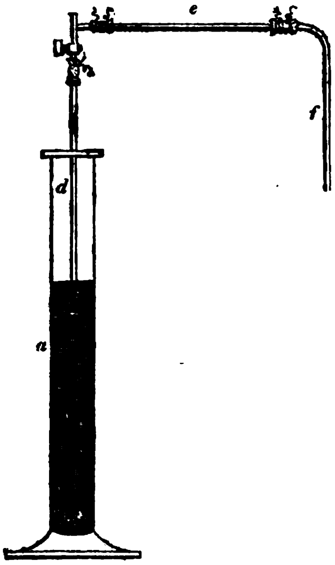
Arabin. [Gum, P. C.]

Arsenic, *Detection of*. In addition to the modes of detecting arsenic already given, we may describe that proposed by Mr. Marsh, which is of unquestionable delicacy, and may be adopted in conjunction with that of reducing the oxide to its metallic state; indeed it is such in point of fact. The liquid suspected to contain the poison is acidulated with sulphuric acid and placed in contact with metallic zinc, both of which must be previously ascertained to be free from arsenic; if any arsenic be present in the liquid, the hydrogen gas generated reduces and dissolves it, forming arsenuretted hydrogen gas. This gas is to be lighted at a jet, and a piece of white porcelain or of glass is to be held over the flame, when, if any arsenic be present, a brilliant black spot of metallic arsenic is deposited on the glass or porcelain. It has been supposed that antimony will produce similar results, but it is stated in reply to this, that arsenic when received on glass is nut-brown by transmitted light, while that from antimony is grey-black, and both are opaque at the centre. The annexed drawing represents a convenient form of instrument for the purpose: it consists of a bent tube, having two bulbs blown upon it, fitted with a stop-cock and narrow jet. Slips of zinc are to be put into the lower bulb, which is afterwards to be filled with the acidulated liquid to be examined; on replacing the stop-cock, closed, the hydrogen gas, or arsenuretted hydrogen gas, as the case may be, collects and forces the fluid into the upper bulb, which then acts by its hydrostatic pressure, and expels the gas through the jet as soon as the stop-cock is opened.



The other method of proceeding is to boil a slip of bright metallic copper in the fluid suspected, previously acidulated with hydrochloric acid. If arsenic be present, the copper is covered with a whitish alloy, and then by heating the metal in a test tube, the arsenic is volatilized, and sublimes in the metallic state in the cold part of the glass. This method is susceptible of detecting very minute portions of arsenic.

The scientific committee of the Prussian government has suggested an improvement in Marsh's apparatus, which in the opinion of Berzelius surpasses all other modifications on account of the certainty and distinctness of the result. The annexed figure shows the simple arrangement of the apparatus :—



a is a glass tube 1¼ inch in diameter and 10 inches long, contracted at the lower extremity to an aperture half an inch in diameter. It should be of thick glass, so as to possess the requisite strength. A glass tube *d*, 2 lines in width and 20 inches long, is joined to the upper end, which is likewise contracted. A brass stop-cock is fixed, by means of a short caoutchouc tube, air-tight, to the upper extremity of this tube, closed at the summit, and provided with a short lateral tube at a right angle with it, to which a narrow straight glass tube, 8 inches in length, *e*, is connected, air-tight, by means of caoutchouc. To the other extremity of tube *e*, a second descending tube *f*, bent at right angles, is affixed.

Some strips of zinc, ascertained to be free from arsenic, are inserted in the tube *a* through the inferior aperture; they should be of such length as to reach to two-thirds of the tube, in which they are maintained by a spirally-wound copper wire, which is likewise inserted through the inferior aperture. The tube, thus arranged, is placed in a glass cylinder, whose inner diameter is rather greater than required to admit it, and from 16 to 18 inches in height.

The acid liquor to be tested for arsenic is poured into this cylinder to such a height, that when the tube *a* is filled with it, it stands 1 or 2 lines above the connexion of *a* with *d*. The cock is then opened, so that the liquid may enter and fill the tube, when it is again closed. The zinc now dissolves, and the liquid is forced back again through the inferior aperture of *a* into the cylinder. If any froth is formed in the operation, as is usually the case, the apparatus is shaken gently, that the zinc strips may destroy the froth, and cause it to subside.

In the mean time the tube *e* is heated to redness in the centre, or somewhat nearer to the cock, by means of an Argand spirit-lamp, the open extremity of the tube *f* being immersed in water contained in a convenient vessel; and when *e* is perfectly red-hot, the cock is opened sufficiently to admit of the gas passing in slowly successive bubbles through the tube *f* into the water. It must not be allowed to proceed faster if the whole of the arsenic is to be deposited from the gas, on its passage over the incandescent part. As soon as the tube *a* is again filled with liquid, the cock is closed, and not opened until the whole of the liquid has been expelled. The experiment is continued in this manner until a quantity of arsenic has been deposited sufficient to apply the necessary tests.

In order to collect gradually the whole of the arsenic which has been deposited near the incandescent spot, the flame is advanced by degrees as far as the centre of the tube, when the whole of the arsenic will be contained in the half nearest to *f*. When the cork is closed, the tube is filled with hydrogen gas, and we are able to test by sublimation whether the body deposited has the volatility of arsenic, that is, whether it sublimes at a gentle heat; and consequently to ascertain whether it is pure arsenic, or accompanied by any other less volatile bodies, antimony for instance. The arsenic is then collected so as to form a ring in the interior of the tube, which, when it has become cold, is removed, and a fresh one substituted for it; and the arsenic is collected in this manner in fresh tubes as long as the liquid affords any gas.

The glass tube which has been removed is cut with a file near the place where the arsenic is collected, and this is placed in a small glass containing fuming nitric acid, in which the arsenic is dissolved with the assistance of heat. The solution obtained is then evaporated over a water-bath on a watch-glass to dryness, to drive off the nitric acid. Arsenic acid is soluble in water, while antimonic acid, or oxide of antimony, is insoluble. The arsenic acid, when mixed with neutral nitrate of silver, yields a brick-red precipitate of arseniate of silver. The arsenic collected in the second tube is not employed in this manner, but sealed at both ends, and preserved to be presented as evidence.

The third tube should be of rather greater diameter, in order that after the arsenic has been collected in it and the hydrogen gas expelled by air, the arsenic may be oxidized in it and sublimed as arsenious acid, when the usual octohedral form of the crystals may be recognised by the magnifying glass. The arsenious acid may be then washed out with water containing a little ammonia to test it with nitrate of silver.

The zinc and sulphuric acid employed in these experiments are previously submitted to examination in the apparatus, in order to ascertain that they are free from arsenic.

The great advantage of the above-described apparatus is stated to be that none of the arsenic is lost, as the experimenter has it in his power to regulate the passage of the gas through the heated tube as slowly as he chooses, and the disengagement of gas may be stopped at pleasure, if any circumstance should require delay.

Asparagin, a peculiar substance obtained from asparagus, and also from marshmallow root; it is also contained in the potato, liquorice-root, and beet-root.

It crystallizes in transparent, limpid, colourless prisms. It is inodorous, has a mawkish disagreeable taste, and is rather hard; it dissolves more plentifully in hot water than in cold, and is dissolved by dilute alcohol, but is insoluble in absolute alcohol, æther, and in oils, both volatile and fixed.

Acids, as well as the alkalis, decompose it when heated, but not when cold: the results are aspartic acid and ammonia.

It consists of

Eight equivalents of Carbon	6	×	8	=	48
Eight equivalents of Hydrogen	1	×	8	=	8
Six equivalents of Oxygen	8	×	6	=	48
Two equivalents of Azote	14	×	2	=	28
		Equivalent			132

Its formula is $C^8 H^8 O^6 N^2$.

Aspartic acid contains 3 equivalents less of hydrogen and 1 less of azote.

Bell-metal, an alloy of copper and tin, to which small proportions of zinc, and it is even stated of lead, are sometimes added. According to Dumas, the most famous compound consists of four parts of copper and one part of tin, which are not far from four equivalents of copper and one equivalent of tin. [Bronze, P. C.; Bell-Casting, P. C. S.]

Benzile. In order to obtain this compound a current of chlorine gas is passed into melted benzoin till the evolution of hydrochloric acid ceases. The mass obtained by cooling is to be dissolved in boiling alcohol, which as it cools deposits pure benzile.

Benzile crystallizes in six-sided prisms; they are transparent, inodorous, and tasteless, and of a sulphur yellow colour; they fuse at about 200°, are insoluble in water, but dissolve in alcohol and æther; volatile without decomposing, insoluble in an aqueous solution of potash, even when boiled in it, but dissolved in an alcoholic solution of this alkali, and decomposed with the production of a blue colour and of benzilic acid. Formula $C^{14} H^5 O^2$, which is the same as that of benzule.

Benzilic Acid.—Formed by boiling benzoin or benzile in an alcoholic solution of potash, in which they dissolve readily with a violet colour, which disappears by continued boiling; small portions of potash are to be added occasionally as long as it causes any blue colour, after the previous portion has been decolorized by boiling; the solution is then to be carefully neutralised by hydrochloric acid, which separates a resinous matter; to the filtered solution excess of hydrochloric acid is added, and on cooling the benzilic acid crystallizes.

The properties of this acid are—that it is in the form of colourless, brilliant, transparent, rhombic crystals, or in long prismatic crystals; it is sparingly soluble in cold water, but dissolves more readily in boiling water. It melts at 248°, and is not volatilized; at a higher temperature benzoic acid is obtained, accompanied with violet vapours, and a residue of charcoal. Concentrated sulphuric acid dissolves it cold, and acquires a bright crimson colour.

The formula of benzilic acid is $C^{28}H^{11}O^{5}+HO$, or two equivalents of benzile and one equivalent of water.

Benzilic acid combines with bases to form salts, and of these the potash and silver salts have been examined: the former crystallizes in large transparent crystals, which are soluble in water and in alcohol; the latter salt is a white crystalline powder, insoluble in water; its formula is $C^{28}H^{11}O^{5}$, AgO.

Benzimide is one of the ingredients of crude bitter almond oil; it crystallizes in laminæ or white acicular crystals, which are very light and have a pearly lustre. Benzimide is insoluble in water, very slightly dissolved by boiling alcohol, and rather more soluble in pyroxilic spirit; it melts at 332°, is very inflammable, and burns with a red sooty flame; it is dissolved and decomposed by concentrated hydrochloric, nitric, and sulphuric acids; the latter solution has a deep indigo blue colour, and becomes emerald green in moist air; this reaction is characteristic of benzimide. Its formula is $C^{28}H^{13}O^{4}N$.

Benzoen. [Hydrogen—*Carburets*, P. C.]

Benzule denotes the hypothetical radicle of a series of compounds which are produced from the volatile oil of the bitter almond, or are connected with it by certain relations. Indeed we have already stated [Benzoic Acid, P. C.] that benzule is the supposed basis of that acid, to which it gives rise when combined with an additional equivalent of oxygen. Although it has never been isolated, yet it is imagined to exist, since, like cyanogen, it appears to act the part of a compound base or radicle. It is composed of 14 equivalents of carbon = 84, 5 equivalents of hydrogen = 5, and 2 equivalents of oxygen = 16, making its equivalent 105. Its formula is $C^{14}\ H^{5}\ O^{2}$, and its symbol Bz. We shall now state the compounds of benzule which are to be added to those already given.

Benzule, Hydruret of. When the residue of bitter almonds from which the fixed oil has been expressed is distilled with water, the product of the operation is bitter almond oil, which does not appear to exist previously in the almonds. This oil contains benzoin, benzoic acid, and hydrocyanic acid; to purify it, it is made into a thin paste with water, hydrate of lime, and chloride of iron, and redistilled; the oil which passes over is freed from admixture with water by exposure to chloride of calcium. Hydruret of Benzule, when pure, is a transparent limpid fluid, of a strong peculiar odour, and burning taste; its specific gravity is 1·043; it refracts light strongly, and boils at 356°. It is soluble in 30 parts of water, and mixes with alcohol and æther; its vapour is inflammable, and burns with a smoky flame; when exposed to the air it absorbs oxygen and is converted into a mass of benzoic acid. When treated with solid hydrate of potash, it disengages hydrogen and yields benzoate of potash. The crude product, which is extremely poisonous, is however sometimes used for flavouring custards, &c.

It is composed of benzule combined with an equivalent of hydrogen, and its formula is $C^{14}\ H^{5}\ O^{2} + H$, or Bz + H: its equivalent is 106.

Benzule, Chloride of. This is prepared by passing a current of chlorine through anhydrous hydruret of benzule, until hydrochoric acid ceases to be evolved; the yellow mixture obtained is to be heated until it becomes colourless.

The chloride of benzule is a colourless liquid, which possesses a peculiar, very strong, and disagreeable odour, and it affects the eyes; its specific gravity is 1·106; it boils at 417°; its vapour is inflammable, and it burns with a sooty flame which is green on the edges. Cold water slowly, and hot water more readily, converts it into hydrochloric and benzoic acid. When treated with the alkalis, an alkaline benzoate and chloride are produced. It dissolves phosphorus and sulphur without any change; when added to protochloride of phosphorus, great heat is excited, and there are produced perchloride of phosphorus and an oily substance. Ammoniacal gas decomposes it into benzamide and hydrochloric acid; by alcohol it yields oxide of ethyl and hydrochloric acid; æther and bisulphuret of carbon produce no change in it.

It is composed of 14 equivalents of carbon = 84, 5 equivalents of hydrogen = 5, 2 equivalents of oxygen = 16, 1 equivalent of chlorine = 36; its equivalent is 141, its formula $C^{4}\ H^{5}\ O^{2}$ Cl, or Bz Cl.

Benzule, Bromide of, is prepared in the same way as the chloride. Its properties are—that it forms colourless scaly crystals, which by exposure to the air become brown; water and the alkalis decompose it, as they do the chloride; æther and alcohol dissolve it without change. Its formula is $C^{14}\ H^{5}\ O^{2}$ Br, or Bz Br.

Benzule, Iodide of, is prepared by distilling a mixture of chloride of benzule and iodide of potassium; the result of their action is a crystalline mass, coloured brown by an excess of iodine; when pure, the crystals are colourless, but they become brown by exposure to the air; water and the alkalis decompose it. Its formula is $C^{14}\ H^{5}\ O^{2}$ I, or Bz I.

Benzule, Sulphuret of, is obtained by distilling a mixture of sulphuret of lead and chloride of benzule; the product is a soft crystalline mass, which has a very unpleasant smell; boiling water acts but little upon it, but potash converts it into sulphuret of potassium and benzoic acid. It dissolves unchanged in alcohol and æther, and is combustible. Its formula is $C^{14}\ H^{5}\ O^{2}$ S, or Bz S.

Benzule, Cyanide of, is prepared by distilling chloride of benzule with bicyanide of mercury. The product is a yellow oil, which is rendered colourless by rectification. It has a very strong smell, similar to that of cinnamon, which causes tears; its taste is sweetish with an after taste of hydrocyanic acid: it is very inflammable.

Blue, Prussian. [Blue, P. C.]

Bresilin, the colouring-matter of Brazil wood, or Fernambuc (*Cæsalpinia crista, brasiliensis, &c.*). In its pure state this colouring principle is a compact mass, of a deep yellowish red colour, very soluble in water and in alcohol. The aqueous solution is of a reddish yellow colour, and becomes more red by exposure to the air, and paler by the addition of a little sulphuric, hydrochloric, or nitric acid, but reddens by excess of acid, and is precipitated in flocculi. Sulphuretted hydrogen and sulphurous acid decolorize it; strong acids restore the red colour of the solution. Alkalis alter the colour to violet. Phosphoric, sulphuric, hydrochloric, nitric, and citric acids, &c., first render Brazil-wood paper red and then yellow, or even at once yellow; sulphurous acid bleaches it. It is composed of carbon 63·324, hydrogen 3·967, oxygen 34·709, in 100 parts.

According to Chevreul, pure bresilin crystallizes in small acicular crystals of an orange colour, which are partly volatilized by heat, and partly decomposed into a liquid containing acid and ammonia. Nitric acid converts it partly into carbazotic acid.

Bromal, a colourless oleaginous liquid, obtained by the action of bromine upon alcohol; it possesses a very strong and peculiar odour, which excites tears; its taste is caustic; its density 3·34; boils below 212°. It does not act upon vegetable colours, and combines with water, alcohol, and æther. Chlorine and fuming nitric acid decompose it. It dissolves sulphur and phosphorus without altering them. Caustic alkalis convert it into an alkaline formiate and perbromide of formule. Its formula is $C^{4}HO^{2}Br^{3}$. It forms a crystalline solid when combined with water.

Bromine, P. C. Some late experiments seem to prove that the equivalent of bromine is 80, rather than 79 adopted in Bromine, P. C.

Bromoform. This compound is obtained by distilling a mixture of bromide of lime with alcohol and water. It is a heavy liquid, its specific gravity being 2·10. It is volatile. By potash it is converted into bromide of potassium and formiate of potash. Its formula is $C^{2}HBr^{3}$.

Brucia, a vegetable alkali discovered by Pelletier and Caventou. It exists in the bark and seeds of the nux-vomica and in St. Ignatius's bean. Brucia crystallizes by spontaneous evaporation from dilute alcohol, in prismatic crystals, which are colourless, transparent, and often some lines in thickness, and sometimes in stellated needles, or in pearly scales. Brucia is inodorous, has a very bitter taste, and is poisonous. It is unalterable in the air, requires 850 parts of cold and 500 parts of boiling water for solution; it is very soluble both in absolute and dilute alcohol, slightly soluble in volatile oils, and insoluble in æther and fixed oils.

According to Liebig, brucia consists of 44 equivalents of carbon = 284, 25 equivalents of hydrogen = 25, 2 equivalents of azote = 28, 7 of oxygen = 56. Its equivalent is therefore 393. Its formula is $C^{44}H^{25}N^{2}O^{7}$.

Anhydrous brucia, obtained by fusing the crystals, has a waxy appearance; the crystals contain about 16·6 per cent. of water.

It combines with acids to form salts, which are readily obtained by dissolving it in them previously diluted. They possess the following properties:—They are mostly soluble and crystallizable, and have a bitter taste; they are decomposed by ammonia and the fixed alkalis, and by morphia and strychnia, all of which precipitate the brucia; on the addition of tannic acid tannate of brucia is thrown down; nitric acid renders the salts of brucia red.

Bryonin is the peculiar principle of bryony-root to which its power is owing: it is a yellowish white substance, sometimes with a red or brownish tint; its taste is at first rather sweet, then styptic and extremely bitter. It is soluble in water and in alcohol, but insoluble in æther; chlorine does not decompose it; sulphuric acid dissolves it, acquiring first a blue and afterwards a green colour. When decomposed by heat it yields ammonia. Alkalis do not alter it: the aqueous solution is precipitated white by nitrate of silver, and yellow by chloride of gold; white by protonitrate of mercury and by diacetate of lead; tincture of galls precipitates it of a bright grey colour. It is a drastic purgative, and poisonous in too large doses.

Cacodyl *and its Compounds.*—Arsenious acid and acetate of potash are to be accurately mixed and put into a glass retort, to which a cooled receiver is adapted, with an apparatus to carry off the incondensible gaseous product, which is chiefly carbonic acid. When the heat has been long continued, some metallic arsenic and two liquids are found in the receiver: the lighter consists mostly of water, with acetic acid and acetone; and the heavier is impure oxide of cacodyl, or alcarsin, formerly called the *liquor of Cadet.*

The product is obtained in a pure state by repeated washing with water free from air, and redistillation from hydrate of potash in a retort containing hydrogen gas; this operation, on account of the poisonous nature of alcarsin, must be conducted in the open air.

The properties of this substance are—that it is a colourless liquid; its density is 1·462; its smell is extremely disagreeable, and the vapour affects the eyes and nose. Water dissolves little of it, but alcohol takes it up readily; it boils at about 300°, and solidifies, becoming a white crystalline mass, at 9°. By exposure to the air a dense white smoke is emitted, the alcarsin becomes hot, and afterwards burns spontaneously with a pale flame, producing arsenious acid, carbonic acid, and water. It is composed of 4 equivalents of carbon = 24, 6 equivalents of hydrogen = 6, 2 equivalents of arsenic = 76, 1 equivalent of oxygen = 8. Its formula is $C^4H^6As^2O = Kd\ O$.

Chloride of Cacodyl.—Mix a dilute alcoholic solution of oxide of cacodyl with one of bichloride of mercury, avoiding an excess of the latter; by their mutual action a colourless inodorous crystalline precipitate is obtained; and when this is distilled with hydrochloric acid, there are formed water, bichloride of mercury, and chloride of cacodyl, the latter coming over; this is subjected to the action of lime and chloride of calcium, and then distilled in a retort containing carbonic acid gas. The chloride of cacodyl thus produced is a colourless liquid; its odour is more disagreeable and its vapour more poisonous than that of the oxide of cacodyl; it does not fume when exposed to the air, but its vapour, which is colourless, is spontaneously inflammable in it. It is heavier than and insoluble in water; alcohol combines with it readily, but æther does not; its boiling-point is a little above 212°. Its formula is $KdCl$.

Cacodyl. It is from the chloride of cacodyl that this base is immediately obtained. Digest slips of zinc in chloride of cacodyl for three hours, in a glass bulb blown upon a glass tube previously filled with carbonic acid gas. The zinc dissolves without the evolution of any gas; when the residual white saline mass is treated with water, the chloride of zinc dissolves, and a heavy oily liquid separates, which is cacodyl, and is rendered pure by cautious distillation from a fresh portion of zinc.

Its properties are—that it is a thin, transparent, colourless liquid, much resembling the oxide in odour, and is so very inflammable, that when poured into oxygen, chlorine, or the air, it immediately takes fire; it boils at 338°; when cooled to 21° it crystallizes in large transparent square prisms. It is heavier than water, and being nearly insoluble in it, sinks when added to it. Alcohol and æther dissolve it. Its formula is $C^4H^6As^2 = Kd$.

Cacodylic Acid. Alcargen.—When cacodyl or its oxide is left under water to the slow action of the air, they oxidize and become cacodylic acid; or it may be prepared by adding oxide of mercury to oxide of cacodyl, covered with a layer of water, and artificially cooled until the mixture loses all odour; any cacodylate of mercury, which may have been formed, is to be decomposed by the cautious addition of more oxide of cacodyl; by evaporation to dryness and solution in alcohol crystals of cacodylic acid are obtained, which have the following properties: they are colourless, brittle, brilliant, prismatic crystals; permanent in a dry atmosphere, but deliquescent in a moist one. Cacodylic acid is insoluble in æther, but dissolved by alcohol, and the solution has an acid reaction; it yields by combination with the alkalis and evaporation a gummy mass; it forms crystalline compounds with the oxides of silver and mercury. Its symbol is KdO^3.

Cacodyl combines with iodine, sulphur, cyanogen, and various other bodies, yielding compounds which have been particularly described by Bunsen, and of which an account may be seen in Turner's 'Chemistry' and Graham's 'Elements,' and also in Liebig's 'Organic Chemistry.'

Cantharidin. Spanish flies contain a crystalline principle discovered by Robiquet. In order to isolate it, the flies are to be digested in water; the solution is to be evaporated to dryness, and treated with boiling alcohol; the alcoholic solution is to be evaporated to dryness, and treated with æther, which dissolves the cantharidin and by spontaneous evaporation deposits it in the state of micaceous particles, which are to be purified from some yellow matter by washing with alcohol.

The properties of cantharidin are—that when pure, it is insoluble in water; but very soluble in boiling alcohol, and crystallises from it as the solution cools. It is also very soluble in oils, but neither acetic nor hydrochloric acid dissolves it; it melts when heated, and sublimes without decomposing, at a high temperature. It is to this principle that cantharides owe their blistering power.

According to Regnault, cantharidin consists of carbon 61·68, hydrogen 6·04, and oxygen 32·28, or $C^{10}\ H^6\ O^4$.

Capnomor is a colourless, limpid, volatile oil, obtained by Reichenbach, with several other products, from the heavy oil of tar: its odour resembles that of ginger, and it has a styptic after taste. Its density is 0·9775. It is perfectly neutral, boils at 345° Fahrenheit, and distils unaltered; it burns with a sooty flame; it is very slightly soluble in water, but dissolves in alcohol, æther, essential and fixed oils. It dissolves phosphorus, sulphur, and selenium. It combines with chlorine, emitting hydrochloric acid. It mixes with sulphuric acid, and imparts to it a red colour; nitric acid converts it into oxalic acid, carbazotic acid, and another crystalline substance which has not yet been examined. Acetic acid takes up capnomor, and it dissolves several organic acids; potassium and sodium act but slightly upon it, and the alkalis and alkaline earths decompose it but slowly. It has not been analysed.

Carthamin and Carthamein. The yellow colouring-matter of carthamus is to be extracted by water, and it is then to be sprinkled with a very dilute solution of carbonate of soda, which dissolves the carthamin; this is to be precipitated by a salt of lead, and the oxide of lead separated by hydrosulphuric acid. By this treatment a yellow solution is obtained which by spontaneous evaporation yields small prismatic crystals of pure carthamin. Its properties are—that it has a slightly bitter taste, and is only sparingly soluble in alcohol. When exposed to the air it becomes yellow. Sulphuric acid. when cold, dissolves it without alteration, but when heated it blackens; hydrochloric acid and nitric acid do not alter its colour, but dissolve it when heated; when exposed over mercury to oxygen gas, it becomes after some days merely yellowish; but if a little alkali be added to it, it becomes immediately yellow, and then passes rapidly to a rose colour. It is in this state that the acids, and particularly citric acid, precipitate it from the alkali, possessing the well-known fine rose-colour. This red colour is called by M. Preisser *carthamein.* When carthamin is mixed with an alkali, it does not become coloured without the presence of oxygen. Ammonia produces this effect but slowly; neutral acetate of lead added to a solution of carthamin, produces a white precipitate, which first becomes yellow and then rose red, by exposure to the air.

Carthamin submitted to analysis appeared to be composed of

Twenty-six equivalents of Carbon	156	or	76·09
Nine equivalents of Hydrogen	9		4·39
Five equivalents of Oxygen	40		19·52
Equivalent	205		100·

Formula $C^{26}\ H^9\ O^5$

The crystals contain 2 equivalents of water = 18, which they lose when heated.

Carthamein is composed of

Twenty-six equivalents of Carbon	156	or	70·59
Nine equivalents of Hydrogen	9		4·07
Seven equivalents of Oxygen	56		25·34
Equivalent	221		100·

Its formula is $C^{26} H^{9} O^{7}$.

Carthamein which has been decolorized and rendered yellow by exposure to the action of the sun and air, consists of

Twenty-four equivalents of Carbon	144	or	69·57
Seven equivalents of Hydrogen	7	,,	3·35
Seven equivalents of Oxygen	56	,,	27·05
Equivalent	207		100·

Its formula is $C^{24} H^{7} O^{7}$.

It results from the preceding analysis, that carthamin in contact with air and an alkali combines with two equivalents of oxygen and becomes red carthamein; and when exposed to an alkali and the sun's rays, it absorbs six equivalents of oxygen, and is rendered yellow.

Casein is the basis of the various kinds of cheese, and closely resembles albumen in many properties. It is insoluble in water, but a small portion of alkali renders it soluble: it may be prepared by adding dilute phosphoric acid to fresh milk warmed; a coagulum is produced, which after being washed is to be dissolved in a weak solution of carbonate of soda, and this is to be kept in a warm place to allow of the separation of the butter; these re-solutions in carbonate of soda and precipitations are to be repeated several times, and the insoluble casein is then to be washed with boiling water, and treated with æther, to remove any remaining butter or fatty matter.

Casein thus prepared is a curdy white substance, insoluble in water or alcohol, but soluble by water containing an alkali or its carbonate; dilute acids also dissolve a small portion of it. When moist, it reddens litmus-paper, and leaves about 0·3 per cent. of ashes by incineration. Casein is coagulated by certain animal membranes, as is shown in the process of making cheese, in which, by the action of a piece of the stomach of the calf, milk is separated into a yellowish liquid termed whey, and a solid white coagulum which contains all the casein of the milk with portions of some of its other principles.

According to the analysis of Mulder, casein consists of

Carbon . . .	54·96
Hydrogen . . .	7·15
Azote . . .	15·80
Oxygen . . .	21·73
Sulphur . . .	00·36
	100·

It is found that albumen, fibrin, and casein differ only in these particulars—the two first contain both phosphorus and sulphur, but in different proportions; while the last contains only sulphur.

Catalysis, *Catalytic Action. An Action of Presence.* The term catalysis has been applied by Berzelius to a very obscure class of phenomena, in which a substance, by its mere presence, effects certain changes, either of composition or decomposition, without itself undergoing any change whatever. Thus when chlorate of potash and binoxide of manganese are mixed and heated, the salt is decomposed and yields oxygen gas at a much lower temperature than it would do without the presence of the metallic oxide, which however suffers no decomposition or change whatever. This affords an instance of decomposition by catalytic force. An example may be given in which combination is perhaps occasioned by the same force; thus when a small particle of finely divided platina is dropped into a mixture of oxygen and hydrogen gases, they immediately combine with explosion and the formation of water, and this is effected without any change in the state of the platina; it has however been supposed, that in this case the combination is effected by the power of the platina, owing to its greatly extended surface, in condensing the gases so as to bring them within the sphere of their mutual attractions. The action of yeast in fermentation has been considered also as an illustration of catalytic action; the presence of this substance, though invisible, is sufficient to cause the resolution of sugar into alcohol and carbonic acid gas, an effect which cannot be produced by any other means whatever. An example of the action of catalytic power in an organic secretion is afforded by the presence of the minute quantity of the vegetable principle *diastase*, which appears in the germination of barley and other seeds, and converts their starch into sugar and gum, which, being soluble, form the sap that rises into the germ, and nourishes the plant.

Cedriret, a peculiar substance obtained by Reichenbach from the lighter oil of hard-wood tar: this is to be treated first with carbonate of potash, and afterwards with caustic potash, to separate the eupion and other substances, and the potash is then saturated with acetic acid; by this an oil separates, of which some remains in solution with the acetate of potash, and may be obtained by distillation. As soon as the liquid which comes over precipitates protosulphate of iron red, it is to be preserved, and is cedriret.

The properties of this substance are—that it crystallizes in a solution of protosulphate of iron, in red, slender, inflammable crystals. Heat decomposes it; sulphuric acid dissolves it with a blue colour, and nitric acid decomposes it completely. It is insoluble in water, alcohol or æther, oil of turpentine or petroleum, but dissolves in creasote with a purple colour, and is precipitated from it by alcohol in a crystalline state. It is probably to the presence of this substance that the different colours of wood-tar are owing. It has not been analyzed.

Chamelion Mineral. [Manganese—*Manganic Acid*, P. C.]

Chlorine. M. Pelouze has found that 100 volumes of water dissolve the under-mentioned volumes of chlorine gas at the temperatures stated:—

Volumes of Chlorine Gas.		
175 to 180	. .	at 32° Fahrenheit.
270 275	. .	48°
270 275	. .	50°
250 260	. .	53°
200 210	. .	57°
155 160	. .	86°
115 120	. .	104°
60 65	. .	149°

Dr. Draper has found that when chlorine gas is exposed to the direct solar rays it undergoes a permanent change, which it retains in the dark. This modification consists in the property which the gas acquires of immediately combining in this state even in the dark, and without the assistance of light or heat, with hydrogen gas, to form hydrochloric acid gas. Dr. Draper attributes this property to the combination of the chlorine with the *tithonic rays*, which the chlorine retains until they can be employed.

Chloriodic Acid, a compound of chlorine and iodine, which on account of its acid properties was termed an acid by Davy, but by Gay-Lussac simply *choride of iodine*, he being of opinion that the acidity of its solution arises from the presence of hydrochloric and iodic acids, generated by the decomposition of water.

Iodine, when dry, absorbs chlorine at common temperatures with the evolution of heat; when the iodine is perfectly saturated with chlorine, the compound is orange-yellow, but reddish-orange if the iodine be in excess. By heat it is converted into a yellow-coloured liquid, yielding a vapour of the same colour when the temperature is increased. It is deliquescent, readily soluble in water, and forms a colourless solution which is very sour to the taste, first reddens and then destroys vegetable blue colours. It probably consists of 1 equivalent of chlorine 36, and 1 equivalent of iodine 126 = 162.

Chlorocinnose, a compound produced by the action of chlorine upon oil of cinnamon. When pure, it exists in the state of brilliant, colourless, acicular crystals, which fuse and volatilize by heat without change. Even when heated in concentrated sulphuric acid it is not decomposed, nor is it altered by heating in ammoniacal gas. It consists of 18 equivalents of carbon, 4 of hydrogen, 4 of chlorine, and 2 of oxygen. Its formula is $C^{18} H^{4} Cl^{4} O^{2}$. It appears that its formation depends upon the displacement of 4 equivalents of hydrogen from oil of cinnamon by 4 equivalents of chlorine.

Chlorocyanic Acid. [Cyanogen, Chloride of, in Chemistry, P. C. S.]

Chlorosamide, Chlorosalicymide. This compound is prepared by causing chloride of salicyle to absorb dry ammoniacal gas. The result is a yellow mass, which is insoluble in cold water, and decomposed by it when boiling. It is soluble in boiling æther; and, as the solution cools, it separates in iridescent crystals of a yellow colour. It is soluble also in absolute alcohol. When heated in an acid it is decomposed, yielding an ammoniacal salt of the acid employed, and chloride of salicyle. By the action of the fixed alkalis ammonia is evolved, and chloride of salicyle remains in solution. It results from the combination of 2 equivalents of ammonia with 3 equivalents of chloride of salicyle, and the separation of 3 equivalents of water. Its formula is $C^{42} H^{15} N^{2} O^{6} Cl^{3}$.

CHRYSEN. This substance was obtained by Laurent from pitch or gas tar by repeated distillation. The products which come over last consist of a soft reddish or yellow mass, and of a thick oil, in which crystalline plates are visible. That which condenses in the neck of the retort consists principally of chrysen, so called from its golden colour, while the receiver contains pyren. [PYREN, in CHEMISTRY, P. C. S.] These products are separated by æther, in which the pyren only is soluble. When the æthereal solution is placed in a freezing mixture the pyren crystallizes.

Chrysen is yellow, crystalline, inodorous, and tasteless. It is insoluble in water or alcohol, and not very soluble in æther. Boiling oil of turpentine dissolves a small quantity of it, which afterwards separates into crystals. Warm concentrated sulphuric acid dissolves it, and it assumes a beautiful green colour. Nitric acid, chlorine, and bromine all decompose chrysen. It melts at about 450° Fahrenheit, and at a higher temperature volatilizes, with partial decomposition. Its composition is similar to that of idrialin; or it is a tercarburet of hydrogen, composed of 18 carbon and 1 hydrogen. Its formula is $C^{3}H$.

CINCHOVATINA, a vegetable alkali discovered by Manzini in *cinchona ovata;* it is extracted in the same manner as quina and cinchonia. Cinchovatina is insoluble in water, but dissolves in alcohol; and the solution yields large colourless inodorous prisms, which after some time have a bitter taste. It has an alkaline reaction. It melts between 356° and 374° Fahrenheit.

The salts of cinchovatina are soluble, and crystallize very readily, especially on the cooling of saturated boiling solutions; it is soluble in ammonia, and crystallizes from the solution by evaporation. It appears to consist of 46 equivalents of carbon = 276, 27 equivalents of hydrogen = 27, 2 equivalents of azote = 28, and 8 equivalents of oxygen = 64, giving 395 as its equivalent. Its formula is $C^{46} H^{27} N^{2} O^{8}$.

CODEIA, an alkali discovered by Robiquet in opium, is obtained as an accidental product in the preparation of hydrochlorate of morphia by Gregory's process. This salt is to be dissolved in water, and the morphia is to be precipitated by caustic ammonia. This alkali does not throw down the codeia; and it therefore remains in solution. By evaporating the solution, a double salt of hydrochlorate of codeia and hydrochlorate of ammonia is obtained: and this, after being squeezed, is to be washed with a small quantity of water, and then treated with a solution of potash, which separates the codeia in the form of a tenacious mass, which eventually hardens and becomes crystalline: this is to be treated with æther, which dissolves the codeia, and this separates by evaporation, especially if a little water be added.

Codeia crystallizes in regular octohedrons, which are colourless and transparent. They have a bitter taste, a strong alkaline reaction, are very soluble in alcohol and in æther, but insoluble in solutions of the fixed alkalis, which distinguishes codeia from morphia. It does not redden nitric acid, nor render chloride of iron blue.

Codeia is much more soluble in water than morphia, 1 part requiring about 80 parts of cold water and 17 of boiling water for solution. When heated in a small quantity of water it liquefies, and forms oleaginous drops, which are heavier than water. Its composition is denoted by the formula $C^{35} H^{20} NO^{5}$.

Codeia forms salts with acids, some of which crystallize, as is the case with the nitrate. Their solutions are precipitated by tincture of galls, which produces no effect on the salts of morphia.

CONIA, CONICINA, an alkali obtained from hemlock (*Conium maculatum*). It is procured from the seeds or fresh leaves of the plant by distillation with water holding some potash in solution. When pure, it has the following properties:—It has the appearance of a colourless volatile oil, and is lighter than water, its specific gravity being 0·89. Its odour is powerful, diffusible, and repulsive, somewhat like that of hemlock itself. It is intensely acrid to the taste. It has a strong alkaline reaction on turmeric-paper. It combines readily with and neutralizes acids; and some of the salts which it forms with them have been obtained in a crystalline state. It is sparingly soluble in water, and what is remarkable is, that it is more soluble in cold water than in hot. It imparts its odour and taste to water. Alcohol mixes with it in all proportions; and it also dissolves readily in æther. With about one-fourth of its weight of water it forms a hydrate. By exposure to the air it quickly becomes of a dark colour, and spontaneously decomposes with the evolution of ammonia. Its boiling-point is 370° Fahrenheit. It distils however with boiling water, but suffers partial decomposition.

It is one of the most virulent poisons known, destroying small animals by a very small quantity and in a very short time.

Its composition has not been determined with certainty, but it is probably represented by $C^{16} H^{16} N$, or 16 equivalents of carbon, 16 of hydrogen, and 1 of azote.

COTARNINA, an organic alkali obtained from narcotina by the action of sulphuric acid and oxide of manganese, and by subsequent tedious operations.

Cotarnina assumes the form of a radiating mass. It is readily soluble both in water and in alcohol, and imparts to them an intense yellow colour. It has a very bitter taste, and a slightly alkaline reaction. When it is heated, it melts, carbonizes, and emits a disagreeable odour. The charcoal which it leaves is difficult of incineration.

It combines with and saturates acids. When saturated with hydrochloric acid it dries into a yellow amorphous mass, in which crystalline nuclei are occasionally visible. The alkalis do not precipitate it from solution in hydrochloric acid; but it is precipitated by bi-chloride of mercury, chloride of platina, and by tannic acid. M. Wohler, who discovered this acid, states that he is not quite satisfied with the analytical results which he has hitherto obtained. These gave carbon, 69·3; hydrogen, 6·1; azote, 6·3; oxygen, 18·3, in 100 parts.

CYANOGEN, CHLORIDE OF, *Chlorocyanic Acid*. This compound is obtained when anhydrous hydrocyanic acid is exposed to chlorine gas acted upon by the sun's rays; hydrochloric acid being also formed. The properties of this substance are, that it has the form of long colourless needles, which have a powerful and disagreeable odour. The crystals fuse at 284°, and sublime unaltered at a higher temperature. It dissolves in alcohol and æther without decomposing; but when heated with water, it is decomposed into cyanuric and hydrochloric acids. It was probably owing to the formation of these acids that chloride of cyanogen was originally supposed to possess acid properties; and hence the name of chlorocyanic acid. It may be considered as composed of 3 equivalents of chlorine 108 + 3 equivalents of cyanogen 78 = 186. Its formula is $Cl^{3} Cy^{3}$.

Chlorine and cyanogen form another compound, which is gaseous. It is obtained by passing chlorine gas into strong hydrocyanic acid, or by conveying chlorine over moist cyanide of mercury excluded from the light.

This compound is a colourless gaseous body, extremely pungent, and soluble in water, alcohol, and æther. At zero it forms a colourless crystalline mass, and this at 5° melts into a liquid which boils at 11°. When subjected to a pressure of four atmospheres it assumes a liquid form; and if long kept it is converted into the solid chloride just described; so that the two compounds are isomeric. It is composed of 1 equivalent of chlorine 36 + 1 equivalent of cyanogen 26 = 62. Its formula is Cl Cy.

CYANURIC ACID. This acid was discovered by Scheele in the distillation of uric acid; more lately Serullus obtained it by another process, and described it under the name of cyanic acid; and lastly Wohler and Liebig examined its constitution and properties.

This acid is formed under various circumstances, as by the decomposition of solid chloride of cyanogen by water, the decomposition of soluble cyanates by dilute acid, and the distillation of uric acid, &c.

In order to prepare it, the best process seems to be to dissolve dry melam [MELAM, in CHEMISTRY, P. C. S.] with a gentle heat in concentrated sulphuric acid; the solution is to be poured into 20 or 30 parts of water, and the mixture is to be kept for several days, at a temperature near ebullition, or until small portions yield no white precipitate with ammonia. The solution is then to be evaporated to its crystallizing point, and the crystals obtained are to be purified by recrystallization.

Cyanuric acid forms rather small colourless prismatic crystals, which are efflorescent. It is very slightly soluble in cold water and requires 24 parts of boiling water to dissolve it; it is inodorous, has but little taste, and reddens litmus but feebly. It is a remarkably permanent substance, being soluble without decomposition in concentrated sulphuric or nitric acid, though when heated in them it is eventually decomposed.

According to Liebig, the crystallized acid consists of 3 equivalents of cyanogen 78, 3 equivalents of oxygen 24, 7 equivalents of water 63, equivalent = 165: 3 equivalents of the water he considers to constitute the acid a hydrate, and that 4 equivalents are water of crystallization. It combines with 3 equivalents of base to form cyanurets, and is therefore what is termed a tribasic acid. By exposure to a very high temperature 1 equivalent of hydrated cyanuric acid is decomposed into 3 equivalents of hydrated cyanic acid; and urea is by heat converted into cyanuric acid and ammonia.

Dextrine. An isomeric modification of starch procured by boiling common starch in dilute sulphuric acid and also in some other acids; by this treatment the starch soon loses its consistence and becomes thin and limpid, being converted into *dextrine*, so called from its action on polarized light, in causing the plane of polarization to deviate to the right. When sulphuric acid is used, it is to be saturated by the addition of chalk, and the liquor, filtered from the sulphate of lime formed, is to be evaporated to dryness in a water-bath.

Dextrine thus obtained is a white gum-like mass, without any appearance of crystallization, soluble in cold water, and precipitable from it by alcohol. Iodine is stated by some authors sometimes to produce no change in the solution of dextrine, and on other occasions to give a purplish red tint. The non-production of colour has, however, been stated to be a test of the perfect conversion of the starch.

Dextrine may also be prepared by the action of an infusion of malt kept some time at 150°. Its composition is similar to that of starch. Dumas gives as its formula $C^{24}\ H^{10}\ O^{10}$.

When the ebullition is continued after the formation of the dextrine, this substance is converted into grape sugar, and this effect is produced with great readiness.

Dextrine, but not quite pure, is used by calico-printers as a substitute for gum; it is obtained by merely subjecting starch to the action of heat, and thus prepared is known by the name of British gum.

Diastase, a substance formed during germination. It is prepared by reducing freshly germinated barley into a pulp, with half its weight of water, and then pressing out the liquor strongly. To the clear liquid just sufficient alcohol is to be added to destroy its viscidity, and allow of its being filtered; by this an azotized substance is precipitated, which must be considered as vegetable albumen, since it coagulates at 167° F. Having separated this, alcohol is to be again added as long as the liquid becomes turbid; the precipitate is to be purified by solution in water and precipitation by alcohol repeatedly; the precipitate is at last to be dried in thin layers upon glass at a temperature between 104° and 122° F.

The properties of diastase are the following:—It is solid, white, not crystalline, soluble in water, but insoluble in alcohol unless it be weak; the aqueous solution is nearly tasteless, and without any chemical action, not precipitating subacetate of lead. The aqueous solution quickly changes, becoming acid; dry diastase undergoes the same change in a longer time, but when boiled in water the alteration is immediate. Common malt is stated in general not to contain more than 1-500th of its weight of diastase; one part of it is sufficient to convert 2000 parts of starch, thickened with water, into a mixture consisting of much dextrine and a little sugar. It has not yet been obtained absolutely pure.

Didymium is a metal recently discovered in cerite. Cerite eventually yields, by treatment with sulphuric acid, large red crystals, which are sulphate of didymium: when potash is added to a solution of this salt, hydrated oxide of didymium is precipitated; it has a bluish violet colour, and during washing it absorbs carbonic acid from the air, and when dried it consists mostly of carbonate of didymium and is of a light reddish violet colour; by exposure to a red heat the carbonic acid is expelled, and the oxide is obtained in small lumps of a brown or blackish colour; the powder is light brown: if this oxide be exposed to a white heat it assumes a dirty greyish green colour. It has no alkaline reaction, and is dissolved pretty readily even by dilute acids, and they yield salts of an amethystine red colour; they are not precipitated by hydrosulphuret of ammonia unless heated; the oxide is insoluble in carbonate of ammonia.

By the blowpipe the oxide mixed with the salt of phosphorus becomes amethystine red with a tint of violet; when heated with carbonate of soda or platina foil, it melts into a greyish white mass. It does not appear to have been reduced to the metallic state.

Dimorphism. [Isomorphism, P. C.]

Elaterin, a vegetable principle extracted from the wild cucumber (*Momordica Elaterium*). To obtain it the evaporated juice of the fruit is to be treated with water, and the residue with alcohol of specific gravity 0·825; and the solution is to be evaporated to the consistence of a syrup: the elaterin then crystallizes; more is afterwards obtained by adding potash to the mother water; the matter obtained is to be purified by means of æther. Another process consists in pouring water into the concentrated tincture of elaterium, by which the elaterin is precipitated in the state of small silky crystals.

Elaterin has a bitter and somewhat styptic taste. It is insoluble in water, and in dilute acid and alkaline solutions; it is soluble in 5 parts of cold alcohol and 2 parts of boiling alcohol, and also in æther and fixed oils. It melts at a few degrees above 212°, and at a higher temperature it is volatilized in very acrid white vapours.

Concentrated acids decompose it: nitric acid converts it into a yellow gummy mass; sulphuric acid dissolves it, and assumes a deep blood-red colour.

Elaterin acts strongly as an emetic or purgative, in doses of 1-12th or 1-10th of a grain. It has not been analyzed.

Erbium, a metal discovered by Mosander associated with yttria. Its properties are but little known; some of them are as follows:—Its oxide becomes of a dark orange colour when heated in contact with the air, which colour it loses with a little weight when heated in hydrogen gas; it is to the presence of this oxide that yttria owes its yellow colour, when prepared as hitherto directed; the sulphate and nitrate of erbium are free from colour. It does not appear to have been reduced to the metallic state.

Fibrin, Animal. The bodies of animals contain this substance both in a fluid and a solid state; in the former it exists in the blood, and in the latter form in muscular fibre, but that of venous differs from that of arterial blood. To obtain the former, human blood is to be triturated in a mortar with 1½ times its weight of water, and one-third of its weight of nitre; and the mixture is to remain, during at least 24 hours, exposed to a temperature of about 100° to 120° F., by this it is rendered slimy and gelatinous, and at length it becomes liquid, exhibiting the properties of albumen which has been treated with acetic acid. When largely diluted with water, a flocculent substance is thrown down, which closely resembles coagulated albumen. When arterial blood is employed in the same way similar changes are not produced, and the fibrin of venous blood loses the property if it has absorbed oxygen.

Solid fibrin is procured by washing thin portions of muscular flesh in cold water until they are rendered quite white, or in a purer state by stirring fresh blood with a stick to which the fibrin adheres: it is to be rendered pure by washing first with cold water, and afterwards by treatment with æther. Fibrin, when fresh, exists in the state of long, white, elastic filaments; it is inodorous, tasteless, and insoluble in water whether cold or hot, but by long continued boiling a portion is dissolved. When dried at a gentle heat it loses about four-fifths of its weight, which loss is water, and it becomes then horny and translucent, and very much resembles albumen which has been coagulated; acetic acid and fresh fibrin when kept for some hours in contact form a transparent gelatinous mass which is soluble in water; solution of potash dissolves fibrin, and the compound possesses many of the characters which belong to albumen.

According to Mulder dried fibrin consists of

Carbon . .	54·56
Hydrogen . .	6·90
Azote . .	15·72
Oxygen . .	22·13
Phosphorus . .	·33
Sulphur . .	·36
	100·

If it be admitted that the phosphorus and sulphur are in definite combination, the formula of this substance will be $C^{400}\ H^{310}\ N^{50}\ O^{120}$ PS, which certainly includes a very unusual amount of equivalents. Its composition is precisely similar to that of coagulated albumen, and, as already remarked, they have several properties in common.

Fibrin, Vegetable, is obtained from wheat flour by the following process:—Make the flour into a paste, and wash it on a fine sieve with a small stream of water; the *gluten* of the flour will remain, and a milky liquid will pass through the sieve, which when suffered to rest will in a few hours become clear by depositing the starch by which it was rendered turbid. If this clear liquor be boiled, a flocculent precipitate is formed in it, which, when washed, dried, and purified by boiling æther, has the same composition as animal fibrin. When heated, it coagulates, and possesses the properties of coagulated albumen.

Formomethylal, Methylal, a liquid obtained by distilling a mixture of two parts of pyroxylic spirit with three of sulphuric acid, three of water, and three of binoxide of manganese. The liquid which distils is to be saturated with potash, and by this the new compound is separated as a light oily fluid; this is to be purified by rectification, and it then has the following properties: it is colourless, of an agreeable aromatic odour; its density is 0·855, boils at 107° F., and is soluble in three parts of water. It is very inflammable, and burns with a white flame. Its composition is expressed by $C^3H^4O^2$.

Fraxinin, a neutral principle obtained from the bark of the *Fraxinus excelsior*, and at first supposed to be an alkali. It is prepared by precipitating the aqueous solution of the extract of the bark with di-acetate of lead, and this is treated with hydrosulphuric acid, and the liquid is to be evaporated; when fraxinin is obtained in slender hexagonal prisms, which are unalterable in the air.

Fraxinin is very soluble in water and in alcohol, and but slightly so in æther. It has a very bitter taste, and has neither an alkaline nor acid reaction. It does not appear to have been analyzed.

Fumaric Acid, an acid obtained from fumitory by boiling its juice, filtering it, and precipitating it by acetate of lead; by this fumarate of lead is obtained, which is to be decomposed by hydrosulphuric acid.

This acid may also be procured by heating malic acid in a retort, and by its decomposition fumaric acid is obtained, which when purified has the following properties:—It is in the form of small, white, crystalline laminæ; they dissolve in about 200 parts of cold water, but are readily dissolved by hot water and by alcohol; nitric acid, even when heated, does not act upon this substance. Hydrated fumaric acid contains C^4HO^3+HO, and is consequently isomeric with aconitic acid.

Furfurina, a substance artificially formed by Mr. Fownes, which possesses the properties of a vegetable alkali, and forms salts with acids. It is procured, with *furfurol*, a volatile oil, by distilling a mixture of bran, sulphuric acid, and water. Its formula is $C^{30}H^{12}N^2O^6$.

Gases, Liquefaction of.—We have shown that eight gases have been liquefied by Mr. Faraday (vol. xi. p. 84); and a few months ago he read a paper before the Royal Society, in which he shows the condensation and solidification of various other gases. The method which he employed consisted in combining the condensing powers of mechanical compression with that of very considerable depression of temperature. The first object was attained by the successive action of two air-pumps; the first having a piston of one inch in diameter, by which the gas to be condensed was forced into the cylinder of the second pump, the diameter of whose piston was only half an inch. The tubes into which the air, thus further condensed, was made to pass, were of green bottle-glass, from one-sixth to one-quarter of an inch in external diameter, and had a curvature at one portion of their length adapted to immersion in a cooling mixture: they were provided with suitable stopcocks, screws, connecting pieces, and terminal caps, sufficiently air-tight to sustain a pressure of fifty atmospheres. Cold was applied to the curved portions of the tube by their immersion in a bath of Thilorier's mixture of solid carbonic acid and æther. The degree of cold thus produced, when the mixture was surrounded by the air, was—106° Fahr., by an alcohol thermometer. But on placing the mixture under an air-pump, and removing the atmospheric pressure, leaving only that of the vapour of carbonic acid, which amounted only to one twenty-fourth of the former (that is, to the pressure of a column of 1·2 inch of mercury), the thermometer indicated 166° below zero. In this state the æther was very fluid, and the bath could be kept in good order for a quarter of an hour at a time. Mr. Faraday found that there were many gases which, on being subjected to cold of this extreme intensity, condensed into liquids, even without a greater condensation than that arising from the ordinary atmospheric pressure, and they could then be preserved, sealed up in glass tubes in this liquid state. Such was the case with chlorine, cyanogen, ammonia, sulphuretted hydrogen, arseniuretted hydrogen, hydriodic acid, hydrobromic acid, carbonic acid, and euchlorine. With respect to some other gases, such as nitric oxide, fluosilicon, and olefiant gas, it was difficult to retain them for any length of time in the tubes, in consequence of the chemical action they exerted on the cements used in the joinings of caps, and other parts of the apparatus. Hydriodic and hydrobromic acids could be obtained either in a solid or liquid state. Muriatic acid gas did not freeze at the lowest temperature to which it could be subjected. Sulphurous acid froze into transparent and colourless crystals, of greater specific gravity than the liquid out of which they were formed. Sulphuretted hydrogen solidified in masses of confused crystals of a white colour, at a temperature—122° Fahr. Euchlorine was easily converted from the gaseous state into a solid crystalline body, which by a slight increase of temperature melted into an orange red fluid. Nitrous oxide was obtained solid at the temperature of the carbonic acid bath *in vacuo*, and then appeared as a beautifully clear and colourless crystalline body. Mr. Faraday conceives that in this state it might, in certain cases, be substituted with advantage for carbonic acid in frigorific processes, for arriving at degrees of cold far below those hitherto attained by the employment of the latter substance. Ammonia was obtained in the state of solid white crystals, and retained this form at a temperature of—103°. The following liquids could not be made to freeze at—166°: chlorine, æther, alcohol, sulphuret of carbon, caoutchoucin, camphor, and rectified oil of turpentine. The following gases showed no signs of liquefaction when cooled by the carbonic acid bath, even when subjected to great pressure: hydrogen and oxygen at a pressure of twenty-seven atmospheres, nitrogen and nitric oxide fifty atmospheres, carbonic oxide forty atmospheres, coal-gas thirty-two atmospheres.

Gelatine. [Food, P. C.]

Gliadine, a peculiar azotised vegetable matter which exists in small quantity with the gluten of wheat, and to which its adhesive properties are owing. It may be separated by boiling alcohol, together with a thick fluid oil which is separable by æther. Gliadine is adhesive, insoluble in water, when dried it is hard and translucent like horn; it dissolves in acetic acid and solution of potash. No analysis of this substance has, we believe, yet appeared.

Glucose. [Sugar, P. C.; Grape, P. C.]

Gluten. [Food, P. C.]

Glycerin, a substance discovered by Scheele, and called by him the *sweet principle of oil*. It may be obtained by the action of caustic alkalis on oil of olives, or by boiling the oil with oxide of lead and water; in this operation, as is well known, an insoluble soap of lead is formed, and the glycerin remains in solution; this is to be treated with hydrosulphuric acid, which throws down any oxide of lead which may be in solution, and the liquid, after digestion with animal charcoal, is to be filtered, and evaporated in vacuo, without heat. The properties of this substance are:—When pure it is a nearly colourless viscid liquid of specific gravity 1·27; it cannot be made to crystallize. Its taste is extremely sweet, mixes with water in all proportions, and is not fermentable. When heated a portion first volatilizes, and the remainder becomes dark coloured, and is eventually decomposed. By the action and decomposition of nitric acid it is converted into oxalic acid. It is composed of 6 equivalents of carbon, 8 equivalents of hydrogen, and 6 equivalents of oxygen.

Glycyrrhizine. [Sugar, P. C.; Liquorice, P. C.]

Hematosin, the red colouring-matter of the blood; it has not however been obtained in a perfectly pure state, owing to the difficulty of separating it from other substances, and to the facility with which it undergoes change: when the coagulum of blood, which has been drained, is put into water, the colouring matter dissolves and forms a fine crimson coloured solution; this when exposed to a moderate heat dries and forms a brittle dark red substance, which is again soluble in water. When it has been acted upon by heat and alcohol it coagulates, owing to the albumen which it contains, and it is then insoluble in water, but soluble in potash; the red solution is rendered black by carbonic or sulphurous acid, but its colour is heightened by air on account of the oxygen which it contains; nitrous oxide renders it purple, and sulphuretted hydrogen greenish black.

A peculiarity of hematosin is its containing oxide of iron, which does not occur in other parts of the animal system: when the clot of blood is decomposed by exposure to heat and air, the residue treated with hydrochloric acid exhibits by the usual tests the presence of peroxide of iron, unaccompanied by phosphoric acid. So also when dried blood is moistened with a little concentrated sulphuric acid, on the addition of water a solution is obtained which with ammonia yields a precipitate of peroxide of iron.

The hematosin of bullocks' blood, but not quite pure, for the reasons already stated, analyzed by Mulder, yielded the following ingredients:—

Carbon	66·49	65·91
Azote	10·54	10·54
Hydrogen	5·30	5·37
Oxygen	11·01	11·75
Iron	6·66	6·58
	100·	100·15

Hemipinic Acid is formed by the higher oxidizement of opianic acid [Opianic Acid, in Chemistry, P. C. S.], one equivalent of which, by the addition of one equivalent of oxygen, gives rise to two equivalents of hemipinic acid; this addition is effected by heating either opianic acid or narcotina with dilute sulphuric acid and binoxide of lead, care being taken not to decompose the hemipinic acid as it is formed.

Hemipinic acid crystallizes in colourless quadrilateral prisms. The crystals contain two equivalents of water, which are expelled below 212° Fahr. It has a slight taste, is soluble in water, melts at 356°, and sublimes like benzoic acid in shining laminæ. It forms with ammonia a readily soluble and crystalline salt; with oxide of silver it forms an insoluble, white, pulverulent powder, the composition of which is represented by that of the hemipinic acid, $C^{10} H^4 O^5 + Ag O$.

Hesperidin, a neutral vegetable principle obtained from the spongy part of the peel of oranges and lemons, by digesting it in boiling water, and saturating the infusion with cream of lime, then evaporating to dryness, treating the residue with alcohol, and evaporating the filtered solution. The matter left is to be treated with twenty times its weight of distilled vinegar, and the solution set by for a week, when the hesperidin is deposited, and is to be purified by recrystallizations from alcohol.

The properties of Hesperidin are:—It forms white silky needles, grouped in tufts or in mammillated forms; they are inodorous, insipid, fuse at a gentle heat into a resinous substance which becomes electrical by friction; at a higher temperature, this substance decomposes without yielding ammonia, and burns with flame and an aromatic odour. It is insoluble in cold water, and requires sixty parts of boiling water for solution; it is very soluble in boiling alcohol, but insoluble in æther. Nitric acid renders hesperidin yellow; sulphuric acid gives it first a yellow and then a red tint; hydrochloric acid imparts a greenish yellow colour to it. The acetic solution of hesperidin is not decomposed by water; persulphate of iron precipitates it brownish red: it is soluble in the alkalis. No analysis has as yet been made of Hesperidin.

Humopinic Acid, a product of the decomposition of narcotina by heat, which on being melted and exposed to a temperature of 428° is suddenly decomposed, with considerable intumescence, into ammonia and a brown vesicular substance, which consists chiefly of the acid in question.

This acid is a dark brown amorphous body, which melts on exposure to heat, and burns with a bright flame, diffusing an odour resembling that of narcotina. It is soluble in water, dilute acids, and in alcohol, giving with the latter a deep red-coloured solution. With the alkalis it forms saffron-yellow coloured solutions, which give dark brown precipitates with the salts of barytes and lead. When humopinic acid is boiled for some length of time in water, it becomes insoluble in ammonia, and, when added to potash or alcohol, a blackish brown substance remains undissolved, which is probably humin. Its composition has not been determined with certainty.

Humus. [Arable Land, P. C.]

Hyoscyama, the active and alkaline principle of the *Hyoscyamus niger* and other varieties of henbane, from which it is obtained by a very complex and tedious process.

The properties of hyoscyama are:—It crystallizes in stellated groups, which have a silky lustre; and it is often obtained in the state of a colourless, viscid, adhesive mass. When perfectly dry, it is inodorous; but when moist, especially if impure, it has a disagreeable stupefying smell, resembling that of tobacco. When anhydrous, hyoscyama has not an alkaline reaction; but when mixed with water it has, on the contrary, very permanently alkaline properties. It is not volatile at common temperatures, and undergoes no change by exposure to the air; it melts at a low temperature, flowing like oil, and is volatilized at a high temperature; a large portion of it is then decomposed, becoming carbonized and yielding ammoniacal vapour. It is also partly volatilized by the vapour of boiling water, and communicates to the distilled water all the properties of narcotic poisons. It is readily soluble in water, and iodine added to the solution gives a kermes-coloured precipitate; tincture of galls gives a white precipitate; chloride of gold precipitates whitish flocculi; solution of platina gives no precipitate whatever. It dissolves also in alcohol and in æther.

Hyoscyama burns with a sooty flame; concentrated nitric acid dissolves it without acquiring colour, and sulphuric acid renders it brown.

Hyoscyama exists in combination with an acid; it neutralizes acids perfectly, and its power of saturation is great; the salts which it forms by direct combination with dilute acids mostly crystallize, are inodorous, but have an acrid, nauseous taste, are unalterable in the air, and are extremely poisonous.

Hyoscyama is a narcotic poison, like narcotina, and proves fatal as quickly as conia.

Ilicin, a neutral crystalline vegetable principle, obtained by precipitating a decoction of holly-leaves (*Ilex aquifolium*) by di-acetate of lead, evaporating the filtered liquor, and treating the residue with boiling absolute alcohol; by spontaneous evaporation there are produced transparent brownish-yellow crystals, which are bitter, and readily soluble in water, but not in æther. The solution is not precipitated by metallic oxides. This substance has been recommended as a powerful remedy in dropsy and intermittents.

Imperatorin, a neutral crystalline vegetable product, procured from the root of the *Imperatoria Ostruthium:* it is obtained by exhausting the root with æther, distilling the greater part of it, and submitting the remainder to spontaneous evaporation, by which the imperatorin is obtained crystallized in prisms, which are colourless, transparent, inodorous, styptic, and acrid; they do not alter vegetable colours; they melt when heated to 167°, and concrete into a radiated mass, the density of which is 1·192. At a high temperature imperatorin is decomposed, diffusing an acrid vapour. It is insoluble in water, but soluble in alcohol, æther, olive oil, and oil of turpentine; when dissolved in a solution of potash, it is precipitated from it by acids, unchanged. Sulphuric acid dissolves imperatorin, and assumes a brownish red colour; in nitric acid it dissolves with a yellow tint: these solutions are both decomposed by water. Iodine forms with it a brownish red compound, which yields iodine when heated. Its composition is represented by $C^{24} H^{12} O^5$.

Indin is prepared by the action of potash on sulphesathyde, a brown-red powder, consisting of carbon, sulphur, hydrogen, and azote; this is to be triturated in a mortar with a concentrated solution of potash, and by their action and subsequent very complicated operations indin is obtained, possessing the following properties:—It is pulverulent, of a very fine deep rose-red colour, insoluble in water, and slightly soluble in alcohol and æther. When heated, it begins to swell as soon as it melts. It yields a substance which crystallizes in needles, and much charcoal remains. Boiling nitric acid decomposes it, altering its colour very slightly, and red vapours are formed. If the ebullition be continued, the new product is also decomposed and disappears. Sulphuric acid dissolves it, assuming a red colour, and water precipitates it from solution unaltered; bromine colours it violet. Ammonia has no action on indin, but potash attacks it under certain circumstances. It is isomeric with white indigo, and its composition is represented by $C^{16} H^6 NO^2$.

Indinic Acid is formed in combination with potash, yielding black crystals, by the action of the alkali upon indin; the indinate of potash is readily decomposed by water, and still more easily by acids; alcohol dissolves a little of it, but by long washing decomposes it. In the air it becomes of a light rose-colour. Indinic acid is probably similar in composition to isatic acid $= C^{16} H^6 NO^5$.

Inulin, a neutral vegetable principle, resembling starch in many of its properties; it exists in the root of elecampane (*inula helenium*), the *helianthus tuberosus*, the *dahlia*, and some other plants. The roots are reduced to a pulp, which is to be placed on a very fine sieve, and a stream of water is to be poured upon it as long as it is rendered milky; the inulin is then allowed to deposit; the supernatant liquor being poured off, the deposit is to be repeatedly washed with water till it comes off perfectly limpid.

Inulin when dry has the following properties:—It is a white brittle mass composed of crystalline grains, or else a fine and white powder, which adheres to the teeth. It is insipid, insoluble in cold water, but very soluble in boiling water; the solution is fluid, and not gelatinous like that of starch. When it is very dilute, it does not become turbid on cooling; but alcohol, not being a solvent of inulin, precipitates it from this solution. When heated to above 212°, it melts, and is converted into a sweetish mass which is very soluble in cold water (*pyro-inulin*). Cold sulphuric or nitric acid converts it into the same substance.

Iodine renders inulin of a brown tint, which is fugitive. Lime-water, solution of tin, subacetate of lead, tincture of galls, protosalts of mercury, and salts of silver, do not precipitate the solution of inulin; the alkalis act upon it as they do on starch.

Dilute boiling sulphuric acid converts inulin rapidly into glucose; this effect is also produced when inulin is heated alone: the glucose produced undergoes the spontaneous fermentation when mixed with yest. According to Parnell, its composition is represented by $C^{24} H^{21} O^{21}$, when dried at 212°.

Iodoform is a compound of 2 equivalents of carbon, 1 of hydrogen, and 3 of iodine. Its formula is C^2HI^3. It is prepared by adding an alcoholic solution of potash to one of iodine, till the colour of the latter is destroyed; care must be taken to avoid any excess of the alkali; the alcohol is evaporated at a gentle heat, and as it goes off crystals of iodoform are deposited, which are to be washed with pure water to separate the iodide of potassium.

The properties of iodoform are:—It has the form of yellow brilliant laminæ, which have a slight disagreeable odour, somewhat resembling that of saffron; it is insoluble in water, but very soluble in alcohol, æther, and pyroxylic spirit. It sublimes at 212°, and decomposes at 248° into carbon, iodine, and hydriodic acid. Its alcoholic solution decomposes very readily.

Isatic Acid. Isatin dissolves in potash with a deep purple colour, which becomes bright yellow by heat. The solution yields by evaporation a crystalline salt of potash, which is soluble in alcohol, and crystallizes in small, hard, colourless prisms. When a solution of this salt is mixed with one of acetate of lead, a white precipitate is obtained, which, diffused in water and decomposed by hydrosulphuric acid, yields a colourless acid liquid, and this by spontaneous evaporation yields a white and scarcely crystalline powder, which is hydrated isatic acid.

The properties of isatic acid are:—It is perfectly insoluble in cold water, but when heated in water it is decomposed into isatin and water, the mixture becoming of a reddish yellow colour: the soluble isatates act in the same manner with the mineral acids; when they are added to it cold, no decomposition is apparent; but as soon as heat is applied, the mixture becomes yellow, and deposits crystals of isatin.

Isatate of potash gives a white precipitate with barytic salts, soluble in boiling water; with the salts of silver it gives a white precipitate, which dissolves when heated in the mixture, a certain portion of the silver salt being reduced to the metallic state; the boiling solution of isatate of silver deposits crystals which are partly in laminæ and partly granular. Its formula is $C^{16} NH^7 O^5$, HO.

Isatin, a substance obtained from indigo by the addition of two equivalents of oxygen. In order to prepare it, powdered indigo is to be mixed in water with equal parts of sulphuric acid and bi-chromate of potash, the last being dissolved in 20 or 30 parts of water. The indigo dissolves, and at first without the extrication of any gaseous matter, but towards the end with the disengagement of carbonic acid gas, and the formation of a deep yellowish brown liquid, from which the isatin separates by evaporation, in crystals; these are purified by repeated crystallizations in water, and one and the last in alcohol.

The properties of isatin are:—It crystallizes in prisms, which are of a yellowish red or deep aurora-red colour, possessing much splendour when deposited from an alcoholic solution; they are slightly soluble in cold water, but dissolve readily in boiling water and in alcohol: these solutions discolour the skin, and impart a disagreeable odour to it. The crystals are decomposed by heat, leaving a charcoal which it is difficult to incinerate; the caustic alkalis convert it into isatic acid. Its formula is $C^{16}NH^5O^4$.

Itaconic Acid. When citric or aconitic acid is distilled, two liquids are obtained in the receiver, the lighter of which mixes perfectly with water, whilst the heavier, which is oleaginous, combines with it slowly, and becomes a crystalline mass, to which a sufficient quantity of boiling water is to be added to dissolve the oleaginous liquid and the crystals formed, and the solution is to remain exposed to the air; after some days' spontaneous evaporation, crystals of itaconic acid are deposited, which are transparent and hard; these are to be purified by repeated crystallizations from water.

The properties of the itaconic acid thus prepared are:—It crystallizes in rhombic tables or rhombic octohedrons. It has no smell, but possesses a very strong acid taste. It dissolves in 17 parts of water at 50°, and in 10 parts at 68°, and boiling water dissolves much more. It is soluble in alcohol and in æther; at 248° the crystals lose no weight. At 320° they melt, exhaling white irritating vapours, and volatilize without leaving any residue when the heat is continued. When subjected to distillation they decompose into anhydrous citraconic acid and water. The formula of this acid is $C^5 H^2 O^3$, HO.

Jervina, a vegetable alkali found with veratria and sabadillina in white hellebore root. It is white and crystalline, and melts when heated into an oleaginous liquid; at a higher temperature it takes fire, and burns with a sooty flame, without any residue. It is nearly insoluble in water, but dissolves in alcohol.

It compounds with hydrochloric, sulphuric, and nitric acids, are but slightly soluble in water and acids; the acetate dissolves readily in water; ammonia decomposes the solution and occasions a bulky precipitate of jervina. According to Will its composition is represented by $C^{60} H^{45} N^2 O$.

Lanthanium. A new metal discovered by Mosander in what had been previously supposed to be entirely oxide of cerium: it is prepared by calcining the mixed nitrates of cerium and lanthanium; by this the oxide of cerium becomes insoluble in dilute acids, and the oxide of lanthanium, which is a powerful base, may be extracted by nitric acid diluted with 100 parts of water; when an alkaline carbonate is added to the nitrate of lanthanium, the carbonate of the metal is precipitated. Oxide of lanthanium is not reduced to the state of metal by potassium, but it separates a grey metallic powder from the chloride of lanthanium, which oxidizes in water with the evolution of hydrogen gas, and is converted into a white hydrate.

Oxide of lanthanium, in the purest state in which it has hitherto been obtained, is nearly white or of a light salmon colour without any admixture of brown, or brownish red; there is every reason to believe that the colour is owing to some impurity, from which it has not been hitherto possible to free it. It undergoes no alteration by calcination at a red heat in close vessels; it restores the blue colour of reddened litmus-paper; when sprinkled with water, it is gradually converted into a hydrate, and becomes a bulky white powder; this alteration occurs very rapidly in boiling water; it dissolves very readily in acids, even when dilute; when boiled in a solution of hydrochlorate of ammonia, it expels ammonia and an ammonio-chloride of lanthanium is formed; the equivalent of lanthanium is about 48; hydrate and carbonate of lanthanium are both insoluble in carbonate of ammonia.

Lanthanium seems to combine with oxygen in one proportion only; it dissolves in hydrochloric acid without evolving chlorine; it appears to be composed of 1 equivalent of oxygen 8 + 1 equivalent of lanthanium 48 = 56.

Chloride of Lanthanium. When a solution of oxide of lanthanium in hydrochloric acid is evaporated over sulphuric acid, prismatic crystals of chloride of lanthanium of a rose colour are obtained; it deliquesces on exposure to the air, readily dissolves in alcohol, to the flame of which it imparts no colour. This salt melts in water of crystallization, gives off hydrochloric acid, and leaves a mixture of chloride and oxichloride of lanthanium. It appears to be composed of 1 equivalent of chlorine 36 + 1 equivalent of lanthanium 48 = 84.

Nitrate of Lanthanium is obtained by dissolving the oxide in nitric acid. It crystallizes with difficulty, and forms a rose-coloured saline mass which is deliquescent and soluble in alcohol; the form of the crystal appears to be an octohedron, and it contains no water of crystallization. It consists of 1 equivalent each of acid and base, or 54 + 56 = 110.

Carbonate of Lanthanium. The neutral compound is obtained by precipitating the soluble salts of lanthanium with carbonate of soda. It is a white flocculent precipitate, which on drying becomes a white adherent powder.

It is composed of 1 equivalent of acid 22 + 1 equivalent of oxide 56 = 78. It has been found by Mosander that a mineral, which was supposed to be a protocarbonate of cerium, contained only a trace of this metal, and consisted almost entirely of a compound of 1 equivalent of carbonic acid with 3 equivalents of oxide of lanthanium.

Sulphate of Lanthanium. Dilute sulphuric acid very readily dissolves the oxide; by evaporation, acicular radiating amethystine-coloured crystals are obtained. This salt gives off water, but does not melt at a low red heat; when anhydrous, it consists of nearly 1 equivalent of sulphuric acid 40 + 1 equivalent of oxide 56 = 96.

The salts of lanthanium give white precipitates with phosphoric and oxalic acids and ferrocyanide of potassium, but neither hydrosulphuric acid nor tincture of galls produces any change.

Margaramide. When ammoniacal soap, prepared either from animal fat or olive oil, is treated with boiling water, the soap diffuses through it without being dissolved; on cooling the greater part solidifies on the surface, which, if dissolved in boiling alcohol, deposits on cooling a substance which, when purified, has the following properties: it is white, crystalline, perfectly neutral, insoluble in water, very soluble in alcohol and in æther, especially when hot. It melts at about 140° Fahrenheit, and it burns with a sooty flame.

The solutions of potash and soda decompose it, when concentrated and boiling, ammonia being expelled and soap formed. Acids act upon it only when somewhat concentrated, and more readily when hot than cold. Its formula is $C^{34} H^{35} NO^{2}$. It is equivalent to margarate of ammonia less 1 equivalent of water.

Medullin. A name given by John to the pith of the elder, after it has been treated with water and with alcohol. It is insoluble in water, alcohol, æther, oils, or dilute alkaline solutions; concentrated sulphuric acid carbonizes it; nitric acid converts it into oxalic acid.

Melam. A compound substance discovered by Liebig. It may be prepared by simply heating sulphocyanide of ammonium, or a mixture of sulphocyanide of potassium and sal ammoniac; by their action there are produced three volatile products and a solid substance; the three first are ammonia, sulphuretted hydrogen, and sulphuret of carbon; the solid body is a mixture of melam and chloride of potassium, which are easily separated by washing with water.

The properties of melam are:—It is a non-crystalline powder of a greyish white colour, and is insoluble in water, alcohol, or æther; a boiling solution of potash dissolves and eventually decomposes it; boiling and concentrated nitric and sulphuric acid dissolve it, and the solutions, when treated with alcohol, produce a precipitate of ammelide; when the acid solutions are boiled for some hours, the melam is converted into ammonia and cyanuric acid.

By the action of heat melam is converted into ammonia and mellon: hydrochloric and dilute nitric acid convert it into ammeline and melamine: and when fused with hydrate of potash, ammoniacal gas and cyanate of potash are produced. Its formula is $C^{12} H^{9} N^{11}$, or 72 carbon, 9 hydrogen, and 154 azote = 235.

Melamine. One of the simplest processes for preparing melamine is to boil melam until it dissolves in a moderately strong solution of potash; when the liquor has been concentrated and cools, melamine separates in crystals, and by recrystallization it is obtained in a pure state.

Its properties are:—It crystallizes in rhombic octohedrons, which are transparent and colourless, or only slightly yellow. It is very slightly soluble in cold water, but more so in boiling water. It is insoluble in alcohol or in æther, and is unalterable in the air; the aqueous solution has a bitter taste, and has no action on vegetable colours. When dry melamine is heated, it fuses, and sublimes almost entirely without decomposing; but a small portion is converted into mellon and ammonia.

Concentrated sulphuric acid and nitric acid decompose it, when heated, into ammonia and ammelide or ammeline. When fused with hydrate of potash, there are produced ammonia and cyanate of potash.

It combines with dilute acids to form salts, all of which have an acid reaction except the double basic salts. The nitrate, phosphate, and oxalate are less soluble than the melamine itself; but the acetate and formiate are very soluble. Melamine precipitates a part of magnesia from solution, and forms a double salt with that which remains dissolved.

It is the most azotized body known. Its formula is $C^{6} H^{6} N^{6}$.

Mellitic Acid. [Mellite, P. C.]

Mesoxalic Acid. When a saturated solution of alloxanate of barytes or strontia is heated to ebullition, a precipitate is obtained which consists of a mixture of mesoxalate, alloxanate, and carbonate of the base employed. On evaporating the barytic solution crystalline crusts are formed composed of urea and mesoxalate of barytes. When these are digested in alcohol the urea is dissolved, and the mesoxalate of barytes is unacted upon. If a solution of alloxane is gradually added to a boiling one of acetate of lead, a heavy granular precipitate of mesoxalate of lead is formed, and there remains in the acid liquor merely the excess of acetate of lead and pure urea. The mesoxalic acid is obtained by treating the mesoxalate of lead or barytes with dilute sulphuric acid.

The properties of the solution thus obtained are, that it is very acid, reddens vegetable colours, crystallizes, and produces, when saturated with ammonia, as alloxanic acid does, white precipitates in the salts of lead, lime, barytes, and strontia. These precipitates are soluble in acids and in a large quantity of water. A solution of mesoxalic acid may be boiled and evaporated without decomposing.

The distinguishing character of this acid is the mode in which it acts on the salts of silver. When a salt of silver is added to mesoxalate of ammonia, a yellow precipitate is formed, which becomes black, and is reduced with effervescence when the mixture is gently heated.

The formula of this acid is $C^{6} HO^{9}$.

Metacetone. When a mixture of 1 part of sugar and 8 parts of lime is submitted to distillation, the temperature, after reaching 284° Fahrenheit, rapidly rises, and a very small quantity of combustible gas is liberated, accompanied with a liquor which is a mixture of acetone and metacetone. When water is added the metacetone separates, which is to be rectified, the last portions of the product being preserved.

Metacetone is a colourless liquid of an agreeable odour. It boils at about 153° Fahrenheit; does not mix with water, but combines with alcohol and æther. It may be regarded as acetone minus an equivalent of water. Its formula is $C^{6} H^{5} O$.

Methyl, the hypothetical radicle of pyroxylic spirit [Pyroxylic Spirit, P. C.], is composed of 2 equivalents of carbon 12 + 3 equivalents of hydrogen. Its composition was formerly supposed to be 1 equivalent of carbon and 2 equivalents of hydrogen. Its formula is $C^{2} H^{3}$.

Oxide of Methyl, Methylic Æther, is a compound of this base (or at any rate of the proportions of carbon and hydrogen assigned to it) and 1 equivalent of oxygen. Its formula is $C^{2} H^{3} O$. It is prepared by distilling a mixture of equal volumes of concentrated sulphuric acid and pyroxylic spirit. The gases which are evolved are passed first through cream of lime, and afterwards into several bottles containing pure water, which absorbs the oxide of methyl. When the aqueous solution is moderately heated, it parts with the oxide of methyl, which is collected over mercury. The gas is deprived of humidity and of hydrated oxide of methyl, by leaving it in contact with potash.

The properties of oxide of methyl are:—It is a colourless gas, with a very agreeable æthereal odour. It burns with a blue flame; does not liquefy at 5° Fahrenheit; dissolves in water, giving it a sharp taste and an æthereal smell; 1 volume of water dissolves 37 volumes of the gas. It dissolves in alcohol in much larger quantity, as also in hydrate oxide of methyl (pyroxylic spirit), and concentrated sulphuric acid, to which, when water is added, it gives out the gas.

When gaseous oxide of methyl is introduced into a cooled receiver with the vapour of anhydrous sulphuric acid, these two substances combine and form neutral sulphate of oxide of methyl; and in combining with the oxacids it forms either neutral or acid salts. It contains the same elements combined in the same relative proportions as alcohol. The density of this gas is 1·605.

When oxide of methyl is combined with an equivalent of water it forms hydrated oxide of methyl, or pyroxylic spirit.

Chlorine, iodine, sulphur, and cyanogen, all form compounds with methyl.

Mucic Acid, *Saclactic Acid*. This acid is formed by the action of dilute nitric acid upon gum arabic, or sugar of milk, and some other bodies. One equivalent of crystallized sugar of milk is converted into 2 equivalents of crystallized mucic acid, by combining with 12 equivalents of oxygen and losing 2 equivalents of water.

Mucic acid is a white crystalline powder, which is gritty between the teeth: its taste is weakly sour. It dissolves in 6 parts of boiling water, and the solution reddens litmus-paper. It is insoluble in alcohol, and dissolves very sparingly in dilute acids; it dissolves in concentrated sulphuric acid, imparting a crimson colour to it. When the mixture is heated, charcoal is developed. When submitted to dry distillation it blackens, and pyromucic acid and other products are obtained.

It is composed of 6 equivalents carbon, 5 equivalents hydrogen, 8 equivalents oxygen = 105. Its formula is $C^6 H^5 O^8$.

The alkaline mucates are soluble in water, whereas those which contain an alkaline earth, or a metallic oxide, are insoluble. These salts are all decomposed by the mineral acids, they combine with the basis and set the mucic acid free.

Mudarin. The name given by Dr. Duncan to a peculiar principle obtained from the bark of the root of the *Calotropis Mudarii*, and to which he attributes its emetic effects. It is procured in the state of a brown, transparent, extractiform mass, by evaporating the alcoholic tincture of the bark. It is very soluble in water and in alcohol, but insoluble in æther, oil of turpentine, and fixed oils. Its aqueous solution gelatinizes at 95° Fahrenheit, coagulates at a higher temperature, and separates into a porous substance, which, when once cooled, does not redissolve for some days.

Murexan, *Purpuric Acid* of Dr. Prout. To prepare this substance, murexide is to be dissolved in potash with the assistance of heat, which is to be continued until the blue colour has disappeared, and then an excess of dilute sulphuric acid is to be added.

Its properties are:—It crystallizes in very brilliant silky scales of a yellowish colour, which are insoluble in water and dilute acids. It dissolves cold in solution of ammonia, and the other alkalis, without neutralizing them. The ammoniacal solution becomes purple by exposure to the air, and deposits brilliant crystals of murexide.

It is composed of 6 equivalents carbon, 2 equivalents azote, 4 equivalents hydrogen, and 5 equivalents oxygen = 108. Its formula is $C^6 N^2 H^4 O^5$.

Murexide, *Purpurate of Ammonia* of Dr. Prout. This substance may be obtained by several processes. The least operose is probably that of dissolving uric acid in dilute nitric acid, evaporating the solution till it assumes a reddish colour; after the liquor has cooled to 158° Fahrenheit, add excess of ammonia; then dilute it with half its volume of boiling water, and allow it to cool. Care must be taken not to employ too much or too little nitric acid. Whilst ammonia continues to give a red precipitate, when added to small portions, the nitric acid is insufficient. If, on the contrary, ammonia produces a glairy yellow precipitate, murexide cannot be obtained without passing a current of hydrosulphuric acid into the liquor.

The properties of murexide are:—It crystallizes in short four-sided prisms, which exhibit a green metallic reflection. They are garnet-red by transmitted light. Murexide is very little soluble in cold water, and gives it a magnificent purplish red colour. It dissolves readily in water at 158°, and crystallizes from the solution unaltered. It is insoluble in alcohol and in æther. It is insoluble also in solution of carbonate of ammonia, but dissolves in a solution of potash, producing a superb indigo-blue colour, which disappears by heat, with the evolution of ammonia. It contains 12 equivalents carbon, 6 equivalents hydrogen, 5 equivalents azote, 8 equivalents oxygen = 212. Its formula is $C^{12} H^6 N^5 O^8$.

Naphtha. [Hydrogen—*Carburets*, P. C.]

Niobium, a metal lately discovered in the tantalate of Bavaria by H. Rose. When perchloride of niobium is submitted to the action of dry ammonia it becomes yellow, with considerable evolution of heat, and when this is heated it becomes black, with the disengagement of hydrochlorate of ammonia. On washing it with water, to free it entirely from this salt, the water passes clear as long as it contains any of it; but when the metal is nearly pure the water becomes turbid. When niobium is heated in the air it burns with the evolution of light, and becomes white niobic acid. Nitric acid and aqua regia, even when boiling, do not act upon niobium; but it is acted upon by a mixture of nitric and hydrofluoric acids, and a red vapour is formed during the action.

Niobic acid readily combines with the alkalis; and when fused with alkaline carbonates, carbonic acid is expelled. These compounds are soluble in water. Acids precipitate niobic acid from these salts.

Infusion of galls, added to a solution of niobate of soda, produces a deep orange-yellow precipitate. Ferrocyanide of potassium produces a similar effect, and the red ferrocyanide gives a deep yellow precipitate. When a plate of zinc is put into a solution of niobate of soda, a blue precipitate is formed, which in course of time becomes brown.

Opiammon, a substance produced by the decomposition of opianate of ammonia. This salt is to be evaporated to dryness with a gentle heat, by which a substance separates after washing with water, which is opiammon, and is rendered pure by boiling in water.

Its properties are:—It is a powdery substance of a pale yellow colour, which is probably derived from some foreign substance: viewed under the microscope it appears to consist of a collection of small transparent crystals. It fuses readily, and at a high temperature it emits a yellow smoke which has the same odour as opianic acid. It is insoluble in cold water, and boiling water dissolves but little of it, and this is owing to a change which it undergoes. The solution is of a pale yellow colour, and has an acid reaction. It dissolves slowly in boiling alcohol, which on cooling deposits crystals of opiammon and opianic acid. Concentrated sulphuric acid dissolves it, and is rendered of an orange colour. Water renders the solution milky; but when it is heated its transparency is restored, and afterwards it deposits, on cooling, crystals of opianic acid, and retains in solution an ammoniacal salt. Opiammon dissolves in ammonia, and produces opianate of ammonia.

It appears to be composed of $C^{40} H^{17} N O^{14}$, or in 100 parts, of carbon, 60·168; hydrogen, 4·248; azote, 3·545; oxygen, 32·039. M. Wohler states that opiammon possesses the properties of bodies described as *amides*.

Opianic Acid is obtained by the action of an excess of dilute sulphuric acid upon narcotina, with the addition of small portions of binoxide of manganese in fine powder, and heating the mixture to ebullition. The liquor becomes of a pale yellow colour, and yields a little carbonic acid. Excess of the oxide of manganese is to be added, and care is to be taken to have sulphuric acid also in excess.

On the cooling of the reddish yellow liquor, small reticulated yellow crystals are obtained, which are opianic acid. To render them colourless they are to be twice washed with cold water, and then dissolved in a boiling solution of hypochlorite of soda, with the addition of hydrochloric acid in excess. The liquor, after filtration and cooling, deposits colourless crystals of opianic acid.

The crystals of this substance are colourless, very small, reticulated laminæ, inodorous, slightly bitter, redden litmus-paper feebly: they melt at 284° Fahrenheit without losing water. When heated in a retort they rise up the sides of it without being properly volatilized, and the properties of the acid are altered. When heated in atmospheric air, this acid volatilizes with an odour resembling that of vanilla, and it burns with a bright flame. It is very slightly soluble in cold water; but it dissolves in boiling water in so large quantity that the solution solidifies on cooling.

It combines with various bases to form salts, of which many are soluble and crystalline; such are those of ammonia, barytes, lead, and silver.

It appears to consist very nearly of $C^{20} H^9 O^{10} = 209$; or in 100 parts, of carbon, 57·460; hydrogen, 4·295; oxygen, 37·245.

Oxygen. With respect to the density of oxygen gas, it is to be observed that the experiments performed by MM. Dumas and Boussingault gave 1·10566 as its specific gravity, agreeing as nearly as possible with the previous determination of Saussure, and exceeding by 0·0026 only the density according to Berzelius and Dulong. M. Wrede finds the results to be 1·1052.

M. Dumas adopts 8 as the equivalent of oxygen, that of hydrogen being 1; and he admits 9 as the number representing water, and 14 for azote; all of which are those previously proposed by Dr. Prout, and adopted in this work.

Mr. Balmain has proposed a new process for obtaining oxygen gas, which may be advantageously employed on many occasions, and more especially on the lecture-table, as affording a ready means of procuring the gas. It consists in heating in a glass retort, by means of a spirit-lamp, a mixture of 4 parts of concentrated sulphuric acid and 3 parts of bichromate of potash. The quantity obtained is large, and it is nearly or quite pure; the oxygen is of course derived from the reduction of the chromic acid to the state of oxide of chromium, which remains combined with the sulphuric acid and potash; and from this, with proper treatment, a fresh supply of bichromate of potash may be obtained for future operations.

Paranaphthalin, Anthracin, a substance contained among the products obtained by the distillation of coal. It is white, crystalline, but less brilliant than naphthalin. It melts at 356°, distils at 392°, and sublimes at a lower temperature in crystalline leaves. It is insoluble in water, slightly soluble in boiling alcohol and in æther. It crystallizes in flocculi from solution in the latter. It is dissolved more readily by oil of turpentine, and is deposited from it in granular crystals. The density of its vapour is 6·7325. It dissolves in concentrated sulphuric acid, imparting a dirty green colour to it. Its composition may be represented by $C^{15} H^{6}$.

Pirolichenin, a substance obtained from the *Variolaria amara*. In order to procure it the powder of the lichen is to be treated with alcohol, and the solution evaporated to the consistence of a syrup. The pirolichenin then crystallizes, and after being washed with a solution of carbonate of potash it is to be dissolved in and crystallized from alcohol.

Its properties are:—It forms colourless inodorous crystals unalterable in the air, inodorous, and of a bitter taste. It fuses below 212°, and concretes on cooling. It is insoluble in cold water, and slightly soluble in boiling water, and nothing is deposited from it on cooling. It is very soluble in alcohol, æther, sulphuret of carbon, and oils, both volatile and fixed. The alcoholic solution has an acid reaction, and, like the solution in acetic acid, and also in concentrated sulphuric acid, it is precipitated by water. It is not decomposed by the nitric, hydrochloric, or phosphoric acids.

It combines with ammonia, and forms yellow brilliant crystals, which effloresce in dry air. They are insipid, and dissolve readily in alcohol and the caustic alkalis. Solution of potash dissolves pyrolichenin with a wine-red colour, which gradually becomes brown. Acids precipitate from it a bitter reddish-brown substance. When decomposed by heat it yields no ammonia; and when heated in the air it burns with a bright sooty flame, which is violet-coloured on the edges. Its composition is not known: it is stated to possess antifebrile properties.

Populin, a peculiar product obtained from the bark and leaves of the poplar (*Populus tremula*). After extracting salicin from them, this remains in the mother water: carbonate of potash being added to it, a white precipitate is obtained, which is to be dissolved in boiling water. On cooling it crystallizes in needleform crystals, which have an acrid and also a sweet taste, resembling that of liquorice. It dissolves in 70 parts of boiling water and in 1000 of cold water. Its solution in acids is precipitated by water. To sulphuric acid it imparts a red colour. The crystals contain 5·43 per cent. of water of crystallization.

Protein, a substance obtained by Mulder from albumen, casein, horn, and animal and vegetable fibrin. When any one of these is dissolved in a solution of potash, and the filtered solution is mixed with a slight excess of acid, a copious greyish-white, flocculent precipitate is formed, and a slight smell of hydrosulphuric acid is perceived. This white substance is *protein*, so called from its occupying the first or most important place in relation to the albuminous principles.

Its properties are:—While moist the white flocculi are diaphanous, but by drying they become yellowish, hard, and brittle. It possesses neither smell nor taste, attracts moisture rapidly from the air, and loses water at 212°. It is insoluble in water, alcohol, æther, and essential oils. By long continued boiling in water it undergoes some change of properties, and is rendered soluble.

Acetic and phosphoric acids, whatever may be their state of concentration, dissolve it; hydrochloric acid also dissolves protein, and acquires an indigo tint. When heated the solution blackens. With concentrated sulphuric acid it produces a jelly which contracts in water, and which, after being washed with water and alcohol, though it does not redden litmus-paper, contains 8·34 per cent. of sulphuric acid. Mulder calls this compound *Sulphoproteic acid.* When protein is boiled in dilute sulphuric acid, it acquires a purple tint.

Protein is precipitated from its acid solutions by the ferro- and ferrid-cyanide of potassium, by tannin, and by neutralization with an alkali. When strongly heated, protein is decomposed with the production of ammonia and a charcoal which burns with difficulty, but leaves no residue.

Protein consists entirely of carbon, hydrogen, azote, and oxygen; and it will be observed, that whether obtained from albumen (1), casein (2), horn (3), animal fibrin (4), or vegetable fibrin (5), the statements of its composition differ so slightly, as to show that it must be the same from whichsoever of the sources named it is procured.

	(1)	(2)	(3)	(4)	(5)
Carbon .	55·30	55·16	55·408	55·44	54·99
Hydrogen	6·94	7·17	7·238	5·95	6·87
Azote .	16·02	15·86	15·593	16·65	15·66
Oxygen .	21·34	21·81	21·761	21·36	22·48

These analyses may be represented by $C^{40} H^{31} N^{5} O^{12}$.

When protein, or the substances which yield it, are boiled in a concentrated solution of potash as long as ammonia is evolved, and the solution is afterwards neutralized by sulphuric acid, evaporated to dryness, and the residue treated with boiling alcohol, three products of the decomposition are dissolved, one of which, *erythroprotide*, separates in oily drops as the solution cools; *leucin* is deposited in small crystalline scales by spontaneous evaporation; whilst the mother water contains *protide* and formiate of ammonia in solution.

Binoxide and tritoxide of protein are produced by the long continued action of boiling water upon fibrin in contact with air. They are the chief ingredients of the buffy coat of the blood in a state of inflammation, being produced at the expense of the fibrin.

Pyren, a crystalline substance procured from gas-tar. It is insoluble in water, but crystallizes in small rhombic laminæ in alcohol. It is insipid and inodorous, slightly soluble in alcohol and in æther. It melts at about 350° Fahrenheit, and concretes on cooling into a crystalline mass. A stronger heat volatilizes it without alteration. Sulphuric acid carbonizes it. It has not, we believe, been analyzed.

Quassin, a neutral substance contained in the *Quassia amara* and *Quassia excelsa*. Its properties are:—It crystallizes in small white prisms, which have little lustre; they are very bitter, and do not alter by exposure to the air.

One hundred parts of water at 54° dissolve 0·45 part of quassin; the solution is precipitated white by tannin; but neither iodine, chlorine, bichloride of mercury, nor the salts of iron or of lead, occasion any precipitation in it. Quassin dissolves readily in alcohol and in æther. Concentrated sulphuric acid and nitric acid of 1·25 dissolve it without acquiring colour; when heated in the nitric acid, oxalic acid is produced. When quassin is heated, it fuses like resin and loses 1·76 per cent. of hygrometric moisture; when cooled it forms a transparent yellowish brittle mass; at higher temperature it becomes more liquid, brown, carbonizes, and yields acid products, but no ammonia.

It yielded by analysis carbon 66·77, oxygen 26·32, hydrogen $6·91 = C^{20} O^{6} H^{12}$.

Quercin, a neutral crystalline substance procured from the bark of the oak. Its properties are:—It forms small colourless crystals, which are inodorous, and have a very bitter taste; they are very soluble in water, 100 parts at 66° taking up 7·3 parts; at a higher temperature a greater quantity is dissolved: the solution has no action either on litmus or turmeric paper. Quercin is soluble in weak alcohol, but not in absolute alcohol, æther, or oil of turpentine. Concentrated sulphuric acid has no action upon it at first, but it eventually becomes yellowish, and then orange yellow, but not bright red as is the case with salicin; when heated in sulphuric acid the yellow colour becomes brown, and if water is added to it a brownish yellow powder separates, which is soluble in alcohol, less so in water, and not at all in æther or oil of turpentine. It dissolves in various acids, but does not appear to combine with them; a dilute solution of potash, and lime-water also, dissolve it, but they are not saturated by it. The solution of pure quercin is not affected by carbonate of potash, acetate of lead, nitrate of silver, protonitrate of mercury, or solution of gelatin.

Quercitrin, the name given by Chevreul to the colouring principle of the bark of the quercitron. It crystallizes in colourless acicular crystals, which have at first a slightly sweet taste, and subsequently a bitter one. They are very soluble in water, in alcohol, and in æther. When quercitrin is exposed to the air in solution in water, it gradually becomes of a bright yellow colour, and by degrees the solution deposits yellowish white flakes of a crystalline appearance.

The mineral acids dissolve quercitrin, giving it a yellow colour; alkalis in contact with the air turn it of a dark brown yellow. Ammonia produces the same effect, and lime-water immediately renders it brown yellow; acetate of lead affords a white precipitate, which may be dried in a tube containing azotic gas, without becoming perceptibly coloured; but by a few hours' exposure to the atmosphere it acquires a yellow tint.

On boiling a solution of quercitrin, it becomes turbid, and deposits a quantity of small acicular crystals of *quercitrein*, less soluble in water, and which forms with hydrate of lead a beautiful yellow lake of lead. It appears from analysis that *quercitrin* is converted into *quercitrein* by absorbing four equivalents of oxygen. The formula representing *quercitrin* is $C^{32} H^{15} O^{14}$, and *quercitrein* is represented by $C^{32} H^{15} O^{18}$.

Quinoidina, the name given by Sertuerner to a third alkali, contained in yellow red and bark. Its properties are, that it is a brownish, resinous, diaphanous, lamellated mass, having the appearance of colophony. It is inodorous, and is bitter like quina; it is not volatile, fuses when heated, and burns in the air without leaving any residue; it is nearly insoluble in cold water, and fuses in hot: the solution possesses nearly the same chemical reactions as that of quina; it is very soluble in alcohol; æther renders the alcoholic solution turbid, and precipitates brown flocculi from it.

It neutralizes acids perfectly, and yields with them brown, viscid, bitter, uncrystallizable compounds, which are very soluble in alcohol; its capacity of saturation appears to be greater than that of cinchonia or quina.

Quinoïl, a neutral substance, obtained when kinic acid is decomposed by heat, or better by gently heating in a retort one part of crystallized kinic acid, four parts of binoxide of manganese, and one part each of sulphuric acid and water. The mixture swells considerably, and the thick vapours arising condense in the receiver in the form of yellow needles, and an acid liquor is produced, containing formic acid; the crystals are to be purified between folds of blotting-paper, and again sublimed.

The properties of quinoil are:—It is of a golden yellow colour; possesses great lustre, and is heavier than water; it volatilizes without decomposition, and melts at 212°. Its vapour is penetrating, and causes the eyes to water; it is slightly soluble in cold water, but alcohol and æther dissolve it readily.

The caustic alkalis alter it, and give a brown-coloured solution with it, which leaves, by evaporation, a black mass, which dissolves in water, and gives brown precipitates with acids and metallic salts. Concentrated sulphuric acid carbonizes quinoïl, and when diluted converts it into brown insoluble flocculi. Nitric acid and hydrochloric acid dissolve it with a yellow tint. Its aqueous solution is not precipitated by the salts of silver or copper; the diacetate of lead forms with it when hot a bright yellow gelatinous mass; gaseous chlorine yields with it a crystalline compound, which is soluble, and of a pale yellow colour. When quinoïl is treated with ammoniacal gas, it becomes of an emerald colour.

Quinolein, an alkali obtained by heating quina, or, which is better, conchonia, with potash; by this the quina loses the elements of carbonic acid, which combine with a portion of the potash; by distillation, colourless or slightly yellow oleaginous drops mixed with water are obtained; they are heavier than water, and dissolve in it to some extent; but they are more soluble in alcohol and in æther. The taste of quinolein is very acrid and bitter: its odour is strong, resembling that of St. Ignatius's bean. It has a strong alkaline reaction, neutralizing acids very perfectly, and precipitating certain metallic solutions. The salts of quinolein are crystallizable and soluble in water; the sulphate crystallizes in radiating silky crystals. Its composition is represented by $C^{38} H^{20} N^{2}$.

Roccellic Acid, obtained from the *Roccella tinctoria*. This acid crystallizes in fine colourless needles of a silky lustre. It is insoluble in water, whether cold or hot; alcohol dissolves it readily, 100 parts of 0·819 density, at the boiling-point, taking up 55 parts. Æther also dissolves it easily: it melts at 266°, and solidifies at 251°.

The alkaline roccellates dissolve in water, and yield solutions which froth like soap; but when concentrated, the solutions cannot be drawn out in threads like those of other soaps. Roccellate of potash crystallizes in small laminæ; the salt of lime is a white precipitate, insoluble in water, and contains 15·9 per cent. of base.

Its probable formula is $C^{17} H^{11} O^{4}$ when in crystals.

Sabadillina, an alkali contained in the different kinds of hellebore. It is obtained in the form of reddish stellated hexagonal prisms; but when quite pure it is colourless; its taste is extremely acrid; at 392° it fuses into a resinous mass, and loses 9·53 per cent. of water: at a high temperature it is decomposed. It is soluble in boiling water, but dissolves very sparingly in cold water: it is insoluble in æther. It possesses a strong alkaline reaction, and forms with acids salts which are generally crystallizable; by the concentrated acids it is decomposed; 100 parts of sabadillina saturate 19 parts of sulphuric acid. It has not yet been analyzed.

Saccharic Acid, Oxalhydric Acid, is formed by the action of dilute nitric acid on common or on grape sugar. When the solution is much evaporated it deposits crystals after long standing.

The properties of this acid are:—It forms white flocculent precipitates in lime and barytes water, soluble in excess of acid. It does not precipitate the salts of lime or barytes; nitrate of silver is not precipitated by it, but when ammonia is added to the mixture, a white precipitate is formed, which is reduced to the metallic state by exposure to the slightest heat. Nitric acid when hot converts saccharic acid into oxalic and carbonic acids; the alkalis dissolved in water with it assume a brown colour, when in excess and exposed to heat: this acid dissolves in all proportions in alcohol, and but slightly in æther; it dissolves zinc and iron with the evolution of hydrogen gas. Formula $C^{12} H^{5} O^{11}+5 HO$.

Sacchulmic Acid and Sacchulmin.—When cane-sugar is boiled for a long time in sulphuric acid diluted with about thirty parts of water, or with very dilute nitric or hydrochloric acid, *sacchulmin* is deposited in brown, brilliant, crystalline scales, contaminated with *sacchulmic acid;* the latter is readily dissolved by ammonia, in which the former is insoluble.

The properties of sacchulmic acid are:—It is dissolved by ammonia and the alkalis, and is precipitated from them by acids in brown flocculi; these when dry become a light brown powder, insoluble in alcohol and in æther; by long ebullition in water it is converted into sacchulmin, and loses its solubility in ammonia, but without undergoing any change in its composition. Its ultimate analysis leads to the formula $C^{2} H^{2} O=22$, as its composition; but its saturating power indicates fifteen times this number as its equivalent.

Salicin. The composition of this substance is probably more correctly represented by $C^{42} H^{23} O^{16}+6HO$, than as we have formerly stated it. [Salicin, P. C.]

Saliculous Acid. When a mixture of one part of salicin, one of bichromate of potash, two and a half of sulphuric acid, and twenty of water are made to act on each other in a retort, the result is the formation of saliculous acid. The salicin is to be dissolved in one part of the water, and the sulphuric acid diluted with the remainder. Heat and effervescence are produced, and when these cease distillation commences; the acid comes over with the vapour of water, and after some time they separate: the acid is to be purified by washing with water and rectifying from chloride of calcium.

The properties of saliculous acid are:—It is an oleaginous liquid, colourless or slightly yellow; inflammable, and burns with a sooty flame; specific gravity 1·1731, boils at about 354° F., becomes solid at 5° below zero; its taste is hot, and its smell aromatic and agreeable. Water dissolves it pretty readily, and the solution, at first green, reddens tincture of litmus, and eventually destroys the colour.

Concentrated sulphuric acid decomposes saliculous acid; chlorine and bromine take an equivalent of hydrogen from it, and hydrochloric or hydrobromic acids are formed and evolved; the chlorine or bromine, replacing the hydrogen, form chlorosaliculic or bromosaliculic acid.

Saliculous acid is also obtained when the flowers of the *Spiræa ulmaria*, or meadow-sweet, are submitted to distillation. Its formula is $C^{14} H^{6} O^{4}$ or $C^{14} H^{5} O^{3}+HO$.

This acid combines with bases to form salts, in which case it loses an equivalent of oxygen and hydrogen in the form of water, which is replaced by the combining base.

Saliculic Acid is obtained by heating saliculous acid with potash; the mixture is of a faint brown colour, and the heat must be continued till it becomes colourless. During this process hydrogen is evolved; the residue is to be dissolved in water and treated with excess of hydrochloric acid, this precipitates the saliculic acid, which is to be purified by repeated solutions and crystallizations.

The properties of this acid are:—It crystallizes from solution in hot water in small tufts, and by sublimation it is obtained in long needles; it is but slightly soluble in cold water, but very readily dissolved by hot water and by alcohol. It reddens litmus-paper, and decomposes the alkaline carbonates. It is decomposed by hot sulphuric acid, with the development of charcoal, and the evolution of sulphurous acid gas. Its formula is $C^{14} H^{5} O^{5} + HO$.

The salts which it forms have been but little examined.

Saliculimide. When ammonia is added drop by drop to saliculous acid dissolved in alcohol, the liquor becomes a paste composed of very fine yellow needles; when moderately heated the crystals redissolve, and on standing the solution deposits brilliant transparent prisms of a golden-yellow colour, which when dry are hard and reducible to powder, and are insoluble in water, whether cold or boiling.

When submitted to dry distillation saliculimide is decomposed, leaving a coaly residue; acids and alkalis convert it into saliculous acid and ammonia. It appears that at first saliculite of ammonia is formed, which is very soluble in alcohol, and that this by the subsequent excess of ammonia becomes gradually converted into saliculimide. Its formula is $C^{42} H^{18} O^{6} N^{2}$.

Saliretin. When a solution of salicin in dilute sulphuric or hydrochloric acid is boiled, it soon becomes turbid, and deposits a yellowish white substance on the sides of the vessel, which possesses the consistence and properties of a resin, and this is saliretin.

Its properties are:—It is insoluble in water or in ammonia, but very soluble in alcohol, æther, and in concentrated acetic acid. Water precipitates it from its solutions. It is soluble in the caustic alkalis, and is precipitated from them by acids. Concentrated sulphuric acid gives it a blood-red colour. With nitric acid it yields carbazotic acid.

By analysis it yielded carbon 72·96, hydrogen 5·83, oxygen 21·21, in 100 parts.

Scillitin, the bitter principle of squills (*Scilla maritima*). This is obtained by first inspissating the juice of the root, then treating it with alcohol, and after having evaporated the solution, dissolving the residue in water; to the solution acetate of lead is to be added, which gives a precipitate that is to be separated; afterwards sulphuretted hydrogen is to be passed into the solution, and it is finally to be evaporated. By this scillitin is obtained, which has the following properties: it is colourless, friable, of a bitter taste at first, and afterwards nauseous and sweetish, and attracts moisture from the air. It is soluble in alcohol and in æther; its solution is not precipitated by acetate of lead. It is emetic and purgative, and when it is very pure may occasion death.

Smilacin, *Pariglin*, *Salseparin*, *Parillic Acid*, a peculiar principle found in sarsaparilla (*Smilax Sarsaparilla*). It exists in the form of colourless needles, is inodorous, very soluble in water and in alcohol, when boiling, but less so when cold. It dissolves in æther and volatile oils; the fixed oils dissolve it sparingly.

Smilacin dissolves in weak acids and alkaline solutions, and separates from them unaltered when they are neutralized. Nitric acid partly decomposes it. Sulphuric acid colours it first deep red, then violet, and afterwards yellow; water precipitates it unaltered. Its formula is $C^{15} H^{18} O^{5}$.

Solanina, an alkali existing in the nightshade (*Solanum dulcamara*) and several other species of solanum; it has been found also in the potato which has been allowed to germinate in the dark.

A boiling saturated alcoholic solution of solanina deposits on cooling a pearly white powder composed of flattened quadrangular prisms. It changes by exposure to the air; is inodorous, and has a nauseous, acrid, and somewhat bitter taste.

Its alkaline reaction is but weak; it does not alter the colour of turmeric, but restores that of reddened litmus. It is very slightly soluble in water, and the solution is not rendered turbid by tincture of galls. It cannot be melted without decomposing. Its affinity for acids is but weak, and the greater number of the salts which it forms with them do not crystallize. The sulphate effloresces, by the spontaneous evaporation of the solution into masses resembling cauliflowers in form, or in crystalline crusts.

The salts of solanina have a disagreeable permanently acrid taste, and are poisonous. They are very soluble in water and in alcohol. The aqueous solution is precipitated by tincture of galls, and gives a yellow precipitate with chloride of platina. Its formula is $C^{84} H^{68} NO^{28}$.

Stramonin, a neutral principle obtained from the *Datura Stramonium*. It has the form of acicular crystals, which are white, inodorous, and insipid; they melt at 302°, and sublime unchanged when carefully heated, and at a higher temperature burn with a sooty flame. Stramonin is insoluble in water; alcohol takes up but little; in æther it is very soluble. The solutions have no alkaline reaction. Neither sulphur nor iodine, even when heated, acts upon it; concentrated sulphuric acid dissolves it with a blood-red colour; boiling hydrochloric acid decomposes it; moderately diluted nitric acid does not decompose it even when boiling, nor does potash act upon it. It is not precipitated by the chlorides of mercury or platina, or by acetate of lead.

Sulpharsin, a substance produced by the decomposition of alcarsin by means of sulphuretted hydrogen, or it may be obtained by distilling chlorarsin with sulphuret of barium. It is an ethereal liquid possessing a very disagreeable odour, and is heavier than water, and insoluble in it.

Sulphocyanogen, *Bisulphuret of Cyanogen.* This substance is prepared by saturating a concentrated solution of a metallic sulphocyanide with chlorine or by heating it with nitric acid; it falls in the form of a deep yellow amorphous powder, which retains its colour when dry; it is light, porous, insoluble in water, alcohol, and æther, but it is dissolved by strong sulphuric acid, and precipitated from it by water. It is decomposed by nitric acid, and by potassium with the aid of heat, giving rise to the formation of the sulphuret, cyanide, and sulphocyanide of potassium. By the action of heat it is decomposed, and yields sulphuret of carbon and sulphur, and the residue is mellon, which at a high temperature is decomposed into azote and cyanogen gases. Its formula is $Cy\ S^{2}$.

Sulphocyanogen combines with one equivalent of hydrogen to form hydrosulphocyanic acid.

Terbium, a peculiar metal recently discovered by Mosander in the state of oxide in gadolinite, orthite, &c., associated with yttria, and with oxide of erbium, another new metal.

The oxide of terbium has not yet been reduced to the state of metal; it is distinguished from that of erbium in not becoming of a dark orange-yellow colour when heated in the air. The oxide of terbium is insoluble in water and in the caustic alkalis; it is soluble even after heating to redness in a boiling solution of carbonate of soda, but after a few days it separates from solution in the state of a double salt; the carbonate of terbium is soluble in solution of carbonate of ammonia, and after saturation forms with it in a few hours a double salt, which separates in such quantity that a very little of the oxide remains in solution; the salts of this oxide are colourless and have a sweetish taste. The sulphate is more soluble in cold water than in hot; the nitrate yields by evaporation a crystalline mass which deliquesces in a moist atmosphere.

The oxide of terbium has hitherto been obtained in small quantity only, and its properties are but little known.

Thein, a neutral vegetable principle obtained from common tea, and supposed to be identical in its nature with caffein [Caffein, P. C.], the peculiar principle of coffee. To prepare it a decoction of tea is mixed with excess of solution of di-acetate of lead. The solution, filtered from the precipitate formed, is to be treated with sulphuretted hydrogen to remove the excess of lead, filtered, evaporated to a small bulk, and neutralized by ammonia; the thein crystallizes on cooling, and is to be purified by animal charcoal. It forms tufts of white delicate silky needles, which have a bitter taste, melt and lose water when heated, and sublime without decomposition. It is soluble in about 100 parts of cold water and more soluble in boiling water, or water slightly acidified. According to Liebig the formula representing its composition is $C^{8}H^{5}N^{2}O^{2}$.

CHEMISTRY, ORGANIC. [Tissues, Organic, P. C. S.]

CHEMNITZ, MARTIN, the most eminent of the Protestant divines of the sixteenth century, after Luther and Melanchthon, was the son of parents in an humble condition of life. He was born at Treunbrietzen in the Mark of Brandenburg, on the 9th of November, 1522. He received his education at Magdeburg and at Frankfort on the Oder, and in 1544 accepted the place of a schoolmaster at Wrietzen on the Oder; he devoted the small salary which he derived from it, in the following year, to the prosecution of his studies at Wittenberg. By the advice of Melanchthon, he applied to mathematics and astronomy, and in 1547 went, in company of his relation, George Sabinus, to Königsberg, where he obtained, in 1548, the place of Rector in the Cathedral School; he composed the calendar for 1549-1550, and having been recommended for his astronomical knowledge to Duke Albert of Prussia, was appointed his librarian. From that time forward, theology became his principal study. In the disputes of Osiander, on the doctrine of justification, he took part with Mörlin against him; but this affair caused him so much vexation, that he requested and obtained the duke's permission, in 1553, to return to Wittenberg to pursue his theological studies. Here he delivered lectures on Melanchthon's 'Loci Communes,' from which his own 'Loci Theologici,' published by Leyser (Frankfort, 1591, folio), arose, and which form a commentary on the doctrines of Melanchthon, which is superior to all other works of the kind of that age, and is still of permanent value. In 1554 he obtained the situation of pastor at Brunswick, and attacked the Jesuits by a simple exposition of their dangerous doctrines, in his 'Theologiæ Jesuitarum præcipua Capita' (Leipzig, 1562). On the publication of a defence of the order of the Jesuits and of the Council of Trent by the Portuguese Jesuit Didacus de Paiva de Andrada, he took occasion to subject the resolutions of that council to a severe examination. Hence arose his 'Examen Concilii Tridentini' (4 vols. Leipzig, 1565, 8vo.). The best edition is that of Frankfort, 1707, folio), a work full of historical information, and of solid refutation of the Roman Catholic doctrines, which has not been surpassed by any subsequent writer against the Roman Catholics, and is still serviceable, in the opinion of Protestants, beyond other works of the kind, to prove the fallacy of the Papal system. The sound judgment, the clear and easy yet serious and impressive style, and the spirit and moderation manifested in his work, caused even the Roman Catholics to admire him: they used to say to the Protestants, '*Vos habuistis duos Martinos; si posterior non venisset, prior non stetisset.*' With equal approbation he defended Luther's doctrine of the Lord's Supper against the Calvinists in his 'Repetitio sanæ Doctrinæ de vera Præsentia Corporis et Sanguinis Domini in Cœna Sacra' (Leipzig, 1561). He also took a decided part in fixing the doctrines of the Protestant church. In conjunction with Mörlin, he compiled at Königsberg, in 1566, the 'Corpus Doctrinæ Prutenicæ,' which acquired great authority among the Protestants in Prussia. Having become superintendent of the diocese of Brunswick in 1567, he drew up a creed for the churches of Lower Saxony, which was adopted in 1571, at the Convention of Wolfenbüttel, and from 1573 he exerted himself, with Jacob Andrea, to induce the churches of Saxony and Suabia to adopt the 'Formula Concordiæ,' which was introduced in Upper and Lower Saxony, Suabia, and Franconia, as a rule of faith. He devoted himself almost exclusively to this work; took, with Andrea, a leading part in all the meetings that were held on the subject; and obtained the admiration of his contemporaries, as well by the prudence and firmness of his conduct as by the depth and extent of his knowledge. Having resigned his office in 1565, he died at Brunswick on the 8th of April, 1586. The 'Harmony of the Gospels,' which he had begun, was completed by Leyser and Joh. Gerhard.

Chemnitz was so highly esteemed by his contemporaries, that, after his settling at Brunswick, he received offers of important situations from Frederick, king of Denmark; from the electors Louis of the Palatinate, Augustus of Saxony, and John George of Brandenburg, likewise from Duke Albert of Prussia, and the Protestants in Austria, but he was satisfied with his situation, and declined them.

(Brockhaus, *Conversations-Lexicon; Die Kirchen Historie*, 2 vols. 4to. Jena, 1735.)

CHEQUE, an order on a banker by a person who has money in the bank, directing him to pay a certain sum of money to the bearer or to a person named in the cheque, which is signed by the drawer. Cheques are immediately payable on presentment. They are not liable to stamp-duty, and are therefore limited in their functions in order to prevent their circulating as bills of exchange. They must, for example, be payable on demand, without any days of grace; be drawn on a banker within fifteen miles of the place where they are issued; the place of issue must therefore be named, and they must bear date on the day of issue. A cheque should be presented on the day on which it is received, or within a reasonable time. One of the first rules to be observed in writing a cheque is to draw it in a business-like manner, so as to prevent a fraudulent alteration in the amount, for if otherwise the drawer may be liable. A 'crossed' cheque is an ordinary cheque with the name of a particular banker written across the face of it for security, or it may be crossed simply '& Co.'; and in these cases it will only be paid through that particular banker or some banker. If presented by any other person, it is not paid without further inquiry. The 'Bankers' Magazine' for Oct. and Nov. 1844, and Jan. and Feb. 1845, contains some valuable information on the Law of Cheques.

On of the great advantages of a banking account is the convenience of drawing cheques. A person is thus relieved of the necessity of keeping ready money in his hands, and a cheque is some evidence of payment in the absence of a proper receipt. The Bank of England allows cheques to be drawn for sums of 5*l*., but a few years ago it allowed no cheques under 10*l*.

CHEREMISSES. [Russia, P. C.]

CHERLE'RIA, a genus of plants belonging to the natural order Caryophylleæ. It has 5 sepals, 5 petals (sometimes absent), 10 stamens, the outer ones opposite to the sepals springing from an oblong, emarginate, glandular base, 3 styles, a 3-valved capsule. There is only one species which is a native of Great Britain. It was called by Linnæus *C. sedoides*. The petals are very generally wanting, the flowers are solitary on short stalks. The stems are numerous, forming a dense mass close to the ground. The leaves are very numerous, linear-subulate, and finely ciliated. It is found on the summits of the mountains of Scotland.

(Babington, *Manual of British Botany*.)

CHERUBI'NI, MARIA-LUIGI-CARLO-ZENOBI-SALVADOR, was born in Florence, in 1760. At nine years of age he commenced the study of composition under the two Felicis, father and son, both of whom dying, he was transferred, first to Bizzari, and afterwards to Castrucci. In 1773 he composed a mass and a motet, which excited a great sensation in his native city; and during the five following years he produced many other works, both for the church and the theatre, which met with decided success. This attracted the notice of the grand-duke Leopold II. of Tuscany, who in 1778 granted him a pension, and enabled him to complete his studies under the celebrated Sarti, at Bologna, with whom he passed nearly four years, not only receiving much valuable instruction from that master, but also assisting him in filling up his scores, a practice to which, under such superintendence, his skill in this branch of composition may, in great measure, be attributed. In 1784 he was invited to London, where he continued two years, and composed his operas 'La Finta Principessa,' and 'Giulio Sabino,' in the latter of which the famous *musico* Marchesi made his débût at the King's Theatre. In 1786 Cherubini quitted the British capital, and settled in that of France, which thenceforward became his adopted country and the scene of his greatest triumphs. He however occasionally visited Italy, and in 1788 brought out his 'Ifigenia in Aulide' at Turin. Returning to Paris in the same year, he gave, at the Académie Royale, his 'Demophoon.' The opera of 'Lodoiska' was produced in 1791, at the Théâtre Feydeau, an event that forms an epoch in the annals of the comic opera. From this it was apparent that Cherubini meant to tread, and that he was worthy to tread, in the footsteps of Haydn and Mozart. (*Dictionnaire Historique des Musiciens.*)

'Lodoiska' was succeeded by 'Elisa,' 'Médée,' 'Les deux Journées,' 'Anacreon,' and 'L'Hôtellerie Portugaise.' In 1805 Cherubini was invited to Vienna, and there brought out, at the Imperial Theatre, his 'Faniska.' His fame now became European, and in 1815 he was invited to London by the Philharmonic Society, for which he composed an overture, a symphony, and a grand concerted vocal piece, all of which were performed under his own direction at the concerts of that distinguished society, and certainly exhibit the pen of a master. But his Muse proving less propitious on this than on many former occasions, the effect of these works was not commensurate with the labour he bestowed on them, and with the anxiety he felt (to which we can bear testimony) to justify the expectations which his overture to 'Anacreon'—as performed with marvellous effect at the very first of the Philharmonic Concerts—had excited. On his return to Paris, he found himself much injured by the impolitic changes making by the restored dynasty in the musical as well as the other government establishments of that city, and retired from some of his situations in disgust; but he was soon recalled, and became composer of the Chapelle du Roi, Professor of Composition at the Ecole Royale—of which in 1822 he was made Director,—a member of the Académie Royale des Beaux Arts, and Chevalier of the Legion d'Honneur. His last theatrical work was 'Ali Baba,' a grand opera, produced in 1833, but, though received with every mark of respect by the French public, it did not keep possession of the stage. He died in March, 1842, and his obsequies were celebrated in a most solemn and distinguished manner. His own fine 'Requiem,' the last composed of his masses, was performed on the occasion.

In instrumental music Cherubini's fame has spread throughout Europe. But it is in the field of sacred music that his genius expanded in its full dimensions. His masses, psalms, motets, &c. unite the most learned construction and the charms of the most original and sweetest melody. His mass *à trois voix* is a masterpiece, and of itself sufficient to ensure the composer great and lasting reputation. Of his secular vocal works we only need mention his admirable finale to 'Les deux Journées,' of which M. Castil-Blaze has given so picturesque a description, and so laboured an analysis, in his work on the French opera. The other compositions of this great artist are too numerous to be even named here.

(*Harmonicon*, iii.)

CHETTLE, HENRY, whose name occurs very frequently in the history of the old English drama, was a contemporary of Shakspere. We read the names of forty plays attributed to him in whole or in part, the dates of which extend from 1597 to 1602; but his writing for the stage is inferred by Mr. Collier to have begun before 1592, when he published Greene's 'Groatsworth of Wit.' He appears to have been originally a compositor. Four only of his plays have been printed, of which an account is given in Collier's 'History of Dramatic Poetry;' and the same editor has inserted, in his 'Supplementary Volume' to Dodsley's Collection, 'The Death of Robert, Earl of Huntington,' written by Chettle and Anthony Munday.

CHIEF-JUSTICE. [Courts, P. C.]

CHILD, SIR JOSIAH, Bart., was an eminent London merchant in the latter part of the seventeenth century, and one of the ablest of our earlier English writers on commerce and political economy. His principal publication is entitled 'Brief Observations concerning Trade and the Interest of Money, by J. C.,' 4to., Lond. 1668. In his preface he tells us, that this tract was written at his country-house in the sickness-year, that is in 1665. Its leading purpose is to defend the late reduction of the legal rate of interest from 8 to 6 per cent. (originally made by ordinance of the Long Parliament in 1651, and confirmed at the Restoration), and to urge a still further reduction. The author's great example of commercial success is that of the Dutch; and he maintains that 'the lowness of the rate of interest is the *causa causans* of all the other causes of the riches of that people.' The rate of interest, as is now well understood, is merely a measure or expression of the ratio of the supply of money to the demand. It rises or falls with the rate of profits: and that again depends in great part upon the quantity of capital seeking for employment: so that, in fact, instead of a low rate of interest being the cause of accumulated wealth in a community, it is more likely to be the consequence of that state of things. This was pointed out in an answer to Child's treatise, published the same year under the title of 'Interest of Money Mistaken, or a Treatise proving that the abatement of Interest is the Effect and not the Cause of the Riches of a Nation.' In another respect also Child's notions in this publication are opposed to those now generally entertained: his recommendation, namely, that the natural rate of interest should be kept down, or rather attempted to be kept down, by a legal restriction. In support of his views he reprints, as an appendix, Sir Thomas Culpeper's 'Tract against the High Rate of Usurie,' first published in 1623. Notwithstanding some fundamental defects, however, the work contains much that is sound and valuable; and some of the principles laid down in it are both in advance of the current opinions of the day, and pithily and happily expressed. A second edition, much enlarged, appeared in 1690, under the title of 'A New Discourse of Trade;' a third in 1698; and the work has since been twice reprinted, the last time in 12mo., at Glasgow, in 1751. It is in this work that Child has explained his plan for the relief and employment of the poor, of which Sir Frederic Eden has given an account in his 'State of the Poor,' vol. i. pp. 186, &c. It included the substitution of districts or unions for parishes, and the compulsory transportation of paupers to the colonies. He proposes that the funds should be managed by an incorporated body, to be styled 'The Fathers of the Poor,' and to wear, each of them, 'some honourable medal, after the manner of the familiars of the Inquisition in Spain.' In Watt's Bibliotheca, and other catalogues, this plan is noticed as a separate publication (though without date); but we do not know that it ever appeared except as one of the chapters of the 'New Discourse of Trade.' Child, who was one of the directors, and for some time chairman, of the East India Company, and who took a leading part in the conduct of its proceedings, is stated to have written several tracts in defence of the trade to the East Indies; but they appear to have been all anonymous, and the only one which has usually been distinctly assigned to him is that entitled 'A Treatise wherein it is demonstrated that the East India Trade is the most national of all Foreign Trades, by Φιλοπατρις,' 4to. Lond. 1681.' This is affirmed in the work called 'The British Merchant' (originally published in 1710), second edition, vol. i. p. 162, to have been written by him, or at least by his direction. It was contended by the opponents of the company, that the East India trade was ruinous, or prejudicial, by reason of its draining the country of gold and silver: it was answered by Child, as it had been many years before by Thomas Mun, in his 'Discourse of Trade from England unto the East Indies,' that the trade in reality brought more treasure, or gold and silver, into the country than it took out of it, by our sales of Eastern commodities to other European nations. It was upon this ground, simply, that parliament had recently (by the 15 Car. II. c. 7, s. 12) so far permitted the trade to be legally carried on in the only way in which it could be carried on at all as to allow the exportation duty-free of *foreign* coin and bullion.

Taking his stand upon what has been called the mercantile system, the principle of which is, that the value of a foreign trade depends upon the balance which it leaves to be received in money, Child admitted the paramount importance of gold and silver, but contended that the effect of the India trade, taken in its whole extent, as including the trade with other countries which we carried on by means of our imports from the East, was to promote, not to prevent, the accumulation in our hands of the precious metals. The destruction however of the fancy that there was anything necessarily desirable in that result, as far at least as it could be destroyed by reasoning, and the demonstration of the truth that gold and silver do not differ in any respect, in their commercial character, from other commodities, were accomplished a few years after this date by Sir Dudley North, in his 'Discourses upon Trade, principally directed to the cases of Interest, Coinage, Shipping, and Increase of Money,' 4to., Lond. 1691.

Sir Josiah Child was of good family. In the chapter of his 'New Discourse of Trade' which relates to the support of the poor, he mentions his father, stating that he had much studied that subject. He was Richard Child, and, like his son, a merchant of London. He is stated to have been descended from John Child, the son of William Child, by Catherine, daughter of Sir Thomas Coventry, one of the Judges of the Common Pleas, the father of the first Baron Coventry, Lord Keeper of the Great Seal, and the ancestor of the earls of Coventry. As Judge Coventry died in 1606, Richard Child, who is stated to have died in 1638, could not well have been a more remote descendant than his grandson, and was most probably the son of his daughter. Her husband was one of the family of Child, Le Child, or l'Enfant, originally of Shropshire, but which had been seated at Northwich in Worcestershire since the middle of the fourteenth century. Sir Josiah was his father's second son: his mother was Elizabeth Roycroft, of Westonwick, in Shropshire, of a family stated to be originally from Abbeville in Normandy. He was born in 1630, was created a baronet in 1678, and died in 1699. He was thrice married. By his first wife, Anne, daughter of Edward Boat, of Portsmouth, who appears to have been a person in an inferior station of life, he had, besides two sons who died in infancy, a daughter Elizabeth, who married John Howland, Esq., of Streatham, in Surrey, and whose daughter Elizabeth married Wriothesley, son of William Lord Russell (the celebrated patriot), and in this way became Baroness Howland in 1695, and Duchess of Bedford in about a year after the death of her grandfather. Sir Josiah's second wife was Mary, daughter of William Atwood, Esq., of Hackney, merchant of London, and widow of Thomas Stone, also a London merchant; by her he had a son, Josiah, and two daughters, the elder of whom, Rebecca, married, in 1683, Charles, Marquess of Worcester, and became by him the mother of Henry, the second duke of Beaufort, who succeeded to the dukedom a few months before his grandfather died. She was afterwards re-married to John lord Granville, second son of John, first Earl of Bath. The third wife of Sir Josiah was Emma, the younger of the two daughters and co-heirs of Sir Henry Bernard, of Stoke, in Shropshire, Knight, and the widow of Francis Willoughby, Esq., of Wollaton, Notts, by whom she was the mother of Thomas, the first Lord Middleton, and of Cassandra, the second wife of James, first Duke of Chandos; her sister Elizabeth having been the mother of his Grace (the Timon of Pope, or the Grand Duke, as he was popularly called). Sir Josiah had two sons, Bernard and Richard, by this wife, who survived till the year 1735; 'at which time,' we are told by Morant, the historian of Essex, 'it was said she was nearly allied to so many of the prime nobility that eleven dukes and duchesses used to ask her blessing; and it was reckoned that above fifty great families would go into mourning for her.' Bernard Child died unmarried about a year before his father; Sir Josiah's successor in the baronetcy, his eldest son, of his own name, who had been knighted by King William before his father's death, and sat in parliament for Wareham, died without issue in 1704; and the title then devolved upon the last of the three brothers, Richard. He sat in the House of Commons first for Maldon and afterwards for Essex; and was made Viscount Castlemaine in 1718, and

Earl Tylney in 1732, both in the Irish peerage, having previously married Dorothy, daughter and heir of John Glynne, Esq., of Henley Park, Surrey, by Dorothy, daughter of Francis Tylney of Rotherwick, in Hants. Lady Tylney eventually inherited the Rotherwick estates; upon which, in 1734, the surname of Tylney was assumed under the authority of an act of parliament by her son John, who became Earl Tylney on the death of his father, the first Earl, in 1750. Upon his death without issue, in 1784, the title became extinct; and the estates devolved upon Sir James Tylney Long, the son of his sister Lady Emma, who had, in 1735, married Sir Robert Long, Bart., of Draycote House, Wilts. In 1812, Catherine, Sir James's eldest daughter and co-heir, married the Hon. William Wellesley Pole, who thereupon assumed the additional names of Tylney Long, and is now Lord Maryborough; his father, an elder brother of the Duke of Wellington, having assumed the surname of Pole in 1778, on succeeding to the estates of his cousin, William Pole, of Ballifin, Esq.; and the previous family name of Wellesley having been assumed, in 1728, instead of that of Colley, by the first Lord Mornington on succeeding to the estates of his cousin, Garret Wellesley, of Dangan, Esq. Of the estates of Sir James Long which came to Mr. Wellesley Pole in right of his wife, a principal portion consisted of the manor of Wanstead in Essex, which had been purchased by Sir Josiah Child of the heirs of Sir Robert Brooks, and upon which his son, the first Earl Tylney, had erected one of the most magnificent houses in England. This house, the building of which is said to have cost 360,000*l.*, its new possessor, whose wife died in 1825, sold in 1823 by auction for 10,000*l.*, one of the conditions of the sale being that the purchasers should clear everything away to the foundation before Lady-day, 1825.

(*The History and Antiquities of Essex*, by the Rev. Philip Morant, 2 vols. fol. 1768; Kimber's *New Peerage*, 1778; Collins's *Peerage*, by Brydges; *The Irish Compendium of Honour*, various editions; Brayley and Nightingale's *Middlesex; Annual Register*, various volumes; Anderson's *Chronological Deduction of Commerce*; Macpherson's *Annals of Commerce;* MacCulloch's *Principles of Political Economy*, and *Literature of Political Economy.*)

CHILD-KILLING. [INFANTICIDE, P. C.]

CHILD-STEALING. [ABDUCTION, P. C.]

CHIMNEY (derived immediately from the French *cheminée*, which conveys the idea of a narrow passage, a diminutive or feminine form of *chemin*, but primarily from the Latin *caminus*), an enclosed passage, funnel, or tunnel (see remarks on the etymology of TUNNEL, P. C., p. 368), for the escape of smoke from a fire-place or furnace. The office of a chimney is not merely the removal of smoke, but also the production of draught to excite the combustion of the fire, by the heating and consequent rarefaction of the column of air inclosed in the funnel, the rising of which causes a partial vacuum, which should be filled with air admitted either through or over the burning fuel. [SMOKE, P. C., p. 154; FURNACE, P. C., p. 21; WARMING AND VENTILATION, P. C., p. 71.]

The construction of house-chimneys is briefly treated of under HOUSE, P. C., pp. 327, 328; but the explanatory diagram of a stack of chimney-flues, referred to under BRICKWORK, P. C., p. 410, was omitted there. Before introducing it we shall enumerate, on the authority of Nicholson's 'Architectural Dictionary,' article 'Chimney,' the technical names given to the various parts of a chimney and fire-place. That which builders term the *fire-place* is the square recess or opening, facing the room, in which the stove is fixed or *set*. The *hearth* is the flat piece of stone, or marble, or metallic plate, immediately *under* the fire-place, while the large flat stone on the same level, but *before* the fire-place, though very commonly called the hearth, is technically called the *slab*. The vertical sides of the opening of the fire-place, and the projections from the face of the wall at each extremity of the slab, are the *jambs;* and the horizontal head of the fire-place, the ends of which rest upon the jambs, is styled the *mantel*. *Covings* are the oblique facings of stone, marble, or metal, sometimes applied to the inside of the jambs to reduce the space at the back of the fire-place. *Funnel* is a general name applied to the cavity or passage of the chimney, from the fire-place to the top of the wall, the lower part of which, where the sides are sloped so as to contract the passage from the dimensions of the top of the fire-place to those of the flue, is called the *gathering of the wings*, or simply the *gathering*. The *flue* is the long narrow passage which extends from the gathering to the top of the wall, and which, whatever may be its course, should be of equal dimensions throughout its whole length; and the *throat* is the lower end of the flue at its junction with the gathering. The *breast* is that part of the wall which faces the apartment, and forms that side of the funnel which lies parallel to it; and the *back* is the opposite wall of the flue, parallel with the breast, but at the side farthest from the apartment. *Withs* are the narrow partition-walls which separate one flue from another rising beside it, and which form the sides of the flue, the *breast* and *back* being considered the front and back. A *stack*, or *chimney-stack*, is a wall containing a number of chimneys or flues arranged side by side. The *chimney-shaft* is the turret rising above the roof, to conduct a chimney or stack of chimneys to a sufficient height; and the *chimney-top* is the horizontal termination of the chimney-shaft, which is commonly surmounted by *chimney-pots*, to contract the upper end of the funnels or flues.

In modern English houses it is a common practice to form the chimney-flues within the substance of the party-wall, an arrangement which, while it involves rather more brickwork than the older plan of forming them in the projecting jambs, has the advantage of leaving the width and projection of the jambs entirely dependent upon the taste of the architect. Where this plan is adopted in the case of two adjoining houses, the fire-places of which are back to back, the flues of the two houses may be brought into one plane, as illustrated in the annexed diagrams, *Figs.* 1 and 2. *Fig.* 1 represents the arrangement of the flues in a four-story house, having two fire-places on each of the three lower floors, and three on the upper floor, making nine in all. Being one of two houses with their flues united into one stack, the number of separate flues required is eighteen; but to show the arrangement more distinctly, the flues of one house only are tinted, while those of the adjoining house, rising from fire-places in the same positions, but on the opposite side of the party-wall, are left in outline. The fire-places are indicated by a dark tint, and the positions of the floors and partitions are shown by dotted lines. *Fig.* 2 represents transverse sections or ground-plans of the party-wall and flues, at the respective levels of the floors, *a*, *b*, and *c*, the flues of the one house being shown by a dark colour, while those of the other, left in outline in *Fig.* 1, are shown white. If the stack were for a single house only, the arrangement of the tinted set of flues would need to be a little altered, so as to bring them close together in the chimney-shaft. Were the flues of the same house to be formed in the jambs, instead of being in the substance of the party-wall, the transverse section of the wall at the floor *a*

Fig. 1.

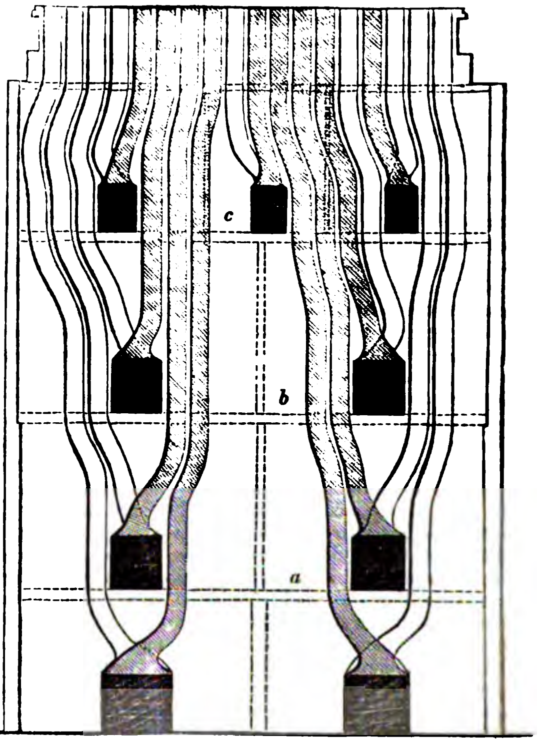


Fig. 2.

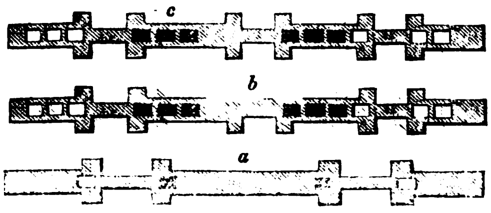
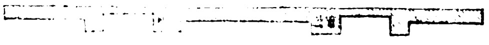


Fig. 3.

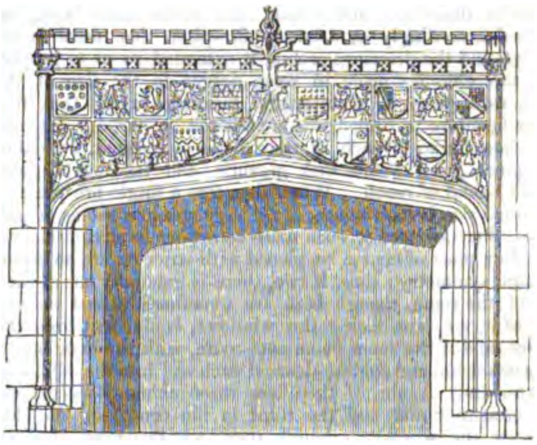


would be as in *Fig.* 3, the inner jambs being widened to receive the flues from the basement story; but the arrangement of the flues in the upper storeys would be altered, so as to distribute the flues as equally as possible on each side of the fire-places. It is however impossible in a lofty house, with flues of this description, to avoid the disfigurement of unequal jambs, since it will inevitably occur that in some cases a fire-place will have one flue in the one jamb and two in the other, or two flues on one side and three on the other. Another important advantage gained by placing the flues in the party-wall is, that the projection of the jambs and breast may be reduced from fourteen inches, the projection necessary when the flues are in the jambs, to four inches and a half. This advantage is not apparent in the cuts here given, because where fire-places are made back to back they cannot be made to recede so far into the wall as in other cases, it being necessary to preserve a thickness of nine inches between the backs of the two fire-places. The variations from the straight vertical course necessary to enable the flues which rise from the fire-places of the lower storeys to pass beside the fire-places of upper storeys, are useful in checking the tendency of the chimneys to smoke, and are frequently increased for that purpose beyond the degrees necessary for their arrangement in the stack; but in making them it is very desirable to avoid angles and sudden turns, which encourage the lodgement of soot, and impede the operation of the sweeping-machine. It is hardly needful to observe here the importance [Smoke, P. C.] of avoiding the communication of one flue with another. Such an arrangement is now very rarely permitted, excepting in the case of a copper or oven flue, which is frequently turned into a kitchen flue, instead of being carried up separately to the top of the stack.

Indispensable as chimneys now appear, they are of comparatively modern invention. Beckmann, who gives a long dissertation on their early history, with numerous references to passages in antient writers bearing upon the subject (*History of Inventions*, English edition of 1814, vol. ii. pp. 62-101), says that the oldest certain account of chimneys with which he was acquainted occurs in the year 1347, when several chimneys at Venice were thrown down by an earthquake; but they were not in general use until long after that time.

On the subject of engine and factory chimneys the reader may consult Dr. Ure's 'Dictionary of Arts,' article 'Chimney,' where it is stated that the celebrated Montgolfier was the first to investigate the general principles of chimney-draughts, as applied in manufacturing establishments. Dr. Ure gives sectional and other diagrams of one of the immense and yet beautiful chimneys at the Camden Town station of the London and Birmingham Railway, connected with the furnaces of the stationary engines for working the Euston inclined plane. Hebert, 'Engineer's and Mechanic's Encyclopædia,' vol. i. p. 364, describes a curious mode of constructing chimneys with circular flues enclosed within common brick flues of an octagonal form, in such a manner that the inner flue, which forms the only passage for the smoke, is surrounded by a current of hot air supplied by enclosed chambers at the back of the fire-place, the effect of which is greatly to improve the draught. The internal flue is formed of a peculiar wedge-shaped kind of brick, which affords facilities for the formation of curves without any roughness or irregularity in the work, whenever it is desired to conduct the flue in a serpentine direction. This plan, which is patented by Mr. Hiort, is said to have been adopted in several public buildings with success. In the better sort of houses the flues are sometimes so constructed that they may be swept from openings in the basement story, without any communication with the rooms into which the fire-places open.

CHIMNEY-PIECE. The assemblage of architectural dressings around the open recess constituting the fire-place in a room, and within which the fuel is burnt, either immediately upon the hearth itself, or in a raised grate or open stove. Accordingly, the fire-place being the spot around which persons naturally group themselves in an apartment, or near which they take their station—literally the focus of the domestic circle—the chimney-piece has always been made a principal feature and one chief point for decoration, so much so as to have come to be considered almost essential to the character of a sitting-room; for though an equal degree of warmth and a more equable temperature may be obtained by means of flues for hot air, a room has a rather blank and comfortless appearance without one; and though the want of a fire-place is not felt, the chimney-piece is missed as an architectural feature, there being about the same want of expression as there is in a house which shows no chimneys. Both chimney-shafts and chimney-pieces were therefore properly made significant and ornamental features in our antient domestic architecture. For a long time indeed, fire-places were used only for one or two principal rooms in a building, and were of very rude and primitive design, the funnel of the chimney projecting into the room, and sometimes sloping forward, downwards, and the opening for the fire-place being a simple arch, with scarcely any attempt at ornament. The more antient examples are those of mere fire-places rather than chimney-pieces. In domestic architecture much was exceedingly uncouth and inconvenient, at the time when the Gothic style had attained in ecclesiastical edifices what has been considered by many its highest perfection. But as soon as some degree of architectural refinement began to be introduced into the habitations of nobles, external dressings constituting a chimney-piece were added to the fire-place. The annexed example of one from Tattershell castle, Lincolnshire, may serve as a type for such internal feature where the Gothic style is employed, both on account of its marked fitness and propriety of character, and the happy union of simplicity with richness. It exhibits the style characteristically as employed for that particular purpose and no other, by those who were familiar with it, and who therefore did not, like modern Gothic designers, including Horace Walpole and his friend Bentley, look to tombs and gateways for ideas for chimney-pieces: here there is nothing borrowed from aught of the kind, nor from door or window. Some other examples—one from the same building, and two from Windsor Castle—are given in Pugin's 'Gothic Specimens,' all of them very similar in their general character and proportions, in which respect and in regard to compactness and simplicity of composition they accord much more nearly with modern taste, and have a less 'Gothic' air than the cumbrous and extravagantly ornamented chimney-pieces in the Renaissance style of the Continent and our own Elizabethan. In these the design was carried quite up to the ceiling so as to form a sort of architectural frontispiece, composed of two or more stages piled up on each other, adorned with columns, pilasters, caryatides, termini, niches, &c., and presenting an overloaded mass of carving and sculpture. But though such compositions were generally exceedingly capricious, and equally fantastic and coarse in detail, some were real works of art—truly admirable for artistic beauty of design and masterly execution. In the palace of Fontainebleau were many sumptuous structures—for so they may be called—of the kind, and among those still remaining is the one



in the ball-room, originally decorated with two bronze caryatides, larger than life, but for which columns are now substituted. Various magnificent examples, of the same period, occur in the Low Countries; two noted ones in the Hôtel de Ville at Courtrai, and one of matchless beauty for its exquisite carvings in chestnut-wood, in the Hôtel du Franc at Bruges. In our own country, chimney-pieces of the time of Elizabeth and James I. are by no means uncommon: many are remaining not only in mansions of that period which are still kept up, but in houses which have been almost completely modernized in all other respects. A great number and also a great variety of them may be found in Nash's 'Old English Mansions,' and Richardson's different publications illustrative of Elizabethan architecture. In general they are exceedingly heavy and cumbrous in their mass, 'over-informed' with ornament of all sorts, in the style of the ponderous cabinets of the time, and showing in fact sometimes like immense pieces of furniture of the kind, owing to their rather contrasting than according with the enrichment bestowed on other parts of the room. Some however are of comparatively sober design, and even those which are most extravagant as compositions, and over-loaded with ill-assorted details, are of interest as exhibiting numerous samples of ornament.

As the more regular Italian style gained ground, the fashion of chimney-pieces greatly changed; the decorated superstructure reaching from the chimney-piece itself to the ceiling was either discarded altogether, or greatly reduced so as to become no more than a carved framing to a pannel. The chimney-piece and fire-place were reduced to nearly their modern proportions and dimensions, whereas the opening or fire-place had previously been of such size that a person might stand within it, as it resembled that of a large open kitchen fire-place; which, putting aside other objections, caused a room to appear low by comparison. At present the *height* of the opening is made nearly the same in all cases, viz. from three to three feet and a half, the *width* alone being increased accordingly as a larger fire-place than usual is required, and the dressings around it extended so as to proportion the chimney-piece in some degree to the size of the room as a piece of architectural furniture in it: thus like other furniture its dimensions are limited by purpose and convenience, for were such as they dictate exceeded, the chimney-piece itself would look gigantic, and the mantel-piece would be out of reach. When therefore a single fire-place of the usual size is insufficient, as for very spacious rooms or galleries, there are two or even more according to circumstances, and they must of course be placed with strict regard to architectural symmetry: thus, if two, there is generally one at each end of the room, though both are sometimes placed on one side of it, viz. that facing the windows, equidistant from the centre, and if the room be an ante-room, with the door into it between them, and folding-doors at each end into the adjoining apartments. Again, if there are three chimney-pieces, one will be at each end, and the third in the centre of the side opposite the windows, though there are instances of even three being placed all on that side. More than that number are scarcely ever required,—even so many being rather for ornament and regularity of design than actual use. Apartments of such size as to require them on that account, are rarely used as ordinary sitting-rooms, and there is little occasion for fires in them at all when they are thronged with company. Still there is occasionally a greater number: the picture-gallery at Buckingham Palace, for instance, has no fewer than five chimney-pieces, viz. two on each side, and another at the north end. Fire-places are sometimes made on the window side of the room, which although by no means to be recommended for general practice, or for more than one or two rooms at the most in the same house, has its advantages in particular cases. It is a convenient disposition for them in libraries, because a person can sit and read by the fireside and a window at the same time; it is also very agreeable to have a chimney-piece so placed when the windows command a fine prospect; thirdly, it produces a difference of character between that and the other rooms. In such case there must of course be a central pier for the fire-place, and that pier must be of such width as to allow the chimney-piece to be placed against it without seeming to be squeezed in between the windows. It is objected that when the chimney-piece is so placed, not only is the window side of the room apt to look crowded, but the opposite one to look blank; but that depends entirely upon circumstances: in a library, the opposite wall would be sufficiently filled with bookcases; or in any other room a sufficient balance may be kept up between the opposite sides by hanging some very large picture, or mirror, immediately facing the chimney-piece, or by a cabinet or some other large piece of furniture; or it may chance to be a very great convenience to have that side of the room free from a chimney-piece, as it affords the opportunity of obtaining spacious folding-doors in the centre of it into another apartment, or else a recess, either of which would sufficiently fill up that side of the room. Instead of being placed between windows, chimney-pieces are sometimes put *beneath* them, the mantel-piece forming the internal sill of the window, and the flue being carried up in one of the adjacent piers. Again, where fanciful effect is aimed at, a chimney-piece is set in an architectural compartment entirely filled with looking-glass, in which case the jambs and mantel-piece are made to project very considerably, so that, doubled by reflection, the chimney-piece has the appearance of being a solid and insulated mass of marble.

Marble is now the usual material for chimney-pieces even in ordinary houses, and such very general employment of it for the purpose has caused economy to be consulted by excessive plainness of design and scantiness of workmanship, sculpture being out of the question; the mouldings very few and plain, and the mantel-piece a mere shelf. Chimney-pieces of this class are manufactured by wholesale, and are kept like any other articles of furniture ready-made, requiring only to be fixed up when purchased. Convenient and economical as it may be, such a system is not calculated to advance taste, since a chimney-piece ought to be designed expressly for the particular room where it is to be put up. That is done of course in houses of a superior kind, and yet in some recent instances there is so far from being that accordance between the style of the chimney-pieces and the other architectural decorations of the room, that, although the former call for rather a greater than a lesser degree of embellishment, inasmuch as they are more closely observed, they have frequently very much less, consequently appear to be in a style of affected and harsh severity in comparison with all the rest. Worse than this, both style and keeping are sometimes so outrageously violated, that chimney-pieces of 'crinkum-crankum' design, *à la Louis Quatorze*, are stuck in rooms whose other architectural dressings are marked by the opposite extreme of soberness or even plainness. Neither is that attention given to colour which ought to be: very dark or black marble is by no means the most suitable for such purpose, because instead of relieving the fire-place, the chimney-piece and fire-place together form a dull and sombre mass. This disagreeable effect is very greatly increased when—as is actually the case in the morning room of the new Conservative Club-house—black marble chimney-pieces are introduced among scagliola columns and pilasters of pale or bright hues: all consistency of composition as to colour is destroyed, and instead of being ornamental objects, the chimney-pieces look no better than two dismal blots in the architecture. In fact black is quite as unsuitable a colour for chimney-pieces as it would be for door-cases and window-dressings. Among collections of designs for chimney-pieces, Piranesi's 'Maniere di ornar di Camini' is unrivalled for magnificence of ideas.

CHINA. The first attempt of the English to open a trade with China was in 1596, when three ships, bearing letters from Queen Elizabeth, were freighted for that purpose, but they were lost on the voyage out; and no further attempt appears to have been made till 1637, when four merchant-ships from England arrived in Macao Roads. In a few days they sailed up to the Bocca Tigris, which is considered the mouth of the Canton river; but in the mean time the Portuguese, already established at Macao and trading with the Chinese, had misrepresented the purposes of the English, who, having communicated with the mandarins, were directed to wait, and told that their wishes should be attended to. A few days afterwards they were, without warning, fired upon from the fort. Incensed by this act of treachery, they sailed up the river as far as Canton, stormed the castle, and carried off the guns. A further communication then took place with the mandarins, who laid the blame on the Portuguese. Cargoes were supplied by the Chinese, and the guns were restored, and the English ships sailed quietly away. Little or no commercial intercourse took place for some years afterwards. The East India Company established by degrees small commercial agencies at Amoy, at Ningpo, and on the islands of Chusan and Formosa; but the trade, owing to the exactions of the mandarins, proved so troublesome and unprofitable, that the Company deemed it expedient to withdraw their agents from those places, and managed to establish a trade at Canton, which continued to advance, but slowly and with many interruptions, in consequence of the high duties and the exactions to which it was subjected. Only one ship was sent to Canton in 1734, and during the whole of 1736 the total number of European ships which took in cargoes at Canton was only ten, of which four were English, two French, two Dutch, one Swede, and one Dane. In 1644 the Manchow Tartars obtained possession of the government of the Chinese empire, after a contest of more than twenty years.

The exactions and insulting assumption of superiority on the part of the Chinese authorities, as well as disputes with the French and Portuguese, led occasionally to outrage and tumult; but the trade at Canton continued to advance, till at length the attention of the British government was drawn to its growing importance, and in 1788 Lord Cathcart was appointed ambassador to China; he died however on his passage out, and the frigate in which he had sailed returned to England. In 1792 Lord Macartney sailed from England in a 64-gun ship as ambassador to the Chinese emperor at Peking, accompanied by Dr. Staunton, afterwards Sir George Staunton, as secretary of legation, chiefly in order to obtain leave to trade at Ningpo, Tientsing, Chusan, and other places besides Canton. The embassy was unsuccessful, and the emperor, in his communication to the king of England, stated that British commerce was to be limited to the port of Canton.

After the mission of Lord Macartney the general condition of the English at Canton was considerably improved; the conduct of the mandarins became less imperious; the exactions fewer and less annoying; and though some of the heaviest burthens on the trade still continued, the commercial progress of the English was tolerably quiet and rarely interrupted.

An interruption however of some importance occurred in 1808, in consequence of Admiral Drury, by direction of the East India Company, landing troops on Macao, for the protection of that island against the supposed designs of the French. The Chinese, regarding Macao as a portion of their empire, and the Portuguese as mere tenants at will, ordered the British troops to be withdrawn; the order was not complied with; the Company's trade at Canton was stopped in consequence, and provisions denied to all British ships in the river. Admiral Drury, having in vain endeavoured to obtain an audience with the viceroy at Canton, threatened to force the line of ships which the Chinese had placed across the river, but did not carry his threat into execution. After fruitless discussions which lasted three months, the Chinese gained their point; the British troops were withdrawn from Macao, trade was resumed, and Admiral Drury sailed away to Bengal.

Another dispute between the British and Chinese occurred in 1814, in consequence of the British frigate Doris having captured the American ship Hunter, and brought her prize into the Canton river. The Chinese authorities directed the Committee of Merchants to send the Doris away, to which the Committee replied, that they had not the power. The Chinese authorities thereupon began a series of aggressive measures, not against the frigate, but against the mercantile community. The Committee of Merchants, feeling the aggressions to be intolerable, determined on the bold measure of stopping the trade. The Chinese, finding the weapon which they had more than once used against the British now turned against themselves, became more conciliatory. Sir George Staunton, son of Sir George Staunton who had been in Lord Macartney's embassy, was appointed to manage the negotiation, and he ultimately gained the principal points for which the British contended, which were then incorporated in an official document signed and published by the viceroy.

Still the conduct of the Chinese authorities at Canton was such that the commercial transactions of Great Britain were at all times exposed to the risk of interruption from the caprice and extortions of the official delegates at Canton, who kept the court of Peking in profound ignorance of their own corrupt participation in the profits of the illegal traffic and of their oppressive conduct towards the merchants.

A principal object of Lord Amherst's embassy in 1816 was to complain of the treatment to which British commerce was subjected at Canton, and to fix it upon a solid and equitable basis, with the means of appeal to the emperor himself in case of need. Lord Amherst left England on the 10th of February, 1816, and the ships arrived in Macao Roads on the 12th of July. Having been joined by Sir George Staunton and others, the embassy reached the gulf of Pecheleo on the 28th of July, but the ambassador did not land till the 9th of August. The objects of the mission were not attained, and the ambassador, after reaching Peking, returned through the interior of China. Meantime the Alceste, the Lyra, and the Hewett Indiaman had returned to Canton, and the local authorities displayed their ill feeling by prohibiting the Hewett from taking in a cargo, and refusing to allow the Alceste and Lyra to anchor at Wampoa and take in provisions. The Alceste was fired at by the war-junks and the fort at the Bocca Tigris. A single shot silenced the junks, and a single broadside sent the garrison scampering up the hill against the side of which the fort is built. The effect of this decisive retaliation was, that provisions in abundance were sent to the Alceste at Wampoa, the Hewett was permitted to take in a cargo, and a statement was published which described the firing as a salute.

Though Lord Amherst's mission was unsuccessful, it was followed by a longer interval of freedom from Chinese annoyance than had ever before been experienced. From 1816 to 1829, not a single stoppage of British trade took place, except a short interruption in 1822, arising out of an unprovoked attack by the Chinese on some of the crew of the Topaze frigate, who were taking in water at the island of Lintin. In this case the Chinese local government at Canton made the first advances towards a resumption of the intercourse which had been suspended in consequence of the provocation on the part of the Chinese.

The illegal trade in opium had been driven in 1822, owing to the exactions of the Portuguese, from Macao to Lintin, a small island between Macao and the mouth of the Canton river. The local government of Canton, by its long course of secret participation in the profits arising from the sale of the prohibited article, and consequent connivance at the introduction of it, had placed themselves in such a position with respect to the emperor as well as Europeans, that they dared not interfere to protect their own subjects at Lintin, where armed European smugglers lay in defiance of their authority.

The exclusive trade of the East India Company with China terminated on the 22nd of April, 1834, and several private ships soon afterwards quitted Canton with cargoes of tea for the British Islands. The new act declared 'that it should be lawful for his majesty, by commission under his sign manual, to appoint not exceeding three superintendents of the trade of his Majesty's subjects with China, and to give to such superintendents certain powers and authorities.' Lord Napier was appointed chief superintendent, John Francis Davis, Esq., second superintendent, and Sir George B. Robinson third superintendent. The instructions, under the royal sign manual, dated Dec. 31, 1833, say, 'In execution of the said commission, .you will take up your residence at the port of Canton,' &c., and the instructions from the Foreign Office, signed by Lord Palmerston, Jan. 25, 1834, say, 'Your Lordship will announce your arrival at Canton by letter to the viceroy.' The British government seem neither to have provided for nor indeed to have contemplated any objections on the part of the Chinese authorities, or any difficulty arising from their insolent assumption of authority and bigoted adherence to matters of ceremony connected with that assumption. Till 1834 the East India Company stood in the way of any interference on the part of the British government. With the whole trade under their control, they adopted the general policy of entire submission to the Chinese, their great object being to carry on their trade peaceably and without interruption, at whatever cost to the personal feelings of the supercargoes.

Lord Napier arrived at Macao from Great Britain on the 15th of July, 1834, on the 25th he sailed up to Canton, and on the 26th addressed a letter to the viceroy, announcing his appointment as chief superintendent, and requesting an interview. The letter was rejected on the ground that it was not superscribed with the character 'pin,' or 'petition.' This character had been used by the supercargoes of the East India Company, but Lord Napier, as a high officer representative of the British government, was expressly directed not to use it. On the 18th of August, Lord Napier was ordered to withdraw to Macao. The order was not complied with. On the 21st of August a shipment of cargo which had been announced by the Hong merchants was countermanded, and on the 2nd of September the British trade was entirely suspended by the viceroy. On the 4th of September the residence of Lord Napier was surrounded by a large number of soldiers, his native servants were driven away, and his supply of provisions was cut off. Under these circumstances Lord Napier sent for a guard of marines, and requested that the Imogene and Andromache might be sent up to the anchorage of the trade at Whampoa. The guard was sent up on the 6th of September, and the two ships sailed through the Bocca Tigris on the 7th, silencing as they passed the batteries which were opened on them. Negotiations ensued, and on the 15th of September Lord Napier announced to the British merchants that, having in vain used every effort to establish the commission at Canton, he did not at present feel authorized, by continuing to maintain his claims, to cause any further interruption to the trade of the port. The two ships then returned down the river, and on the 21st Lord Napier was embarked under a strong guard of Chinese officers and soldiers to proceed by the Inner Passage to Macao, where he arrived on the 26th, suffering from fever brought on by the noise, the heat of the weather, and the annoyance to which he had been subjected. On the 11th of October, 1834, he died.

Mr. Davis, who, previously to his becoming second superintendent, had been the chief supercargo of the East India Company, succeeded Lord Napier as first superintendent. Mr. Davis, on the 7th of August, 1834, had written to Lord Palmerston in the following terms:—'Lord Napier seems to be clear as to his instructions allowing him to decline any but a direct communication with the officers of government, and in the policy of his course I have no hesitation whatever in concurring; for to be governed by the Hong merchants, a system which has always been highly detrimental to our true interests, would now be infinitely worse than under the reign of the Company, whose transactions, amounting to some millions per annum, did of course give them great influence over those merchants. This species of influence is out of the question with us, who, unless we can have direct access to the government officers, can do nothing whatever. Lord Napier's letter of announcement was rejected on the most frivolous and inadmissible pretexts.'

Mr. Davis, in January, 1835, embarked for England, and was succeeded by Sir George Robinson as chief superintendent. Captain Elliot, who had previously been secretary, then became second superintendent. On the 21st of January, 1835, some of the crew of the Argyle, which had anchored on the coast of China in consequence of sea damage, were seized and detained by the local authorities. Captain Elliot, proceeding to Canton, on the 4th of February, for the purpose of demanding the restoration of the crew, was grossly assaulted by the authorities there, and forcibly removed. The crew of the Argyle however were restored on the 18th of February. On the 23rd of February several chests of opium, which had been seized from smugglers, were publicly burnt at Canton.

The reciprocal interests of China and Great Britain kept affairs tolerably quiet, and trade continued to prosper under the charge of Sir George Robinson during 1835 and 1836, the Chinese and British authorities carefully abstaining from any communication with each other.

Sir George Robinson was recalled by the British government, and Captain Elliot appointed chief superintendent. This order was received at Canton December 4, 1836.

The opening of the British trade in 1834, had given additional stimulus to smuggling of all kinds, and the illicit trade in opium continued to increase, though the edicts against it became more severe, and were more rigidly enforced. The smugglers were entirely driven from Lintin, in consequence of which the traffic extended not only to the east coast, but was carried on within the Canton river as far as Whampoa by Europeans in their own boats in the most audacious manner. Captain Elliot used every effort in aid of the Chinese authorities, to check the importation, at the same time adopting a system of conciliation which had the effect of making them more imperious. Their communications were always addressed to the Hong merchants: 'they are not addressed to me at all,' says Captain Elliot in one of his dispatches; 'they speak of me, not to me;' and he was directed to submit his communications to the Hong merchants, in order that they might judge whether the language was sufficiently respectful.

In March, 1837, an edict was received from the emperor allowing Captain Elliot to reside at Canton, and he continued to communicate by the medium of the Hong merchants, and to use the character 'pin,' or 'petition,' though both were repeatedly objected to by the British ministers, who thus kept Elliot squabbling with the Chinese authorities, without themselves taking any steps to get rid of the offensive formalities.

The aspect of affairs at Canton became more gloomy about the beginning of 1838. The differences between the officers of the two nations remained unadjusted, and a debt of more than three millions of dollars was due to the British factory from two insolvent Hong merchants, with little prospect of liquidation. Admiral Sir Frederic Maitland arrived at Macao, July 12, 1838, in the Wellesley ship of war, accompanied by the armed brig Algerine. Captain Elliot joined him, and an edict of the viceroy was sent to them through the old channel of the Hong merchants, which was returned unopened, with a notice that such a mode of communication was prohibited by the British government. Captain Elliot then proceeded to Canton, and, to evade the 'pin' difficulty, sent an open paper to the viceroy by a mandarin, but it was returned with a notice that it could not be received without the character 'pin.' Meantime a British boat passing by the Bocca Tigris was brought-to by a shot, and a mandarin came on board to ascertain whether Admiral Maitland was on board, stating, that if he was, the boat would not be permitted to pass. Admiral Maitland, on being informed of this insult, proceeded with the Wellesley and Algerine to require an explanation, the result of which was, a written disavowal of any intention to insult, with which the admiral was satisfied, returned to his former anchorage, and soon afterwards sailed away.

Fresh disturbances broke out in consequence of the smuggling of opium. Preparations were made on the 12th of December, 1838, to strangle a Chinese opium-smuggler in the square immediately in front of the factories at Canton, which the Europeans resisted, and the man was executed elsewhere, but a riot and contest with the Chinese afterwards ensued; the Europeans retreated within the factories, which the Chinese, then amounting to many thousands, attempted to force, but they were at length dispersed by a body of Chinese soldiers. Captain Elliot, on the 18th of December, published a notice, requiring all British-owned vessels trading in opium to leave the river within three days. The Chinese authorities however were not conciliated; on the 26th of February, 1839, a Chinese opium-smuggler was strangled in front of the factories, in spite of the opposition of the Europeans; in consequence of which insulting and offensive proceeding all the foreign flags were struck, and remonstrances sent to the viceroy, to which no answer was returned.

On the 10th of March, 1839, Lin Tsih Sew arrived at Canton as high commissioner from the imperial court, and immediately commenced a series of measures which rendered a war between China and Great Britain unavoidable. In consequence of Captain Elliot's order (which in fact he had no authority to make nor any power to enforce) the opium-vessels had left the river, but this was not enough for Commissioner Lin. Having first sent round the Hong merchants to ascertain by inquiry what arms the foreigners possessed for their immediate defence, he then, on the 18th of March, issued an order commanding all opium in British ships, whether in the Canton river or on the coast of China, to be given up to his officers in order that it might be destroyed. On the 19th the foreign residents were forbidden to leave China, and on the 21st the factories were surrounded by soldiers, the native servants withdrawn, and the means of subsistence cut off. Captain Elliot had joined his countrymen in the factories, and demanded passports, which were refused. The surrender of all the opium on board the ships was demanded of him, and under these circumstances of intimidation he issued a notice enjoining all British subjects to surrender to him all the opium under their control, for the service of her Majesty's government, pledging himself as responsible, on the part of the government, to each and all of them, for the value of the opium delivered up. Having ascertained that he could obtain 20,283 chests, he undertook to deliver them to the officers of Commissioner Lin. On the 20th of April half the quantity was delivered, and the remainder on the 21st of May. The burning and destruction commenced on the 3rd of June, and occupied twenty days.

Meantime Captain Elliot had written to Lord Auckland, then governor-general of India, detailing the system of violence and spoliation which had been adopted by the Commissioner, and requesting him to send as many ships of war and armed vessels as could be spared from the Indian station. This message had been sent by the Larne sloop-of-war, and there did not then remain a single British armed vessel in the Chinese waters for the protection of British life and property.

After the delivery of the opium all foreigners were allowed to leave Canton, except sixteen, who were afterwards however allowed to depart under an edict from the viceroy, which commanded them never to return.

On the 29th of July, 1839, Captain Elliot warned the British community, all of whom were now living in the different merchant-ships, that he 'had moved her Majesty's and the Indian governments to forbid the admission of tea and other produce of China into Great Britain and India.' This stoppage of trade irritated Commissioner Lin excessively. He tried by means of placards to induce the British to disregard Captain Elliot's notice, and having gone down to Macao, made it a matter of complaint to the Portuguese against Captain Elliot that 'he had prevented the merchant-ships of his country from entering the port of Canton.' Commissioner Lin adopted the most severe measures to prevent the use of opium by the Chinese; but it was more eagerly sought for than ever, and the very strictness of the prohibition and severity of the measures seemed to create a sort of mania for it which nothing could restrain.

In an affray between the Chinese and some British and American seamen, a Chinaman was killed. In consequence of this homicide, an order was issued on the 15th of August, interdicting the supply of any kind of food to the British in China, and on the 31st of August a proclamation was issued calling upon the Chinese to arm and attack the British, whose situation was becoming daily more critical and dangerous, when, on the 11th of September, the Volage, British frigate, arrived, and Captain Smith, the commander, immediately published a notice of blockade of the port of Canton, on the ground 'that the regular supplies of food had been prohibited to her Majesty's subjects; that the Chinese people had been ordered to fire upon and seize them wherever they went; and that certain of her Majesty's subjects had been actually cut off.' The proclamation against the British was immediately withdrawn, provisions were no longer prohibited, and Captain Smith then withdrew the notice of blockade.

The British frigate Hyacinth joined the Volage on the 29th of October, and on the 3rd of November the two frigates were attacked by twenty-nine war-junks under Admiral Kwan. The Chinese were beaten off with great loss; one junk was blown up, and several were sunk. On the 5th of January, 1840, an imperial edict was issued, directing all trade with Great Britain to cease for ever.

The Chinese now made active preparations for the protection of the Canton river; the old forts were repaired and new ones formed, guns collected, fire-ships got ready, and troops exercised. On the 22nd of May the British merchant-ship Hellas was attacked by eight junks and three large boats, when all the crew of the Hellas were wounded. On the 9th of June an unsuccessful attempt was made to burn the British ships by means of fire-rafts. The British naval force was rapidly augmenting. Sir Gordon Bremer hoisted his broad pendant on board the Wellesley, 74, and on the 22nd of June, 1840, established a blockade of the port and river of Canton in all its entrances, by order of the British government. British armed vessels continued to arrive, and within a day or two after the notice of blockade the chief command was assumed by Rear-Admiral the Hon. George Elliot, who had just arrived in the Melville, 74.

A small force having been left in the Canton river to maintain the blockade, on the 30th of June, 1840, the fleet sailed northward along the coast of China, Rear-Admiral Elliot and Captain Elliot having been appointed joint-plenipotentiaries for settling with the emperor the matters in dispute between the two nations.

On the 2nd of July, a boat sent into Amoy from the Blonde, 44 guns, and bearing a flag of truce, was fired upon. The Blonde having poured in her broadsides with terrific effect on the batteries and war-junks, sailed away and rejoined the fleet. Tinghai, the capital of the island of Chusan, was taken on the 5th of July, after a slight resistance; and on the 10th of July, in consequence of the refusal of the authorities at Ningpo to receive a letter from Lord Palmerston to be transmitted to the Emperor of China at Peking, a blockade was announced of the east coast of China, from Ningpo to the mouth of the Yang-tse-keang, the most commercial part of the whole sea-board of China.

At the end of July, 1840, the entire British force, including the squadron which had sailed to the north together with the fleet assembled in the Canton river, comprised three 74-gun ships, two of 44 guns, three of 28 guns, five of 20 guns, two of 18 guns, one of 10 guns, a large troop-ship, four armed steamers, and twenty-seven transports, having on board three regiments of soldiers, a body of Bengal volunteers, and a corps of Madras sappers and miners.

On the 11th of August, 1840, the Madagascar steamer, with Captain Elliot on board, entered the Peiho, which flows past Peking on the south and falls into the gulf of Pechelee, where the rest of the fleet arrived a few days afterwards. Lord Palmerston's communication was now received, and forwarded to the emperor at Peking, and a conference took place near the town of Tientsing between Captain Elliot and Keshen, the governor of the province. While the emperor's answer was expected, the greater part of the ships sailed northward up the Gulf of Pechelee, as far as the great wall of China. On their return, the result of the emperor's answer and the negotiations with Keshen was, that the two plenipotentiaries agreed to return with the squadron to Canton, whither Keshen was to be sent as imperial commissioner, to supersede Lin, whom the emperor described as 'no better than a wooden image.'

The squadron arrived, November 20, off Macao, on its return from the gulf of Pechelee, and on the 29th Rear-Admiral Elliot was compelled to resign his situation of joint-plenipotentiary, owing to sudden and severe illness.

On the 6th of January, 1841, in the midst of the negotiations with Keshen, an imperial edict was issued, requiring all British ships and men to be destroyed, wherever met with and in any manner. Meantime the Nemesis, a large iron war-steamer of extremely shallow draught of water, and built expressly for service in the Chinese rivers, had arrived, and was of the most important use in the subsequent warfare. In consequence of the violation of the truce, which appears to have been by the emperor's express order, the forts of Chuenpee and Tae-cok-tow were stormed and carried, and 173 guns taken or rendered unserviceable. These are the lowest forts in ascending the Canton river. On the same day the Chinese squadron of war-junks collected in Anson's Bay, under Admiral Kwan, were destroyed, and eighty guns taken. On the following morning the Bogue forts, that is, the forts which defend the Bocca Tigris, were on the point of being attacked, when a boat bearing a flag of truce was sent off to the flag-ship by Admiral Kwan, with a communication to Captain Elliot. Negotiations again commenced, the fleet retired to Chuenpee, and on the 20th of January Captain Elliot announced that a treaty of peace had been concluded with Keshen, by which the island of Hong-kong was to be ceded to the British, six millions of dollars were to be paid as indemnity, and trade was to be resumed at Canton within ten days.

The forts at Chuenpee were then given up, and the British took formal possession of Hong-kong on the 26th of January. On February 2nd, at the end of the ten days, the British were surprised that no proclamation was issued for opening the trade at Canton, and there were also rumours of warlike preparations going on up the river. Captain Elliot waited till the 10th of February: he then went up to Canton, and on the 11th fresh negotiations commenced between him and Keshen. Captain Elliot consented to a further delay of ten days for the preparation of a definitive treaty for signature: but before the ten days were expired it was discovered that the most extensive preparations were going on for a renewal of the conflict, and on the 20th of February Keshen published an edict which he had received from the emperor rejecting the treaty which Keshen had concluded with the British.

The British made immediate preparations for resuming hostilities, which were commenced on the 25th of February by the capture of a masked battery and eighty guns, and the following day was fixed for the grand combined attack on all the Bogue forts, which had now been made very strong. The attack was made, and all the forts taken, and their defenders killed or dispersed. Including the eighty guns captured on the previous day, the whole number amounted to 460 pieces, several of which were from 18 to 42 pounders. The Chinese killed and wounded amounted to 500, and 1300 prisoners were taken, who were soon afterwards set at liberty. Sir Gordon Bremer announced that of the British 'five men were slightly wounded.'

The fleet proceeded up the river on the 27th of February, and found other defences prepared a little below the island of Whampoa, consisting of mud forts, war-junks, and a great raft across the river, very solid and strongly constructed. All these defences were destroyed, and nothing remained but to attack Canton.

The approaches to Canton were imperfectly known, and while an examination was making the Chinese contrived to obtain another short truce. Sir Hugh Gough arrived from Madras, and on the 2nd of March assumed the chief command of all the land forces. On the 12th Keshen left Canton for Peking in disgrace, where he was afterwards condemned as a traitor, because he had not defeated the British; his property was confiscated, and he himself was banished to Tartary. On the 13th a bold exploit was undertaken and successfully executed by the Nemesis: this was the forcing of the Broadway Passage, or Inner Passage, a branch of the Canton river which leads almost in a straight line from Macao to Canton, and had never before been navigated by European ships or boats. This feat occupied the 13th, 14th, and part of the 15th of March: the Nemesis, attended by three armed boats, in many parts literally ploughed her way through the mud, and rejoined the squadron close to Canton. Opposition was made to the passage of the Nemesis, by forts and batteries on the banks of the river, by war-junks, and by armed mandarin boats. Only three of the British were wounded in the series of conflicts. Altogether 115 guns were rendered useless, nine war-junks were destroyed, and six batteries, several armed mandarin boats, and three military stations, with barracks and magazines, were captured or set on fire.

On the 18th of March the forts and all the other defences of Canton were taken, the war-junks and armed boats all dispersed or destroyed, and the city lay at the mercy of the British. Nothing further was done on the 19th, and on the 20th a suspension of hostilities was agreed upon between Captain Elliot and the new imperial commissioner Yang-Fang, who on the following day issued a proclamation, in which he stated 'that as Elliot had represented that all he wanted was peace and permission to trade as formerly, and as all trade depended upon the cherishing goodness of the Celestial Court, therefore it was right now to permit the English to trade as well as other people, in order to show a compassionate regard.'

The other two imperial commissioners associated with Yang-Fang did not arrive at Canton till the 14th of April. Meantime trade went on with activity but much caution; and rumours soon became prevalent of hostile preparations in active progress somewhere above Canton. The authorities displayed great dexterity in 'using words to conceal their thoughts,' but Captain Elliot was at length convinced that a treacherous plot was about to be executed, and he gave notice by proclamation to the Europeans in the factories to be prepared to leave Canton at a moment's notice. The plot exploded on the night of the 20th of May, the European inhabitants having previously been withdrawn from Canton. The sentries discovered several dark-looking masses dropping down the river; these proved to be fire-rafts consisting of boats chained together in twos and threes so as to hang across the bows of a ship while the combustibles were burning. They were set on fire by those who had the charge of them, when the Nemesis and boats immediately dashed among them, and towed them out of the way of the ships. Many of them drifted on shore, and set fire to the suburbs of the town, while masses of fire were seen floating down the river on all sides.

On the 25th of May the heights which command the city of Canton were carried by the British troops, but the breaching of the walls was deferred till the following day, when a flag of truce was displayed, and on the 27th the Chinese authorities agreed to pay six millions of dollars for the ransom of the city. Hostilities were consequently suspended, and on the 31st of May five millions of dollars were paid, and security given for the other million. The British forces then withdrew from Canton; early in June all the ships of war and transports were again at Hong-kong, and on the 16th of July the Canton trade was re-opened.

On the 10th of August, 1841, Sir Henry Pottinger arrived in Macao Roads, as sole plenipotentiary and chief superintendent of trade in China, a man eminently qualified by decision and determination, experience as a diplomatic agent in India, and a thorough knowledge of the Asiatic character, to counteract the manœuvres of the Chinese, and bring the war to a speedy termination. He was accompanied by Vice-Admiral Sir William Parker, by whom all the subsequent naval operations were conducted.

On the 12th of August, 1841, Sir Henry Pottinger issued a proclamation, announcing his appointment, and stating the objects of his mission, and on the 21st of August the fleet, consisting of thirty-six sail, including transports, with two line-of-battle ships, seven other ships of war, and four steamers, set sail northward along the coast of China.

On the 26th of August a notice was sent from the fleet to the town of Amoy, stating that it had been resolved to enforce the demands made in 1840 by Captain Elliot at Tient-sing, and that if the town was delivered up to the British no damage would be done. If this requisition was complied with, a white flag was to be displayed from the fortifications; but as this was not done, hostile operations were commenced forthwith, and by five o'clock the whole of the outer defences were in the possession of the British. The town was taken on the following day; 296 guns were rendered useless; a garrison was placed in the island of Kolingsoo, which commands the entrance of Amoy; and on the 5th of September the fleet sailed away.

On the 1st of October the town of Tinghae, with all its new and extensive defences, was re-captured; and on the 10th of October the town of Chinhae, at the mouth of the Ningpo river, was also captured, with the loss to the Chinese of several hundreds killed and wounded, and 157 guns, of which 67 were of brass, taken or rendered useless. The British loss was three killed and 16 wounded.

The important commercial city of Ningpo, 12 miles up the river, was taken possession of on the 13th of October, the authorities having abandoned it. The troops were moved into winter-quarters at Ningpo. The weather set in intensely cold about the middle of December, when reports were brought in of the assembling of large bodies of troops higher up the river. A military expedition was therefore resolved upon, and a body of Chinese troops collected at the town of Yu-yaou were dispersed, and pursued some miles over the snow. The troops were re-embarked on the 30th of December, and the steamers sailed down the river, and anchored opposite the town of Tsekee, which is about four miles from the banks. On the following morning the troops entered the town, which the authorities had abandoned. The town of Fung-hua, still higher up the river, was entered on the 10th of January, 1842, the soldiers and public officers having all fled. In this case, as in the others, the stores in the public granaries were distributed among the Chinese poor, and no damage was done except to the fortifications and government buildings.

A night-attack on Ningpo by the Chinese, on the 9th of March, was repulsed with some difficulty, but ultimately with great loss to the Chinese. On the following night a similar attack was made by the Chinese on Chinhae, with a similar result. On the 15th of March 1000 men were embarked on board the steamers to attack a large body of troops who were encamped on the Segoan Hills, near the town of Tsekee. A large part of them were Tartars, who fought with the greatest bravery, and when they found their efforts unavailing, nearly all of them refused to surrender, and many deliberately cut their own throats. The town of Tsekee was entered, and treated in the usual way, and the expedition then returned.

Ships of war, steamers, and transports continued to arrive in succession during April. About the same time vast numbers of fire-rafts were discovered concealed among the Chusan islands, and were destroyed by the Nemesis. On the 7th of May, Ningpo was evacuated by the British, and the whole force proceeded towards Chapoo, about 50 miles distant. Chapoo was captured on the 18th of May, after a desperate resistance by the Tartar troops.

On the 28th of May the fleet set sail, and on the 5th of June reached the entrance of the Yang-tse-keang, on the right bank of which is situated the small town of Woosung, at the mouth of the Woosung river, very strongly fortified. On the 16th of June the batteries were attacked and captured, though they were manned by Tartar troops, who served them well and fought desperately. Altogether 150 guns were taken, of which 42 were of brass. On the 19th of June the wealthy city of Shanghae, second only to Canton in commercial importance, was taken with little opposition.

Additional reinforcements had now arrived from England, and it was resolved to proceed up the Yang-tse-keang to Nanking, formerly the capital of China. Sir Henry Pottinger having issued a proclamation explanatory of the complaints and demands of Great Britain, on the 6th of July the fleet set sail from Woosung for Nanking. The navigation of the river was found to be difficult, on account of the numerous sand-banks, but the steamers overcame all obstacles. On the 16th of July the defences of Chin-keang-foo were examined, and on the 21st the town was captured. There were about 2400 Tartar soldiers within the town, and about 3000 in encampments without, who fought with reckless courage and desperation. The town was their stronghold, which they thought impregnable, and when they found that all their efforts to save it were unavailing, the scenes of horror which ensued, arising from the cutting of the throats and strangulation of their wives, their children, and themselves, are indescribable. The number of British killed was 34, including 3 officers, and 107 wounded, including 14 officers.

The Grand Canal enters the Yang-tse-keang beneath the walls of Chin-keang-foo. The communications of the canal were now cut off and the immense traffic upon it entirely stopped, by which a heavier blow was inflicted than even the capture of Nanking would have been.

On the 10th of August the ships were in a position to bombard the city of Nanking, when communications took place between Sir Henry Pottinger and Elephoo and Keying, the two imperial commissioners, who, by offering a ransom for the city and various pretexts, endeavoured to obtain a cessation of hostilities, but nothing could overcome the determination of the British plenipotentiary, and at daylight on the 14th of August the attack was ordered to be made, which the commissioners were informed nothing could suspend except the production of a document bearing the emperor's signature, and authorizing them to treat definitively of peace. After midnight, and just three hours before the attack was to have commenced, the required document was produced, a cessation of hostilities ensued, and on the 17th of August Sir Henry Pottinger announced that the state of the negotiations was now such as to authorize him to require that hostilities should be suspended.

A report was sent to the emperor by the commissioners, in which the true position of affairs was for the first time distinctly pointed out to him. Meantime visits of friendly ceremony took place between the commissioners and Sir Henry on board the flag-ship and within the walls of Nanking. At length the emperor's answer was received, and on the 29th of August, 1842, the treaty of peace was signed on board the Cornwallis flag-ship, by Sir Henry Pottinger on the part of Great Britain, and by Keying, Elephoo, and Neukien, on the part of the Emperor of China. The emperor's entire assent to the treaty, signed on the 8th of September, was received on the 15th. On the 31st of December the great seal of England was affixed to the treaty.

By the end of October the fleet had quitted the Yang-tse-keang, and were assembled in the harbours of Chusan, and by the middle of November nearly the whole of the ships had re-assembled at Hong-kong. Some collisions took place between the factories and the Chinese mob, chiefly arising out of the continuance of the opium smuggling, but a letter addressed to the merchants and another addressed to the viceroy by Sir Henry Pottinger, led to a proper understanding on both sides, and the disturbances ceased. By the end of December the whole of the transports and ships of war not required for further service in China had sailed from Hong-kong for their respective destinations.

Thus ended the Chinese war, which may be said to have commenced with the blockade of Canton, June 22, 1840, and which was terminated by the peace of Nanking, August 29, 1842, during the whole of which, though the conflicts were so numerous and in many instances upon so large a scale, the total loss of British life in actual warfare was probably less than 100 men.

The most important provisions of the treaty of 1842 are as follows:—

British subjects are allowed to reside at the ports of Canton, Amoy, Foochow, Ningpo, and Shanghae, and a consul is to be appointed to reside at each of the five ports.

The island of Hong-kong is ceded in perpetuity to Great Britain.

The emperor of China agrees to pay 21,000,000 of dollars, namely six millions for the opium destroyed by Lin, three millions as the amount of the debts of the Hong merchants, and twelve millions as indemnity for the expenses of the war; six millions to be paid immediately, six millions in 1843, five millions in 1844, and four millions in 1845.

The company of Hong merchants are dissolved, and British merchants are permitted to carry on their mercantile transactions with any persons whatever.

All British subjects, whether natives of Europe or India, who may be in confinement in any part of China, to be unconditionally released.

Tables of tariff to be established at each of the five ports.

Correspondence between the officers of both governments to be on terms of equality.

The military post at Chinhae and the islands of Koolangsoo and Chusan to be held by the British till the money payments and the arrangements for opening the ports to British merchants are completed.

A Supplementary Treaty was signed at Hoomun-Chae, October 8, 1843, to which is attached the tariff of export and import duties which are to be paid at the five ports. The following are the most important articles:—

Article 4, 'After the five ports of Canton, Foochow, Amoy, Ningpo, and Shanghae, shall be thrown open, English merchants shall be allowed to trade only at those five ports. Neither shall they repair to any other ports or places, nor will the Chinese people at any other ports or places be permitted to trade with them. If English merchant-vessels shall, in contravention of this agreement, and of a proclamation to the same purport, to be issued by the British plenipotentiary, repair to any other ports or places, the Chinese government officers shall be at liberty to seize and confiscate both vessels and cargoes; and should Chinese people be discovered clandestinely dealing with English merchants at any other ports or places, they shall be punished by the Chinese government in such manner as the law may direct.'

By article 6, 'It is agreed that English merchants and others residing at or resorting to the five ports to be opened, shall not go into the surrounding country beyond certain short distances to be named by the local authorities, in concert with the British consul, and on no pretence for purposes of traffic.'

Article 7 provides for the setting apart of ground and houses at the five ports for the residence of British subjects and their families, to be purchased at a fair valuation. This article concludes by observing that the number of houses 'cannot be limited, seeing that it will be greater or less according to the resort of merchants.'

Article 8: 'The Emperor of China having been graciously pleased to grant to all foreign countries whose subjects or citizens have hitherto traded at Canton, the privilege of resorting for the purposes of trade to the other four ports of Foochow, Amoy, Ningpo, and Shanghae, on the same terms as the English, it is further agreed, that should the emperor hereafter, from any cause whatever, be pleased to grant additional privileges or immunities to any of the subjects or citizens of such foreign countries, the same privileges and immunities will be extended to, and enjoyed by British subjects.'

Article 12: 'A fair and regular tariff of duties and other dues having now been established, it is to be hoped that the system of smuggling which has heretofore been carried on between English and Chinese merchants—in many cases with the open connivance and collusion of the Chinese custom-house officers—will entirely cease; and the most peremptory proclamation to all English merchants has been already issued on this subject by the British plenipotentiary, who will also instruct the different consuls to strictly watch over and carefully scrutinize the conduct of all persons, being British subjects, trading under his superintendence. In any positive instance of smuggling transactions coming to the consul's knowledge, he will instantly apprise the Chinese authorities of the fact, and they will proceed to seize and confiscate all goods, whatever their value or nature, that may have been so smuggled, and will also be at liberty, if they see fit, to prohibit the ship from which the smuggled goods were landed, from trading further, and to send her away, as soon as her accounts are adjusted and paid. The Chinese government officers will, at the same time, adopt whatever measures they may think fit with regard to the Chinese merchants and custom-house officers, who may be discovered to be concerned in smuggling.'

The other articles relate chiefly to commercial arrangements, to the arrest and punishment of offences committed by British and Chinese subjects, and to the stationing of a British cruiser at each of the five ports, for the enforcement of good order among the crews of the merchant-vessels, and to support the authority of the British consuls.

A treaty has also been concluded between the United States of America and China, which has not yet been published, but its substantial provisions have been stated in a letter from Mr. Cushing to the American secretary of state. The treaty appears to be in some respects more favourable than the English treaties; but Mr. Cushing, in closing his communication, remarks that his treaty, which is called, from the place at which it was concluded, the treaty of Wang Hiya, in the new provisions it makes, confers a great benefit on the commerce of the British empire; for the supplementary English treaty stipulates that any new privileges conceded by China to other nations shall be enjoyed also by England, and there is a similar provision in the treaty of Wang Hiya; and thus, whatever progress either government makes in opening this vast empire to the influence of foreign commerce, is for the common good of each other, and of all Christendom.

A 'Statement of the Foreign Trade with China, and an Account of the Inland and Transit Duties of the Chinese Empire,' dated Government House, Victoria, Hong-Kong, February 16, 1844, and received in London, June 5, 1844, gives the following summaries of the amount of the annual foreign trade of China:—

Exports.	Dollars.
Ship's disbursements and tonnage dues	500,000
Tea	9,450,000
Raw silk, silk thread, and silk piece-goods	2,747,000
Sugar and sugar-candy	370,000
Cassia	240,000
All other kinds of goods	532,750
Treasure, duty free	11,160,250
	25,000,000

Imports.	Dollars.
Opium, rice, treasure, and pearls, which are free, smuggled, or contraband	15,954,630
Ginseng, both kinds, much of which is smuggled	65,000
Raw cotton	5,000,000
Cotton manufactures of all kinds and cotton yarn	2,090,000
Woollen manufactures of all kinds	1,047,000
Metals of all kinds	261,650
All kinds of other goods	941,720
	25,000,000

By a return of the quantities and value of merchandize exported from the port of Canton in eighty-nine British vessels, of 43,012 tons burthen, during the half-year ending June 30, 1844, the total exports are stated to be 1,888,281*l.*, of which the principal articles are—Cassia lignea, 22,206*l.*; China ware, 9211*l.*; quicksilver, 8128*l.*; silk, fine, 190,565*l.*; silk, coarse, 42,335*l.*; silk manufactures, 22,987*l.*; sugar, raw (to Bombay and Sydney), 13,496*l.*; sugar-candy (to Bombay), 10,279*l.*; tea (to Great Britain, British India, Australia, Manilla, Singapore, and Lima), 1,504,570*l.*; vermillion, 8711*l.*

Chinese Weights, Measures, and Money. 1 pecul = 100 catties; 1 catty = 16 taels; 1 tael = 10 mace; 1 mace = 10 candereens; 1 pecul = 133⅓ lbs. avoirdupois; 1 ton = 16 peculs 80 catties; 1 cwt. = 84 catties; 1 lb. avoirdupois = 12 taels, or ¾ths of a catty; 1 tael = 679·84 grains troy; 1 chang = 10 Chinese feet or covids, and is fixed by agreement at 141 inches; a covid therefore = 14·1 inch; 1 foot = 8 tsun, or Chinese inches. A dollar is usually estimated at 7 mace 2 candareens, but in paying large sums 717 taels are equal to 1000 dollars In paying duties 11 to 13 per cent. must be added for the loss in melting the dollars. A tael = 1·39 dollar, but a mace in small amounts is calculated at 14 cents. Copper cash is the only coin made by the Chinese government, of which 1150 to 1180 are exchanged for a Spanish dollar, which is in general circulation for commercial purposes, and may be valued at 4*s.* 3*d.*, as an average value. Cash is not the Chinese name, but a name which it has acquired among foreigners. It has a square hole in the centre, through which is run a string, and they are thus threaded together in convenient numbers for paying away. The great circulation of the people is carried on by this medium, which, being of a low denomination, is extremely suitable to the price of the necessaries of life in China. For larger exchanges silver is indispensable; and, as great traffic is carried on among them, the amount of it in circulation must be very large.

Sir Henry Pottinger, at a dinner lately given to him at Glasgow (April, 1845), among other observations relating to the trade with China, said, 'Next to Canton is the port of Shanghae, which may yet be superior, because it is more open to the north to trade, and because it is more the resort of Chinese trading vessels than Canton. I have heard, since I came here, by a letter from China, that junks of the largest size come from the Yellow Sea, and go alongside of the largest British ships, and take their cargo bodily, and sail away. If the Chinese can only find the means of paying us, I may say the demand for our goods will be unlimited.'

(Davis's *Chinese*, 3 vols. 18mo.; *Narrative of the Voyages and Services of the Nemesis from* 1840 to 1843, from the Notes of Commander W. H. Hall, R.N., with Observations by W. D. Bernard, A.M., Oxon; *Parliamentary Papers*, &c.)

CHLORA, a genus of plants belonging to the natural order Gentianaceæ. It has 8 sepals, a rotate corolla with 6-8 segments withering round the capsule, the stigma bi-lamellate, the anthers not altering, the capsule 1-celled with spongy placentæ, the seeds angular.

C. perfoliata, yellow-wort, has the lowermost leaves elliptico-oblong, narrowed below; the leaves of the stem broadly perfoliate. The corollas are of a bright yellow colour, and the stigmas are scarlet. The whole plant is glaucous, and is very subject to attacks of mildew. It is a native of chalky hills and banks in most countries of Europe. It is found in England and Ireland, but not in Scotland. Like the whole order to which it belongs, it possesses a bitter principle, which renders its action on the system tonic. It may be used in all those cases of debility and in diseases where the roots of the Gentiana and Erythræa are recommended. Its tonic properties are not however so powerful as in many other species of the order.

(Lindley, *Flora Medica*; Babington, *Manual of Brit. Bot.*)

CHLORIODIC ACID. [CHEMISTRY, P. C. S.]

CHOANITES, a group of Spengoid fossils from the chalk of England and France, thus named by Mantell. Analogous living forms occur on the coast of New Holland.

CHOCOLATE. [CACAO, P. C., p. 96; THEOBROMA, P. C., p. 313.]

CHODOWIECKI, DANIEL, a distinguished miniature painter and etcher of the eighteenth century, was born at Danzig in 1726. His father was a tradesman of Danzig, and Daniel was brought up to his father's business, with whom he remained until the death of the latter in 1740. In 1743 he removed to Berlin, and entered into the service of his mother's brother as his bookkeeper. His uncle seems to have kept a general store, and one class of articles which he sold was painted snuff-boxes, the paintings of which were all executed by Daniel in his leisure hours; many of them were on enamel, which art his uncle had had him taught for the purpose. The designs were all copied from prints, and were, according to Chodowiecki's own account, miserable performances: his whole knowledge of drawing and painting he had learnt from an aunt in Danzig. Chodowiecki continued some time employed in this humble way, until through his enamel-master, Haid, he made the acquaintance of some of the artists of Berlin, whose works and conversation excited his ambition, and induced him in the year 1754 to devote himself arduously and exclusively to art. He commenced as a miniature painter, and met with considerable success, but he soon forsook this tedious art for etching. He etched chiefly from his own designs, and as an etcher he ultimately obtained a reputation equal to or perhaps superior to that of any artist of his age in Europe. His etchings are very numerous, amounting to at least two thousand, but they are mostly small, and the greater part were executed for booksellers. A printseller of Berlin, of the name of Jakoby, published a complete catalogue of his prints in 1814, in one volume octavo: there is also a long list of them in his autobiography inserted in Meusel's Miscellany, arranged chronologically; and another in Heineken's Dictionary, arranged according to the subjects, consisting in heads, portraits, historical pieces, sacred and profane, figures and original compositions; landscapes, illustrations for pocket-books and almanacs, from novels, &c., and frontispieces, vignettes, and tail-pieces, for various works. The works engraved after Chodowiecki's designs or drawings by other engravers are less numerous than his own etchings, but amount nevertheless to some hundreds; including several designs for Lavater's work on 'Physiognomy,' engraved by J. H. Lips and others.

Chodowiecki was director of the Royal Academy of the Arts of Berlin, where he died in 1801. Many of his designs are satirical, and he has been called the Hogarth of Berlin. All his works, though on a small scale, are remarkable for their expression, and the character is seldom exaggerated: his subjects are chiefly illustrative of common life or contemporary and recent history. Many novels and other light works which he illustrated, owed their success chiefly and in some cases entirely to his vignettes; and the Almanac of the Berlin Academy, which he illustrated from the year 1770, had, from the same cause, a circulation of about four thousand. The great success of these works led many booksellers to publish similar works with designs in imitation of Chodowiecki's style by other artists, and at the close of the eighteenth century Germany was inundated with illustrated almanacs, pocket-books, and the like publications, to such a degree that Fiorillo states that ladies and young people generally spent the greater part of the year in reading almanacs.

(Meusel, *Miscellaneen Artistischen Inhalts*; Heineken, *Dictionnaire des Artistes*, &c.; Huber, *Manuel des Amateurs*, &c.; Fiorillo, *Geschichte der Zeichnenden Künste in Deutschland*, &c.)

CHOMA'TODUS, a genus of fossil fishes from the mountain limestone of Bristol and Armagh. (Agassiz.)

CHONDRI'TES, a fossil Fucoid from the green sand, named Fucoides Turgionii by Mantell, is thus entitled by Sternberg. ('Flora der Vorwelt.') It is very widely disseminated in the green sand deposits of Europe. Fucoides intricatus of Brongniart belongs also to the lower Cretaceous system in the Alps and Carpathians.

CHONDRUS. [Sea-Weeds, P. C.]

CHRIST'S COLLEGE, CAMBRIDGE, was founded by Margaret, Countess of Richmond, mother of Henry VII., in 1505, on the site of a college founded by Henry VI., called God's House, which seems to have been inadequately endowed. Lady Margaret changed the name to that of Christ's College, made a munificent addition out of her own property to the former revenues, and incorporated the whole for the maintenance of a master, 12 fellows, and 47 scholars, to which Edward VI. added another fellow and three scholars. Sir John Finch and Sir Thomas Baines founded two more fellowships and two more scholarships, with revenues independent of the former endowment.

The foundation was for divinity, and the twelve senior fellows are obliged to take priest's orders within twelve months after they have reached the proper age. The other three fellowships may be held by laymen. The twelve fellowships are open to all counties, but there must not be more than one fellow of any county at the same time. King Edward's fellowship is also unlimited as to county. In the election to the two fellowships founded by Sir John Finch and Sir Thomas Baines, preference is to be given to the descendants of the founders.

The fifteen fellows have an equal claim to the college patronage, and are allowed to hold preferment with their fellowships to a limited amount. The fifty foundation scholarships are now augmented in value to 15*s.* a week during residence: they are open to natives of all counties, but there must not be more than three scholars of the same county at the same time.

Besides the foundation scholarships, there are various other scholarships and exhibitions, which have been founded by private benefactors, in all about 44, with revenues appropriated to each, varying from about 2*l.* a year to about 25*l.* a year, most of which may be held with the foundation scholarships. Christopher Tancred, Esq. founded also four divinity studentships, which may be held till the degree of M.A. is taken, and which now amount to 107*l.* 8*s.* per annum each.

The visitors are the vice-chancellor and two senior doctors in divinity, or, if the vice-chancellor be of Christ's College, the provost of King's College is to supply his place.

Porteus, Bishop of London, in 1807 invested stock to the amount of 1200*l.* in the funds, the interest of which he directed to be expended in the purchase of three gold medals annually, to be contended for by the students of Christ's College—one medal of the value of 15 guineas for the best Latin dissertation on some evidence of Christianity; another of 15 guineas for the best English composition on some moral precept of the gospel; and one of 10 guineas for the most distinct and graceful reader in chapel, combined with regular attendance there.

Besides the medals there are five or six annual prizes of books, of the value of from two to three pounds each set of books, which are bestowed at the different examinations.

There are 18 benefices in the gift of Christ's College, of which 4 are in Cambridgeshire, 1 in Essex, 1 in Hertfordshire, 1 in Leicestershire, 2 in Lincolnshire, 5 in Norfolk, 1 in Northamptonshire, 1 in Suffolk, 1 in Worcestershire, and 1 in Pembrokeshire.

The buildings of Christ's College form a neat quadrangular court 138 feet by 120 feet, opposite St. Andrew's church; the buildings are faced with stone. The elevation of the front is perhaps somewhat too low for the length, but the parapet and tower gateway improve the effect. There is also a more modern range of buildings which fronts the garden and fields. The garden is pleasantly laid out, with open and shaded walks, alcoves, summer-house, bowling-green, and a cold bath surrounded by a small wilderness. The chapel, including the ante-chapel, is 84 feet long, 27 feet wide, and 30 feet high. In the east window are portraits of Henry VII. and others of the family of the foundress. Near the altar is a monument of white marble to the memory of Sir John Finch and Sir Thomas Baines, who were educated at Christ's College, travelled together in Turkey, and were remarkable for their friendship. Sir John Finch was ambassador in Turkey, and died there in 1682; his body was brought to England, and interred in Christ's College Chapel, and Sir Thomas Baines, who did not long survive him, was buried in the same vault.

Sixteen bishops have received their education at Christ's College, among the most eminent of whom are Latimer, bishop of Worcester, Law, bishop of Carlisle, and Porteus, bishop of London. Leland, the antiquarian; Sir Philip Sidney; Milton, the poet; Quarles, the poet; Saunderson, the mathematician; and Archdeacon Paley, were educated at Christ's College.

(Dyer's *History of the University of Cambridge*; Lysons' *Cambridgeshire*; Wilson's *Memorabilia Cantabrigiæ*; *Cambridge University Calendar*, 1845.)

CHROMATIC THERMOMETER is the name given by Sir David Brewster to an instrument consisting of several rectangular plates of glass placed with their surfaces in contact, and intended to measure the difference between the temperature of the glass and of any body, solid or fluid, which may be applied to it. The temperature induced in the glass must however be below that at which the latter would become red-hot.

The plates should be close together, in order to prevent any reflexion of light between them, and the upper edges of all should accurately fit the surface of a plate of metal which may constitute the base of a vessel intended to contain a heated fluid, when the temperature of a fluid is to be found.

The heated body, solid or fluid, being in contact with the edges of the glass plates, the inequality of strain caused by differences of temperature in the parts of each plate of glass gives rise to a polarizing action, by which, when the plates are held in a beam of light polarized by reflexion from the surface of glass or any other transparent body, the following phenomena take place:—A wave of white light appears first at the heated edge of each plate, and advances gradually from thence, sending before it an ill-defined dark band: nearly at the same instant a similar white wave, driving before it a dark band, advances from the opposite edge of the plate towards the former, and a white band or spot appears in the centre of the glass advancing towards both the heated and the opposite edge, compressing the dark bands so as to reduce them to two black fringes. To the white waves both at the edges and centre succeed fringes of yellow, red, purple, blue, &c., all parallel to the heated edge; and, at the same time, the like fringes form themselves on the sides perpendicular to that edge.

As these phenomena take place on all the plates of glass, the united effects are very distinctly visible on the plate at either extremity of the combination; and the maximum of tint produced at the centre of the plate is considered as a measure of the temperature acquired by the glass.

In order to form a scale, Sir D. Brewster applied to the edges of twenty plates, so combined, a temperature equal to 80° (Fahr.), that of the glass being 60°, so that the difference between the temperatures was 20°; and this difference produced a yellow tint of the first order in Newton's scale, which, in that scale, is expressed by 4 [Colours of Plates, P. C. S.]: therefore the tint on each plate, being one-twentieth of the whole, was equivalent to $\frac{4}{20}$, or 0·2; which thus becomes, on the scale of the chromatic thermometer, the indication corresponding to 20°. He then applied to the edge of one plate only, at a temperature equal to 60° (Fahr.), a heated bar of iron; and this produced in the centre a light green of the second order in Newton's scale, which, in that scale, is expressed by 9·35: hence, by the following proportion,

$$0{\cdot}2 : 20 :: 9{\cdot}35 : m \;(= 935°),$$

he obtained *m*, the difference between the temperature of the iron and glass. Then 0·2 (= $\frac{1}{5}$) being considered as one-fifth of the unit of the scale of the instrument, $\frac{935}{5}$, or 187, is the number of units in the scale between the indications of 20° and 935°, reckoning from the zero, that is, in an interval equal to 915°; but $\frac{915}{187}$ is equal to 4·9° nearly; and this is the value, in degrees of Fahrenheit's thermometer, of each division of the scale.

Since the eye may not be able to distinguish accurately the tints produced by the applied heat, Sir D. Brewster proposed to measure them by means of a piece of coloured crystal, two inches long, cut in the form of a wedge, so that the tints might become gradually deeper from the edge to the thick end: this being placed before the plate of glass, and moved till a situation is found where the waves or fringes on the latter exhibit two dark lines crossing each other; at that place the tints of the wedge and that of the glass plate are equal to one another, and, the former being given, the latter is consequently obtained. In this manner any tints produced on the plate may be compared together and referred to the scale of colours.

CHROMULE. [Sap, P. C.]

CHRYSOCO'LLA, from χρυσός, 'gold,' and κόλλα, 'glue,' is a name which the Greeks appear to have applied to borax, perhaps from its use as a flux in melting gold. The reference to Copper, in P. C., seems to have been an error.

CHRYSO'COMA, a genus of plants belonging to the natural order Compositæ, the sub-order Corymbiferæ, the tribe Asteroideæ, and the section Astereæ. The heads of flowers are not radiant; the florets are all hermaphrodite and tubular; the receptacle naked, alveolate (the alveoles with elevated dentate margins in the British species); the involucre imbricated, the pappus pilose, the fruit compressed, silky. The only British species of this genus is the *C. Linosyris*; it has herbaceous, linear, glabrous leaves, corymbose heads, and lax involucres. It has yellow flowers, and is found on limestone cliffs, but is a rare plant. It is the *Linosyris vulgaris* of De Candolle.

(Babington, *Manual of British Botany.*)

CHRYSOPLE'NIUM, a genus of plants belonging to the natural order Saxifragaceæ. It has a 4-fid, half-superior calyx, no corolla, 8 stamens (rarely 10), 2 styles, a 1-celled capsule with two beaks opening in the form of a cup. There are two species of this genus found in Great Britain, and known under the name of Golden Saxifrage. One is *C. alternifolium*, and is characterised by alternate leaves. It has an erect stem 4 or 5 inches high, with umbellate, nearly sessile, deep yellow flowers. It is a native of boggy places. *C. oppositifolium* has opposite leaves. The stem is decumbent and straggling, about 6 inches long. The flowers are paler and more scattered than in the last species. The leaves are usually glabrous, but sometimes they are slightly hairy. It is a native of damp, shady places.

(Babington, *Manual of British Botany.*)

CHURCH DISCIPLINE ACT. [Bishop and Bishopric, P. C. S.]

CHURCH-RATES are rates raised, by resolutions of a majority of the parishioners in vestry assembled, from the parishioners and occupiers of land within a parish, for the purpose of repairing, maintaining, and restoring the body of the church and the belfry, the churchyard fence, the bells, seats, and ornaments, and of defraying the expenses attending the service of the church. The spire or tower is considered part of the church. The duty of repairing and rebuilding the chancel lies on the rector or vicar, or both together, in proportion to their benefices, where there are both in the same church. But by custom it may be left to the parishioners to repair the chancel, and in London there is a general custom to that effect.

The burden of repairing the church was antiently charged upon tithes, which were divided into three portions, one for the repair of the church, one for the poor, and one for the ministers of the church. Pope Gregory had enjoined on St. Augustine such a distribution of the voluntary offerings made to his missionary church in England; and when Christianity came to be established through the land, and parish churches generally erected, and when the payment of tithes was exacted, the tithes were ordered to be distributed on Pope Gregory's plan. Thus, one of Archbishop Ælfric's canons, made in the year 970, is as follows:—'The holy fathers have also appointed that men should give their tithes to the church of God, and the priests should come and divide them into three parts, one for the repair of the church, and the second for the poor, but the third for the ministers of God, who bear the care of that church.' (Wilkins, *Concilia*, i. 253.) The same division of tithes was enacted by King Æthelred and his councillors in witenagemot assembled, in the year 1014. A portion of the fines paid to churches in the Anglo-Saxon times for offences committed within their jurisdictions, was also devoted to church repairs. The bishops were likewise required to contribute from their own possessions to the repair of their own churches. A decree of King Edmund and his councillors, in 940, headed 'Of the repairing of churches,' says that 'Each bishop shall repair God's house out of what belongs to him, and shall also admonish the king to see that all God's churches be well provided, as is necessary for us all.' (Schmid, *Gesetze der Angel-Sachsen*, i. 94.) One of King Canute's laws says, 'All people shall rightly assist in repairing the church;' but in what way it is not said. There is no pretence however for interpreting this law of Canute's as referring to anything like church-rate. A payment to the Anglo-Saxon church, called cyric-sceat (church scot), has been erroneously identified with church-rate by some writers. This was a payment of the first-fruits of corn-seed every St. Martin's day (November 11), so much for every hide of land, to the church; and the laws of King Edgar and King Canute direct all cyric-sceat to be paid to the old minster. (Schmid, i. 99, 165.) Cyric-sceat was otherwise called cyric-amber, amber being the measure of payment.

Churches continued to be repaired with a third of the tithes after the Norman conquest, and to as late as the middle of the thirteenth century. How the burden came to be shifted from the tithes to the parishioners is involved in much obscurity. The following conjectural sketch of the rise of church-rates is from a pamphlet by Lord Campbell:—'Probably the burden was very gradually shifted to the parishioners, and their contributions to the expense were purely voluntary. The custom growing, it was treated as an obligation, and enforced by ecclesiastical censures. The courts of common law seem to have interposed for the protection of refractory parishioners till the statute of Circumspecte Agatis, 13 Ed. I., which is in the form of a letter from the king to his common law judges, desiring them to use themselves circumspectly in all matters concerning the bishop of Norwich and his clergy, not punishing them if they held plea in court Christian of such things as are merely spiritual, as 'si prælatus puniat pro cimeterio non clauso, ecclesia discooperta vel non decenter ornata.' Lord Coke observes, 'that some have said that this was not a statute, but made by the prelates themselves, yet that it is an act of parliament.' In the printed rolls of parliament, 25 Ed. III. No. 62, it is called an ordinance; but in the statute 2 & 3 Ed. VI. c. 13, § 51, it is expressly styled a statute, and it must now clearly be taken to be the act of the whole legislature. From the year 1285 therefore the bishops were authorized to compel the parishioners by ecclesiastical censures to repair and to provide ornaments for the church.' (*Sir John (now Lord) Campbell's Letter to Lord Stanley on the Law of Church-Rates*, 1837.) But for long after the existence of the custom of making the parishioners contribute to the repairs of the church, and after the statute Circumspecte Agatis, the original obligation on the clergyman to repair out of the tithes was remembered. Lord Campbell quotes in the same pamphlet a passage from a MS. treatise in the Harleian Collection, written in the reign of Henry VII. by Edward Dudley, a privy councillor of that king, which thus lays down the law for appropriation of the incomes of the clergy:—'One part thereof for their own living in good household hospitality; the second in deeds of charity and alms to the poor folk, and specially within their dioceses and cures, where they have their living; and the third part thereof for the repairing and building of their churches and mansions.' Lyndwode, who wrote in the fifteenth century, says that by the common law the burden of repairing the church is on the rector, and not on the laity. 'But certainly,' he adds, 'by custom even the lay parishioners are compelled to this sort of repair; so that the lay people is compelled to observe this laudable custom.' (*Const. Legatin.* 113.)

Church-rates are imposed by the parishioners themselves, at a meeting summoned by the churchwardens for that purpose. Upon the churchwardens, conjointly with the minister, devolve the care of the fabric of the church and the due administration of its offices. With a view to provide a fund for such expenses, it is the duty of the churchwardens to summon parish meetings for the purpose of levying rates; and if they neglect to do so they may be proceeded against criminally in the ecclesiastical courts. They may also be punished by the ecclesiastical courts for neglecting to make repairs for which money has been provided by the parish; but if they have no funds in hand, and if they have not failed to call the parishioners together, they cannot be punished. A mandamus also is grantable to compel the churchwardens to call a meeting. If the parish fail to meet, the churchwardens then constitute the meeting, and may alone impose a rate; but if the parish should assemble, it rests with the parishioners themselves to determine the amount of the rate, or to negative the imposition of a rate altogether.

The repair of the parish church and the provision of the necessaries for divine service are thus entirely at the option of the majority of the parishioners assembled. Before the Reformation the parishioners could be punished in the ecclesiastical court for failing to repair the parish church; and the punishment was to place the parish under an interdict, or sentence of excommunication, by which the church was shut up, the administration of the sacraments suspended, and any parishioner who died was buried without bell, book, or candle. But there is now no means of compelling the parishioners to provide church-rates. There is no remedy by mandamus: the Court of Queen's Bench will grant a mandamus, as has been already said, directing churchwardens to call a parish meeting, but not to compel parishioners to make a rate. The ecclesiastical courts cannot make a rate, nor appoint commissioners to make one. An obiter dictum of Chief Justice Tindal in delivering the judgment of the Court of Exchequer Chamber in error in the Braintree case, has lately suggested the possibility of proceeding criminally against parishioners for voting against a rate, or absenting themselves from a meeting called to consider of a rate, where repairs are needed. In Braintree parish, after the parishioners on meeting had refused to make any rate, the churchwardens had levied a rate of their own authority, and proceeded against a parishioner for refusing to pay his portion. The Court of Exchequer Chamber, to which the churchwardens appealed against a prohibition issued by the Court of Queen's Bench, confirmed the prohibition, and declared the churchwardens' rate to be illegal. But in delivering the judgment of the court, Chief Justice Tindal made the following remark:—'It is obvious that the effect of our judgment in this case is no more than to declare the opinion of the court, that the churchwardens have in this instance pursued a course not authorized by law, and consequently all the power with which the spiritual court is invested by law to compel the reparation of the church is left untouched. If that court is empowered (as is stated by Lyndwode, page 53, *voce* 'Subpœna,' and other ecclesiastical writers) to compel the churchwardens to repair the church by spiritual censures; to call upon them to assemble the parishioners together, by due notice, to make a sufficient rate; to punish such of the parishioners as refuse to perform their duty in joining in the rate by excommunication, that is, since the statute of 53 Geo. III. c. 127, by imprisonment, and under the same penalty to compel each parishioner to pay his proportion of the church-rate, the same power will still remain with them, notwithstanding the decision of this case.' In December, 1842, some parishioners of St. George's, Colegate, Norwich, were articled in the Court of Arches for having wilfully and contumaciously obstructed, or at least refused to make, or join and concur in making, a sufficient rate for the repair of the church of the parish. The articles were admitted by Sir Herbert Jenner Fust, the judge of the Court of Arches; but on application to the Court of Queen's Bench the proceedings were stayed by prohibition. Church-rates depend therefore entirely on the will of the majority of the parishioners assembled: and this is obviously a state of things which, where dissenters from the established religion abound, may lead to parish churches being left to go to ruin.

The existing poor-rate of the parish is generally taken as the criterion for the imposition of the church-rate; but decisions as to poor-rates are not binding in cases of church-rates, and the proper test for church-rates is a valuation by competent judges, grounded on the rent the tenant would be willing to pay for the premises. All property in the parish is liable except the glebe-land of that parish, and the possessions of the crown when in the actual occupation of the crown, and places of public worship. Stock in trade is not generally rated for church repairs, but a custom may exist rendering it rateable in a particular parish. The ecclesiastical courts have the exclusive authority of deciding on the validity of a rate, and the liability of a party to pay it; but a ratepayer cannot by an original proceeding in those courts raise objections to a rate for the purpose of quashing it altogether. If he wishes to dispute it, he ought to attend at the vestry, and there state his objections; if they are not removed, he may enter a caveat against the confirmation of the rate, or refuse to pay his assessment. In the latter case, if proceeded against in the ecclesiastical court, he may in his defence show either that the rate is generally invalid, or that he is unfairly assessed. The consequence of entering a caveat is an appeal to the ecclesiastical judge, who will see that right is done.

A retrospective church-rate, or rate for expenses previously incurred, is bad. This has been often decided in the courts of common law and equity, and in the ecclesiastical courts. The reason is stated by Lord Ellenborough in the judgment of the court in Rex *v.* Haworth (12 East, 556):—'The regular way is for the churchwardens to raise the money beforehand by a rate made in the regular form for the repairs of the church, in order that the money may be paid by the existing inhabitants at the time, on whom the burden ought to fall.' It has lately been decided by the Judicial Committee, in the case Chesterton *v.* Hutchins, reversing the decision of the Court of Arches, and confirming the previous decision of the Consistory Court, that a rate not retrospective on the face of it, but admitted to be partly retrospective, was bad.

Previously to 53 Geo. III. c. 127, the only mode of recovering church-rates from parties refusing to pay was by suit in the ecclesiastical court for subtraction of rate. By that statute, where the sum to be recovered is under 10*l.* and there is no question as to the validity of the rate, or the liability of the party assessed, any justice of the county where the church is situated may, on complaint of the churchwardens, inquire into the merits of the case, and order the payment. Against his decision there is an appeal to the quarter-sessions. By several statutes, principally the 58 Geo. III. c. 45, and 59 Geo. III. c. 134, acts passed for the promotion of building churches, the common-law powers of churchwardens have been varied, and extended so as to enable them to raise money on the security of church-rates, and to apply them for the enlargement, improvement, &c. of churches, and for the building of new ones, &c.

The levying of church-rates on dissenters, who are so numerous in this country, has caused so much irritation, and the frequently successful opposition of dissenters at vestry-meetings called to impose rates has rendered church-rates so precarious a resource, that various attempts have been made of late years to abolish them, and to substitute some more certain and less obnoxious provision for the repair of churches and the due celebration of divine worship. Lord Althorp, as chancellor of the exchequer in Lord Grey's government, brought in a bill for the abolition of church-rates in 1834, which proposed to charge the Consolidated Fund with 250,000*l.* a year, to be devoted to the repair of parish churches and chapels (including the chancel), and to be disbursed by commissioners after certificate from the quarter-sessions of the county in which the parish might lie, founded on a report by the county surveyor,—to place on the rector or lay impropriator, relieved of the duty of repairing the chancel, the burden of providing necessaries for the performance of divine service,—to leave the preservation of pews to the owners or occupiers, and to leave the provision and repair of bells, organs, and ornaments to voluntary contributions. This bill fell to the ground, principally owing to the opposition of dissenters, who viewed the substitution for church-rates of a charge on the public taxes as a mere shifting of the burden upon themselves, and objected altogether to being called upon to contribute to a church to which they did not belong. In 1837 Lord Melbourne's government made a second attempt to settle the question; and a bill was brought in by Mr. Spring Rice, chancellor of the exchequer, to abolish church-rates, and provide for the objects of them by a surplus created by a better management of the church lands held by the archbishops, bishops, and deans and chapters; these lands to be managed by commissioners, and 250,000*l.* a year to be the first charge on the surplus. The opposition of the church and of church lessees frustrated this measure, and no measure has since been brought forward by any government.

Lord Althorp stated, in introducing his measure, that the amount of church-rates annually levied was from 500,000*l.* to 600,000*l.*; and about 249,000*l.* was annually expended on the fabrics of churches. Mr. Spring Rice calculated that in 5000 parishes in England no church-rates are levied. There are endowments in many parishes for the repair of the church, which render church-rates unnecessary; and in many parishes arrangements have been made for voluntary subscriptions, to avoid squabblings between churchmen and dissenters, and the scandal of such disputes.

The Parliamentary Returns respecting local taxation issued in 1839 (No 562) give the following particulars respecting church-rates in England and Wales for the year ending Easter, 1839:—Total amount of rates and moneys received by churchwardens, 506,812*l.*, of which 363,103*l.* was derived from the church-rates, and 143,709*l.* from other sources. The total sum expended was 480,662*l.*, and of this sum 215,301*l.* was expended in the repair of churches. The debt secured on church-rates amounted to 535,236*l.* There is a more complete return for the year ending Easter, 1832, which shows some of the principal of the 'other sources' alluded to in the return of 1839. In 1831-2 the total amount which the churchwardens received was 663,814*l.*, derived from the following sources: — Church-rates, 446,247*l.*; estates, &c., 51,919*l.*; mortuary or burial fees, 18,216*l.*; poor-rates, 41,489*l.*; pews and sittings, 39,382*l.*; other sources not stated, 66,559*l.* The payments by the churchwardens in the same year amounted to 645,883*l.*, and included 46,337*l.* for books, wine, &c.; salaries to clerks, sextons, &c., 126,185*l.*; organs, bells, &c., 41,710*l.*; and repairs of churches, 248,125*l.*

CHURN. [BUTTER, P. C., p. 66.]

CHUSAN, or, as Lord Macartney writes it, the Cheusan Islands, are a group of islands on the eastern coast of China, and forming an appendage to the Province of Che-kiang. Their number is very great, and they are dispersed over that part of the sea where 30° N. lat. cuts 119° E. long. Staunton states, that between the Quesan Islands and Chusan Harbour, through a space of about sixty miles in length and thirty in width, the number of islands exceeds three hundred; but others, apparently not less numerous, lie north of Chusan Island. These numerous islands contain almost as many harbours or places of perfect security for ships of any burden. Most of these islands consist of hills rising with a regular slope, and rounded at the top. Though mostly close to each other, they are divided by channels of great depth. Some of them have a very inviting aspect, and one of them in particular, called Poo-too, is described as a perfect paradise. It belongs to a sect of religious men, and contains four hundred temples.

The principal island, which gives its name to the group, is about thirty miles long, and varies in width from six to eight miles. The surface is diversified by pleasant heights and well cultivated valleys. The principal harbour is on the southern coast towards the Chinese continent, and only a few miles distant from Kee-to Point, the most eastern cape of China. It is formed by three small islands, which lie about a mile from Chusan, and has four entrances; but these entrances are so completely shut in by the remoter points, that the harbour looks like a lake surrounded by hills, and it has excellent anchorage for vessels. About a mile from this harbour is the capital of the island, Ting-ghae. The intervening space is a plain, intersected with rivulets and canals, and cultivated like a garden. The road which traverses it, though good, is very narrow, in order that as little land as possible may be lost to cultivation. The town is enclosed by walls thirty feet high, which overtop the houses, which they surround like those of a large prison. Along the walls, at the distance of every hundred yards, are square stone towers. The interior of the town resembles Venice on a smaller scale. It is, in some degree, surrounded as well as intersected by canals, and the bridges thrown over them are steep and ascended by steps like the Rialto. The streets, which are no more than alleys or narrow passages, are paved with square flat stones. The houses are low and mostly of one story. The numerous shops contain chiefly articles of clothing, food, and furniture, which are arranged in good taste.

These islands are of great importance to China in a commercial view, especially for its intercourse with Japan. This commerce is chiefly carried on by the three commercial towns of Ning-po, Hang-sheou, and Shang-hae, which are situated on the continent opposite to the islands. The junks, by which this commerce is carried on, assemble at the Chusan Islands, and depart thence for Nangasaki. The islands are of importance, as protecting the commerce from the Strait of Formosa on the south, to the peninsula of Shang-tong on the north. If a foreign nation or a piratical chief should get possession of them, the whole coast above mentioned would be at their mercy, and the maritime intercourse would be interrupted. The Chinese are well aware of this circumstance, and in the last quarrel and negotiations with England showed that they were aware of it.

In 1840, when the disputes between the British and Chinese governments respecting some commercial transactions at Canton had reached such a height that England thought it expedient to appeal to arms, a British force was sent to the Chusan Islands, which captured them after a slight resistance. In consequence of the occupation of Chusan the Chinese government became more disposed to yield, and, after some negotiations, a truce was agreed upon near Tientsing, between the Chinese imperial commissioner and the British plenipotentiaries, who left Chusan for Canton on the 15th of November, 1840. On the 24th of February, 1841, the British troops were compelled to abandon the Chusan Islands on account of their unhealthiness. The diseases, which soon became alarming, appear especially to have arisen from the Chinese inhabitants having been ordered by the government not to supply the British army with fresh provisions; they were therefore obliged to live on salt meat and dry grain. A new appeal to arms was made, and though the Chinese were beaten near Canton, and only saved that city by paying a million pounds sterling, they refused to fulfil the conditions of the treaty of Tientsing till after the Chusan Islands were again captured in 1842, after a much more vigorous defence, and a British army had been sent to the continent, which took the town of Shanghae, with its harbour Woosung, and advanced towards Nanking. Upon this the peace of 1842 was agreed to [CHINA, P. S. C.]

(Staunton, *Authentic Account of an Embassy to the Emperor of China.*)

CHUVASHES. [RUSSIA, P. C.]

CHYLE. [DIGESTION, P. C.]

CICENDIA, a genus of plants belonging to the natural order Gentianaceæ. It has a 4-parted funnel-shaped corolla, without glands or any corona, eventually twisted over the capsule; the calyx 4-lobed, tubular; the stamens four; the anthers erect, not twisted; the stigma capitate, undivided; the capsule single, or imperfectly 2-celled. The species of this genus were formerly referred to Gentiana and Exacum.

C. hyssopifolium has an herbaceous stem 4-sided, with the angles slightly winged; the flowers 6 or 8 together in axillary whorls, each furnished with a linear spathulate bract; the calyx 5-cleft, permanent, and closely embracing the base of the mature capsule. This is a common plant in many parts of the East Indies, and, like the whole of the order to which it belongs, the plant possesses a bitter principle, though not so intense as some of its allies. It is employed by the natives of India as a stomachic, and is administered in the form of decoction or powder. In addition to the tonic action, it is said to act as a laxative.

C. filiformis (*Exacum filiforme* of Smith and others) has the calyx 4-lobed, half-tubular, adpressed to the subglobose tube of the corolla; lobes ovate, acute; stem thread-shaped, forked; flowers solitary on long stalks. It has yellow flowers, and is a native of Europe. It is found in damp sandy places in England and Ireland. In their cultivation the species of Cicendia require the same treatment as Gentians.

(Babington, *Manual*; Lindley, *Flora Medica.*)

CICHORA'CEÆ, one of the primary subdivisions in the system of Jussieu, of the natural order Compositæ. It is characterised by the absence of albumen in the seed; the seeds are erect, the corollas ligulate, the juice milky. The plants included under this division by Jussieu belong to De Candolle's Ligulifloræ. The Cichoraceæ in their anatomical structure closely resemble the Campanulaceæ; they also resemble that order in their physical properties. Both orders produce a milky juice, possessing in some species powerful medical properties. This juice in the Cichoraceæ has a bitter and astringent taste, and possesses narcotic properties. It is found in the Cichorium Intybus, the common Succory [SUCCORY, P. C.], and in the cultivated and wild Lettuce [LACTUCA, P. C. S.]. From the latter plants the juice has been obtained under the name of Lactucaricum [LACTUCARICUM, P. C.], and used as a narcotic, instead of opium. Many of the species of Cichoraceæ secrete starch in large quantities, and are used as articles of diet, as the Endive, Scorzonera, Tragopogon, or Salsafy, &c. The root of the Dandelion (*Taraxacum Dens Leonis*) is used as a tonic and purgative, and has lately been recommended in diseases of the stomach [LEONTODON, P. C.]. The British genera belonging to this division of Compositæ are as follows:—

Section I. *Lapsaneæ*
Lapsana
Section II. *Hyoserideæ*
Arnoseris
Cichorium
Section III. *Hypochærideæ*
Hypochæris
Achyrophorus
Section IV. *Scorzonereæ*
Thrincia
Leontodon
Oporinia
Tragopogon
Picris
Helminthia

Section V. *Lactuceæ*
Lactuca
Taraxacum
Barkhausia
Crepis
Sonchus
Mulgedium
Section VI. *Hieraceæ*
Hieracium.

The geographical distribution of Cichoraceæ is generally similar to that of Compositæ, but they are found in greatest numbers in cold climates, and in this respect are the representatives of the Corymbiferæ, which are most abundant in hot climates. [CORYMBIFERÆ, P. C. S.]

(Lindley, *Natural System*; Babington, *Manual of British Botany*.)

CIGNARO'LI, GIAMBETTI'NO, one of the most distinguished of the Italian oil painters of the eighteenth century, was born at Salo, near Verona, in 1706. He studied first under Santo Prunati, and afterwards, according to report, with Balestra. There are several excellent works in oil by Cignaroli in Verona, Pontremoli, Pisa, and at Parma. In the last-named place there is a Journey into Egypt, in the church of Sant' Antonio Abate, much praised by Lanzi. In his style Cignaroli resembled Carlo Maratta, but he was inferior to him in colouring: his carnations are occasionally green, with shadows and half-tints, and sometimes too red. He was a great admirer of the works of Guido and of Correggio. With the exception of some works executed in his youth in Venice, he did not paint in fresco; he found the practice injurious to his health.

Cignaroli lived chiefly at Verona, where he educated a numerous school, and he died there in 1770, possessed of considerable wealth. He executed several works for other places, and had several invitations to visit foreign courts, all of which however he declined. In 1769 the Emperor Joseph II. visited Cignaroli in his studio, and observed afterwards, that in Verona he had seen two very rare things—the amphitheatre, and the first painter of Europe.

He is said to have been a very accomplished man: he was a poet, a writer upon art, and familiar with Latin. He had a good collection of books on the arts, which he bequeathed to the Academy of Verona, which preserves his bust. A very flattering memoir of him, by Padre Ippolito Bevilacqua dell' Oratorio, was published at Verona in 1771, the year after his death.

(Fiorillo, *Geschichte der Mahlerey*, vol. ii.; Lanzi, *Storia Pittorica*, &c.)

CI'GOLI, LUDOVICO CARDI DA, Cavaliere, a very celebrated Florentine painter, was born at Cigoli in 1559. He was one of the great reformers of style of the Florentine school, and one of those masters whose works formed an epoch in the history of painting in Tuscany. Cigoli was the first who successfully opposed the anatomical school of the imitators of Michelangelo, and he was seconded in his efforts by his friend Gregorio Pagani. [TUSCAN SCHOOL OF PAINTING, P. C.]

Cigoli was the scholar of Santo di Titi, but his style was founded upon the works of Barroccio and Correggio, and had much in common with the eclectic school of the Carracci. It was however quite independent of that school. His drawing was generally correct; and in colouring and chiaroscuro he was superior to Barroccio, but inferior to Correggio, especially in local tones. His chief productions are large altar-pieces, some of which are considered the finest pictures in Italy. The Lame Man healed by St. Peter, in St. Peter's at Rome, painted for Clement VII., is a very celebrated work, though now destroyed, and was pronounced by Andrea Sacchi the third picture in Rome; the first being the Transfiguration, by Raphael, and the second the Communion of St. Jerome, by Domenichino, now hanging opposite to each other in the same room in the Vatican. There is also at Florence a Martyrdom of St. Stephen, at the Nuns of Monte Domini, which Pietro da Cortona pronounced to be one of the finest pictures in Florence. The Lame Man healed has been engraved by Dorigny, Callot, and Scacciati. As a fresco-painter, Cigoli was not successful. He was also an architect; and he wrote a practical treatise upon perspective, 'Prospettiva pratica di Ludovico Cigoli Cav. e Pittore,' with diagrams engraved in copper by his brother Bastiano Cardi. He also invented a perspective-machine, for drawing objects in perspective from nature without the assistance of rules, an instrument which has in modern times been brought to a high degree of perfection. Cigoli died at Rome in 1613, shortly after the completion of some frescoes painted for Paul V., in that pope's chapel in the church of Santa Maria Maggiore. Cigoli was himself dissatisfied with his works, and wished to repaint them, but the pope would not permit him. He was a Cavaliere of the Tuscan order of San Stefano, and a Knight of Malta.

(Baldinucci, *Notizie dei Professori del Disegno*, &c.; Lanzi, *Storia Pittorica*, &c.)

CI'LIA, in Anatomy, small moving organs found on the surface of the tissues of most animals, resembling hairs, and requiring the use of the microscope to be distinctly observed. They are mostly found on tissues which are in contact with water, or which produce fluid secretions. They are constantly in a state of active movement, and impart to the fluid with which they are in contact the same motion. This is called 'vibratory' or 'ciliary motion.' The best time for observing cilia with the microscope is when their movement begins to slacken. Their figure is generally that of slender conical or sometimes flattened filaments, which are broad at the base or root, and gradually taper to the point. Their size differs greatly on different parts of the same animal. 'The largest I have measured,' says Dr. Sharpey, 'are those on the point or angle of the branchial laminæ in the *Buccinum undatum*; they are at least $\frac{1}{500}$ of an inch long. I have not attempted to determine the exact size of the smallest, but Purkinje and Valentin state it at 0·000075 of an inch, while they make the largest they have met with only 0·000908 in., which is considerably less than I have found them; but they had no opportunity of examining marine animals, in which generally speaking the largest cilia are met with. In the sea-mussel the darker coloured cilia are about $\frac{1}{1000}$ of an inch long, the others considerably less.' The substance of the cilia is for the most part transparent and colourless, in some however a slight colouring may be observed. They assume also various forms, and Ehrenberg has described compound cilia in the Infusoria. In the Ciliograde Medusæ the cilia consist of rows of broad flattened organs, each of which is made up of several simple filaments joined together by a connecting membrane throughout their whole length. In most cases the cilia are arranged in regular order. On the gills of the mussel they are placed in straight rows; in many of the Infusoria they are arranged in circles or spiral lines. In some instances they are erect, but in others they are placed at right angles to the surface on which they are seated.

The movement of the cilia is not very rapid, and may be easily observed with a lens of $\frac{1}{25}$ inch focus. Their most obvious movement is of a fanning lashing kind, the cilium being bent in one direction and returning to it again. In addition to this movement, Mr. John Quekett has lately detected another in the cilia of the gill-rays of the common mussel. This consists of a slight movement of the cilia on themselves, each cilium turning on its own axis through the space of a quarter of a circle, with a movement like that of the *feathering* of an oar in rowing. This observation of Mr. Quekett's is of importance, as it explains how it is that the cilia are capable of propelling bodies over their points which could not be effected by the first-observed up and down movement. When the surface of an organ is examined on which are seated a large number of cilia, a wave-like motion in the whole is observed, which arises from the regularity with which each cilium is affected with the movement.

The cilia were first observed as present on the external surface of the bodies of infusory animalcules. Leeuwenhoek seems to be one of the earliest observers who described the presence of the cilia in animalcules. In his 'Continuatio Arcanorum Naturæ' he describes in many places the nature of the cilia in the common polygastric animalcules as well as in the wheel-animalcules. He also pointed out the probable use of these organs, for he says, 'Moreover it is necessary that these animals, and in general all such as are fixed and cannot change their place, should be provided with an apparatus for stirring up motion in the water, by which motion they obtain any matters that float in the water for their nourishment and growth, and for covering their bodies.' Since the period that Leeuwenhoek wrote, they have been observed in almost every species of Infusoria, and seem to be the active organs by means of which these animals move from place to place, and carry their food into their stomachs. In the polypes they are found in great numbers covering the surface of the tentacula by which these animals obtain their food. Although they have not been observed on the full-grown sponges, they have been described by Dr. Grant as existing upon the ova of these animals before they become fixed. Though not abundant in the Acalephæ, they have been seen by Grant and others in the Beroe pileus and other Medusæ. Dr. Sharpey has observed them in the various forms of the Echinodermata, and also in the Annelida. In the Mollusca they are very abundant, and one of the best means of examining these organs is afforded by the common mussel. Till within a recent period, it was supposed that cilia were confined to the invertebrate classes of animals, or at least the observation of their existence to any extent in the Vertebrata was very limited. One of the earliest observations of their presence in vertebrate animals was by Steinbuck a German anatomist, who found them upon the gills of the salamander. Within the last few years Purkinje and Valentin have devoted much attention to the subject, and have found that cilia exist very generally on the moist surfaces of the membranes of all the higher animals. The systems of organs on the surface of which cilia have been detected are as follows:—

1. *The Surface of the Body.* In this situation cilia have been detected in the Infusoria, Polypi, Medusæ, Actinia, Echinodermata, and in the larvæ of the Batrachian Reptiles.

2. *The Respiratory System.* Cilia have been detected in the lining membrane of the air-passages of reptiles, birds, and mammalia, in the gills of the larvæ of the Batrachia, and on those of the Mollusca and Annelida. Those on the external surface of the Infusoria, Polypes, and Medusæ must also be regarded as belonging to the respiratory system.

3. *Alimentary System.* They are found in the mouth, throat, and gullet of reptiles, in the entire alimentary canal of Mollusca, in the stomach of the Asterias, &c.

4. *Reproductive System.* Ciliary movements have been observed in the mucous membrane of the Fallopian tubes, in the uterus and vagina of mammalia, and in the oviduct of birds and reptiles. A peculiar ciliary movement has been observed in the embryo of many animals. This movement occurs while the embryo is in the ovum, the cilia producing a current in a certain direction along its surface, or causing the whole embryo to move in an opposite direction. In many instances, when the embryo has escaped the egg, it moves about by means of cilia in the same way as occurs in the naked gemmules of the sponge.

There can be little doubt that the functions performed by the cilia in these various parts of the body of animals are important; at the same time their absence in a great number of cases, in organs which perform the same functions as those which possess them, must lead to some hesitation before pronouncing a decided opinion with regard to their use. Where they are situated on the external surface of the bodies of animals, they seem to be the active organs of movement. Where respiration is carried on by means of the external surface, as in the Infusioria and polypi, the cilia assist this process by removing the used water, and bringing fresh currents to the surface containing the matter to be oxygenated. They may undoubtedly perform the same office when seated on internal respiratory membranes. On the surface of the reproductive organs of the higher animals they may also assist in bringing the unimpregnated ovum in contact with the fertilizing cells of the male fluid. The movement in the embryo has probably the same object in view as that on the respiratory membranes, the bringing the surface in contact with currents of oxygenated water.

In coming to the conclusion that the motions of fluids on the surfaces of membranes are produced by cilia where these organs exist, Dr. Sharpey observes, 'The currents cease when the motion of the cilia stops, they are strong and rapid when it is brisk, and feeble when it languishes; and though there are modifying circumstances or perhaps exceptions, yet in general the magnitude and velocity of the current seem to be proportioned to the size and activity of the cilia. It is true that while doubts remained as to the existence of cilia in several well marked instances where the water unequivocally received its motion from the surface over which it flowed, and independently of any visible contractions of the animal tissue, there was always considerable room to doubt, whether, even in the cases where cilia were manifest, the effect of these organs was wholly mechanical, and whether the motion of the water was not rather due to some peculiar impulsive power in the tissue, differing from mechanical action. But more extended observation has almost wholly removed these exceptions, while it has considerably increased the number of conforming instances, insomuch that there seems at present no necessity for having recourse to any other explanation of the motion of the fluids than that it is produced by the action of the cilia, and that their action is the result of muscular contractility, a known property of animal tissues.'

There are however sôme remarkable exceptional cases. Currents are observed in the sponge, in the stem and branches of the Sertulariæ, but no cilia. There are also a number of remarkable cases of the movements of fluids in cells in the vegetable kingdom, which cannot be ascribed to the existence of cilia, as those seen in the cells of Chara, Valisneria, the hairs of Tradescantia, &c.

For further information consult the article Cilia, by Dr. Sharpey, in the 'Cyclopædia of Anatomy and Physiology,' to which we are much indebted in drawing up this article; also the paper of Purkinje and Valentin, entitled 'Commentatio Physiologica de Phænomeno Motus Vibratorii continui,' &c., translated in the 'Dublin Journ. of Med. and Chem. Science' for May, 1835, and in 'Edinburgh New Philosophical Journal,' vol. xix.

CIMICI'FUGA (*cimex*, a bug, and *fugo*, to drive away), a genus of plants belonging to the natural order Ranunculaceæ. The calyx is composed of four deciduous sepals; corolla of four petals; styles one to fifteen; the carpels dry, dehiscent, many-seeded. The species are perennial herbs, with divided leaves, and racemes of whitish flowers; the roots act as drastic purgatives and are poisonous.

C. fœtida, Stinking Bug-wort, has four almost sessile and very villous ovaries; the racemes panicled; the leaves ternate or biternate; the leaflets ovate-oblong, deeply toothed. It is a native of the Carpathian mountains, Dauria, Eastern Siberia, and the north-west coast of America. It is a very fetid plant, and is used in Siberia for driving away bugs and fleas, just as tansy and wormwood are used in this country.

C. serpentaria, Black Snake-root or Bug-wort, has compound, very long racemes; the leaves triternate, with serrated or rather cut leaflets. It is a native of North America, from Canada to Florida. It has white flowers, and resembles the species of *Actæa*, to which genus it was formerly referred under the name of *Actæa racemosa*. Like many other plants possessing active properties, it has a reputation in America for healing the bites of snakes and preventing their poisonous effects on the system. There is one species, *C. Japonica*, a native of Japan; the rest are American plants. They are easily cultivated, preferring a moist shady situation, and may be propagated by dividing the roots or by seeds.

(Don, *Gardener's Dictionary*.)

CINCIUS. L. CINCIUS ALIMENTUS, and his contemporary Fabius Pictor, are mentioned by Dionysius of Halicarnassus (*Roman Antiq*. i. c. 6, ed. Hudson), as the oldest of the Roman annalists. Alimentus is also frequently mentioned by Livy (xxi. 38, xxvi. 23, &c.).

The time of the birth and death of Cincius is not known, but he was actively engaged during the occupation of Italy by Hannibal. Alimentus was of a plebeian family. He was quaestor B.C. 219, tribunus plebis B.C. 214, and plebeian aedile B.C. 212. After Marcellus had taken Syracuse, and left Sicily, Cincius held that province for two years as praetor (Livy xxvi. 28, xxvii. 7), in the years B.C. 210 and B.C. 209. He took with him the soldiers who had survived the defeat at Cannae. In the next year he had the command of a naval force, with which he crossed over from Sicily to Locri, on which he made an unsuccessful attack, and was obliged to retreat. He was afterwards one of three commissioners who were sent by the Senate to give their advice to T. Quinctius Crispinus, the consul, who was lying wounded at Capua. It is not known whether it was at this time or later that he fell into Hannibal's hands, a circumstance which gave him the opportunity of acquiring a more exact knowledge of the events of that period. He learned some facts from the mouth of Hannibal himself (Livy, xxi. 38). Cincius wrote a history of Rome from the foundation of the city to his own time, of which Dionysius says that he treated minutely of the events with which he was personally acquainted, but in a summary way of the events which followed the foundation of the city. Neither the title of his work nor the number of books is known. The work of Cincius is stated by Dionysius to have been written in Greek, and there is no evidence to oppose to this. Livy frequently mentions Alimentus, and in one passage (vii. 3) he calls him an exact authority.

Other works were attributed to Cincius—on Gorgias of Leontini, on the Fasti, the Comitia, on the authority of the Consuls, on the office of a Jurisconsult, on Military Matters, on Antient Words, and De Festis Mystagogicôn. But it is not certain that the Cincius who was the author of these works was the same as the historian, though it is likely enough that so historian might write on military tactics. Gellius (xvi. 4) gives several extracts from the work on military matters, but he simply calls the author Cincius. The chronological difficulty which Krause raises against the author of the treatise on military matters being also the historian is not very great. His arguments against the probability of Cincius having written a grammatical work such as that on antient words are much stronger; and indeed there is no sufficient evidence that the other works that have been mentioned as written by Cincius, were written by the historian.

The epoch which Cincius assigned to the foundation of Rome is about the fourth year of the twelfth Olympiad, or B.C. 728. The discrepancy from other reckonings is accounted for by supposing that Cincius either followed other evidence than the annals of the Roman pontifices; or that he made his calculation by changing the lunar years of the early Roman kings, which were of ten months, into years of twelve months, according to the reckoning of the period when he wrote. Now if we admit, as Junius Gracchanus states, that the old calendar was in use to the time of the first Tarquin, which will give a period of 132 years from the foundation of the city, we may adopt the following solution of Niebuhr:—'If Cincius took these to be cyclical years, he got exactly a secle (110 years) for the first four kings; and if he subtracted the difference, twenty-two years, from the era of Polybius, the result for the building of the city would be the very date, Ol. 12, 4' (Niebuhr, *Roman History*, Transl. i. 280).

The fragments of Cincius are printed in Krause's *Vitae et Fragmenta Veterum Historicorum Romanorum*, Berlin, 1833.

CINERA'RIA, a genus of plants belonging to the natural order Compositæ, the suborder Corymbiferæ, the tribe Eupatoriaceæ, the subtribe Senecioneæ, and the division Eusenecioneæ. It closely resembles Senecio [SENECIO, P. C.], and differs from that genus in its involucre being composed of 1 row of equal scales only. Two species are found in Great Britain.

1. *C. palustris*, a shaggy plant with a much branched stem which is corymbose above, leaves broadly lanceolate, half-clasping, the lower leaves sinuate-dentate. It has a stem 3 feet high, thick, hollow, and leafy. The florets are of a bright yellow colour. It inhabits ditches in fenny districts, and was at one time a more abundant plant in England than it is at present.

2. *C. campestris*, a shaggy plant, with a simple stem, the root-leaves oblong, nearly entire, narrowed below; the stem-leaves lanceolate, heads corymbose, involucre woolly below, nearly glabrous in the upper half; the fruit hispid. It has a stem 6 or 8 inches high with yellow florets. It is found mostly on chalk downs. A variety, *C. c. maritima*, occurs near the sea in very wet seasons; it is then twice or three times as large as usual, and the lower leaves are dentate.

(Babington, *Manual of Brit. Bot.*; Lindley, *Natural System*.)

CINQUE-CENTO STYLE. [RENAISSANCE, P. C. S.]

CIO'NE, ANDREA DI. [ORCAGNA, P. C. S.]

CIRCULAR POLARIZATION, in the undulatory theory of light, is the name given to a supposed circular rotation of the particles of æther in certain media, when a pencil of plane polarized light (or one in which the vibrations are supposed to be rectilinear, in parallel directions, and in a plane perpendicular to the direction of the wave or pencil) is allowed to pass through those media.

When a pencil of light polarized as usual, either by refraction or reflexion [POLARIZATION OF LIGHT, P. C.], is transmitted through a plate of quartz in a direction parallel to the axis of the crystal (the surfaces of incidence and emersion being perpendicular to that axis), and is afterwards allowed to pass through a prism of any doubly-refracting material; it is found to be divided into two coloured pencils, whose tints are complementary to each other (or such as when mixed together would produce whiteness): also, when the prism is turned round upon the direction of the polarized ray, as an axis, the colours of the emergent pencils change successively; those in one of them from red to orange, from orange to green, &c., to violet; again to red, after performing half a revolution, and so on, while those in the other pencil take always the complementary tints. These phenomena were first observed by M. Arago, and an account of them is given in the 'Mémoires de l'Institut' for 1811; but the subject was fully developed afterwards by the researches of MM. Biot and Fresnel.

Let the doubly-refracting prism be turned on the axis of the polarized ray, or of the quartz plate, till one of the two pencils appears to be of a deep violet colour, in which case the yellow, or complementary light, may be conceived to be polarized in the plane passing through the original polarized pencil and the principal section of the prism; and let the angle which the primitive plane of polarization makes with the latter plane be observed.

Next, let the plane of quartz be removed, and a thicker one cut from the same crystal be substituted for it; then the image before examined through the doubly-refracting prism will not appear of a violet colour; but on turning that prism so that its principal section may make a certain angle, which will be greater than the former, with the primitive plane of polarization, the violet colour will be reproduced. The like will be found to hold good for all the homogeneous colours of the pencil; and, for each colour, the angle through which the prism is turned will be proportional to the thickness of the plate of quartz. The angle of the rotation by which the same tint is produced is not however the same for the different kinds of light; and it was found by Biot that the angle is greater, according as the pencils of homogeneous light are more refrangible. The effect thus produced on a polarized pencil of light, in traversing a plate of quartz, may be represented by supposing the plane of polarization, for rays of each colour, to revolve continually during the passage of the pencil along the axis of the plate. It is not however to be understood that there is any such revolving plane, and the phenomenon may be otherwise explained.

With different specimens of quartz, the angle through which the refracting prism must be turned to obtain the same colour in either of the images seen through it, when the thickness of the plate of quartz is increased, is variable; and M. Biot discovered that, with some specimens, in order to produce the same tint, the refracting prism must be turned from right to left, while with others it must be turned from left to right: as if the plane of polarization were caused, by contrary properties in different kinds of quartz, to revolve in contrary directions. This remarkable action upon light is found to have a dependence upon the form of the crystal; for those varieties of quartz in which the solid angles between the regular faces of the natural prism are cut off by planes unsymmetrically situated with respect to the axis cause the plane of polarization to turn from right to left, or the contrary, according as the cutting planes, on the face nearest to the spectator, incline towards the axis of the prism on his right or left hand.

The like rotatory polarization has been discovered to exist in several liquids, and even in vapours, and the circumstances were first observed, about the same time, by M. Biot and Dr. Seebeck. Oil of turpentine, oil of laurel, and some other liquids exhibit a polarization moving towards the right hand, while oil of lemons and concentrated syrup of sugar exhibit a rotation towards the left hand: the angles described by the planes of polarization when the same tint is produced in an image are, however, much less in all liquids and vapours than in quartz.

In order to account for the observed phenomena M. Fresnel assumed, as an hypothesis, a uniform circular motion of the particles of æther, within the substance of the quartz or of the fluids which possess the property above mentioned; and it is readily seen that such motion may result from the combination of rectilinear vibrations performed at the same time, by any number of particles, in parallel lines, with as many in lines also parallel to one another but at right angles to the former lines; all the vibrations being in a plane perpendicular to the wave or pencil of light, and those which take place in one set of parallel lines differing in phase (positions of the particles in the lines of vibration) by one-quarter of an entire vibration or revolution. For, the amplitudes of the rectilinear vibrations being equal to one another, let each be represented by a, and let y and z be the coordinates of two particles, at the same instant in their respective lines of vibration; then, the equation of vibration being, for one particle,

$$y = a \sin. p\,(vt - x),$$

the equation for the other will be

$$z = a \sin. p\,(vt - x - \frac{\pi}{2});$$

and from these equations we have

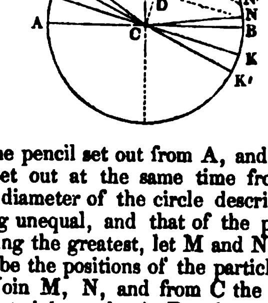
$$y^2 + z^2 = a^2,$$

which proves that two particles while performing vibrations at right angles to one another are always in the circumference of a circle. If the amplitudes of the vibrations had from any cause, as from the particles of æther being unsymmetrically distributed, been unequal, the resulting equation would have been that of an ellipse: in which case the polarization is said to be elliptical.

Now M. Fresnel, by a delicate experiment with wedges of quartz exhibiting apparent movements of the plane of polarization in opposite directions, ascertained that the original polarized pencil passing along the common axis of the wedges in a direction oblique to their common surfaces was, after transmission, really divided into two pencils, which being afterwards made to suffer two reflexions at the interior surfaces of a parallelopiped of glass were found to be polarized, one in a plane making an angle of 45° on the right hand of the original plane of polarization, and the other in a plane making an angle of 45° on the left hand; and the fact of this division of the pencils is a proof that the velocities of their waves within the quartz are unequal.

It is evident therefore that when the original polarized pencil is made to fall perpendicularly on the surface of a plate of quartz in the direction of the axis of the latter, in passing through the crystal, it becomes two pencils, such that the light of one is polarized at right angles to the light of the other while their waves move in the same direction with different velocities. Now, let each of these component pencils, after emergence, be conceived to be made up of two others, each of these last having an intensity of light equal to half the intensity of the pencil of which it is a component, and the particles in one of them differing in phase from those in such pencil by one-eighth of a vibration, in advance, while the particles in the other differ in phase from those in the pencil by one-eighth, in retardation, so that one component pencil differs from the other in phase by a quarter of a vibration: then, of the four pencils, there are two, one on each side of the original plane of polarization, in which the rectilinear vibrations are at right angles to one another, and differ in phase by a quarter of a vibration, and which consequently produce a circular rotation from right to left: the other two being such as will produce a circular rotation in a contrary direction.

In order to explain how light compounded of two pencils whose particles revolve in the manner just stated, and with unequal velocities, may produce the apparent angular movement of the plane of polarization which has been observed when polarized light passes along the axis of quartz: let a particle in one pencil set out from A, and a particle m the other pencil set out at the same time from B the opposite extremity of a diameter of the circle described by each: the velocities being unequal, and that of the particle which sets out from A being the greatest, let M and N unequally distant from A and B be the positions of the particles at the time of emergence. Join M, N, and from C the centre draw CE bisecting MN at right angles in D; then, if the equal lines CM, CN represent the equal attractions exercised on a particle at C, these forces may be resolved into MD, DC, and ND, DC, of which MD and ND being equal and acting in contrary directions destroy one another, and the resulting attraction is such as will create a vibratory motion in CE: in this case a plane passing through the diameter HK perpendicular to CE and to the circle will be the plane of polarization at the given time. But, in proportion as the plate of quartz is thicker, M′ and N′ being the points of emergence, the ratio of AM′ to BN′ at the time of emergence will be greater than that of AM to BN; and the plane of polarization passing through H′K′ parallel to M′N′ will make with AB an angle greater than BCK: thus the plane of polarization will seem to revolve about a line passing through C perpendicularly to the plane of the circle. The above explanation is, in substance, that which is given by Sir John Herschel.



The velocities of the particles in air being by supposition constantly equal, two points as *m* and *n* in a line parallel to AB would be the points of emergence; and the plane of polarization would constantly pass through AB.

Sir David Brewster has observed that the amethyst exhibits phenomena which indicate that, in it, the two species of quartz which give rise to circular rotations in opposite directions are crystallized together in very thin layers succeeding each other alternately; by which, when a plane polarized ray is made to pass through a plate of the mineral cut perpendicularly to the axis of the latter, on examining it after transmission through a prism of quartz, curiously coloured fringes, varying with the position of the plane of polarization, may be observed.

CIRCUMFERENTOR. This instrument is a species of surveying-compass, and its construction may be understood from a view of the diagram in the article Spirit Level, P. C., since, if the reader will imagine the telescope of that instrument to be removed, and, for the supports, called Ys, sight-vanes or perforated plates to be substituted, the instrument will be a complete circumferentor.

Such an instrument, being far inferior to a theodolite in respect of the accuracy with which by its means a survey may be made, is not much used in Europe; but in the United States of America and in the British colonies, where land is less valuable, it is almost the only instrument employed.

In using the circumferentor for the survey of a line of road, or the determination of the boundary of a tract of land, the instrument is set up, on its stand, successively at the principal bends of the road or boundary line; and, a staff being held up vertically at the next bend which is visible from the place of the instrument, the sights of the latter are directed to it; then the bearing of each station-line from the needle in the compass-box, that is, from the magnetic meridian, is observed. Each station-line is measured by the chain, and the smaller bends of the road or boundary are determined by 'offsets' measured perpendicularly to that line. [Surveying, P. C., pp. 328, 330. See also Compass, Azimuth, P. C.]

CIRRHUS. [Tendril, P. C.]

CISSUS. [Vitaceæ, P. C.]

CISTO'PTERIS. [Cystopteris, P. C. S.]

CISTUS, a genus of plants belonging to the natural order Cistaceæ. The calyx is composed of 5 nearly equal sepals in a double row; corolla of 5 equal petals, somewhat cuneated, caducous; the stamens numerous; style filiform; stigma capitate; the capsule superior, 5- or 10-celled, loculicidal; the seed ovate, singular; the embryo filiform, spiral. The species are shrubs or undershrubs with opposite leaves and one- or many-flowered peduncles. The flowers are either red or white, large, resembling a rose.

C. Creticus, Cretan Rock-Rose, has spathulate ovate and oblong leaves, somewhat hairy, downy, dull green, somewhat wavy at the edge, and stalked; the petioles furrowed, nearly distinct, the peduncles 1-flowered; sepals with a long taper point and villous; white flowers. It is a native of dry hills in the most southern parts of Europe. It has evergreen leaves which emit a balsamic odour when rubbed or after damp warm weather in the summer. It yields, with many other species of Cistus, a gum-resin called Ladanum [Ladanum, P. C.], formerly in great repute as a stimulant in medicine, and still used by the Turks as a perfume.

C. laurifolius, the Laurel-leaved Gum Cistus, or Rock-Rose, has stalked ovate-lanceolate three-nerved leaves, with the upper surface glabrous and the under surface tomentose; the footstalks dilated and connate at the base; the capsule 5-celled. It is a native of the south of France and Spain. It has white flowers with a yellow mark at the base of each petal.

C. ladaniferus, Gum Cistus, has almost sessile leaves, connate at the base, linear lanceolate, 3-nerved, the upper surface glabrous, the under surface tomentose; the capsule 10-celled. It is a native of the hills of Spain and Portugal. Two varieties are described, one with white petals having a yellow spot at the base, the other with white petals and a blood-coloured spot at the base.

C. Ledon, has connate leaves, oblong lanceolate, nerved upper surface smooth, shining, under surface silky villous; the flowers in corymbose cymes; the peduncles and calyx clothed with silky villi. It is a native of the south of France. All the species of Cistus here enumerated are said to yield the Gum Ladanum. Many species which were formerly described under Cistus are now referred to Helianthemum. [Helianthemum, P. C. S.] This is the case with the whole of the old British species of Cistus. The flowers of both these genera are very beautiful, and are remarkable for lasting only one day, opening with the rising of the sun in the morning and perishing with the setting sun of the evening. All the species of Cistus are worthy of cultivation in gardens. They should be kept in the greenhouse in the winter, although during mild seasons and against a south wall they will survive in the open air. They may be propagated by seeds as layers or by ripened cuttings procured in July or August, which, if planted under a hand-glass, will root readily.

(Don, *Gardeners' Dictionary*; Lindley, *Flora Medica*.)

CITATION, a process in the commencement of a suit by which the parties are commanded to appear before the Consistorial courts.

CITIZEN, from the French word *citoyen*, which remotely comes from the Latin *civis*. Aristotle commences the third book of his 'Politik' with an investigation of the question, What is a citizen (*πολίτης*)? He defines him to be one who participates in the judicial and legislative power in a state; but he observes that his definition strictly applies only to a democratical form of government. The Roman word Civis, in its original and proper sense, also meant one who had some share in the sovereign power in the state. The word citizen then, if we take it in its historical sense, cannot apply to those who are the subjects of a monarch, or, in other words, of one who has the complete sovereign power. It is consistent with antient usage and modern usage, and it is also convenient to apply the word citizen only to the members of republican governments, which term, as here understood, comprehends [Republic, P. C.] constitutional monarchies. The term constitutional monarchy is not exact, but its meaning is understood: it is a form of republican government at the head of which is a king, or person with some equivalent title, whose power and dignity are hereditary. Constitutional monarchies approach near to absolute monarchies when the constitution gives very little power to the people, and this little power is rendered ineffectual by the contrivance of the prince and his advisers. Constitutional monarchies are of an aristocratical character when much political power is vested in the hands of a minority which is small when compared with the majority; or they may approach to a democracy, and differ from it mainly in having an hereditary instead of an elective head. Citizenship therefore is here understood as only applying to those states in which the constitution, whether written or unwritten, gives to those who are members of such states, or to some considerable number of them, some share of the sovereign power.

The usual form in which citizenship is acquired is by birth; by being born of citizens. In the old Greek states, and generally in those states of antiquity where citizenship existed, this was the only mode in which as a general rule it could be acquired. A person obtained no rights of citizenship by the mere circumstance of being born in a country or living there. Citizenship could only be conferred by a public act either on an individual or on all the members of other communities. Difference of religion was one of the causes of these communities excluding strangers from their political body. The Roman system was at first a close community, but the practice of admitting aliens (peregrini) to the citizenship was early introduced. They were even admitted by the old burgers (the patricians) in considerable numbers, but only by a vote of the collective body of patricians. The admission of aliens to the citizenship, either partial or complete, became a regular part of the Roman polity to which Rome owed the extension of her name, her language, and her power. It is true that the process of admission went on slowly, and for a long time the Romans unwisely, and with danger to their state, resisted the claims of their Italian allies, or subject people, who demanded the Roman citizenship; but this claim was finally settled in favour of the Italians by the Social or Marsic War (B.C. 90), and by the concessions that followed that war. The consequences of this war were, that all the inhabitants of Italy south of the Po became Roman citizens, and forty years afterwards the privilege was extended to the inhabitants north of the Po. We find some instances, before the Marsic war, of the states of Italy declining admission into the Roman political body; they preferred their own constitution to the rights and duties of Roman citizens. Under Justinian all free persons within the Empire were Cives; but Citizens had then become Subjects, for the Emperor was Monarch.

The Roman system did not allow a man to claim the citizenship by birth, unless he was born of such a marriage as the state recognised to be a legal marriage. If a Roman married a woman who belonged to a people with whom the Roman state recognised no intermarriage (connubium), the child was not a Roman citizen; for he was not the child of his father, and it was only as the child of a Roman father that he could claim Roman citizenship. This was the strict principle; but it appears that if a Roman woman had a child by a man with whom there was no connubium, the child was legally a Roman citizen.

The English law gives the citizenship to all persons who are born anywhere of a British citizen or of one whose father or father's father was a citizen of Great Britain. The English law also gives the citizenship to every person born in the British dominions; which rule originated in the king claiming such persons as his subjects who were born within his dominions. In the earliest periods of English history, those were properly called subjects who may now properly be designated citizens, though citizenship in England must be divided into two kinds, as it was in Rome. Some native citizens do not enjoy the suffrage, nor are they eligible to certain offices, such for instance as a membership of the House of Commons. But these are not permanent and personal disabilities: they are temporary incapacities arising from not having a certain amount of property, and therefore the complete citizenship may be acquired by every man who can acquire the requisite property qualification. It follows from what has been said that those who happen to be under this disability are not full citizens, but have a capacity to become such. Those who have not the suffrage are in the situation of subjects to that sovereign body, of which those who possess the suffrage form a part. Thus the word subject may apply to some persons who live in a republic, as it does apply to all who live under a monarchy. The terms on which foreigners are admitted to the citizenship are different in different countries. A recent act of parliament (7 & 8 Vict. c. 76) has rendered the acquisition of partial citizenship in England much easier and less expensive than it was under the former process of a special act of parliament. [Alien, P. C. S.]

The United States of North America have had various rules as to the admission of aliens to citizenship; but at present they require a period of five years' residence as a preliminary to obtaining the citizenship. Some persons in that country would extend the period of probation to twenty-one years. This however would be a very impolitic measure, for if foreigners will throng to a country such as the United States, with the view of settling there, the best thing is to make them citizens as soon as they wish to become such; and there would be manifest danger to the United States if the large number of foreigners who settle there should be considered as aliens for a period which would extend to the whole term of the natural life of many of the new settlers. Indeed there seems to be no objection to giving to aliens in republican governments, as soon as they choose to ask for them, all the rights and consequent duties of citizens, if they are ever to have them. It may be prudent to exclude aliens by birth from some of the high offices in a state, which is done in England and in the United States of North America.

In antient Rome, aliens were not always admitted to the full rights of Roman citizens; and indeed in the early history of the state, even the plebeians formed a body who were without many of the privileges which the patricians enjoyed. A person might receive the Roman citizenship so far as to enjoy every advantage except a vote at the public elections and access to the honours of the state. This however was not citizenship as understood by Aristotle, nor is it citizenship as understood by the free states of modern times. The acquisition of complete citizenship implies the acquisition of a share of the sovereign power: the acquisition of all the rights of a citizen, except the suffrage and access to the honours of the state, is a limited citizenship; and it is no more than may be acquired in those states where there is no representative body, and in which a man by such acquisition gets not citizenship, but the state gets a subject.

The great facilities for a man changing his residence which now exist, and the increased motives to such change in a desire to better his condition by permanently settling in another country, lead to emigration from one country to another, and more particularly from Europe to America. The advantage which any country receives from the emigration of those who possess capital or peculiar arts is so great that, under the present circumstances of the world, it is not easy to discover any good reason for republican governments refusing to give the citizenship to any person who comes to another country with the view of settling there. A difficulty will arise in case of war when a man owes a divided allegiance, for it is a principle of English law that a man cannot divest himself of his allegiance to the king of England; and probably an American citizen cannot divest himself of his allegiance to the United States. And yet the two countries which maintain this principle, allow the citizens of any other country to become citizens of their several communities. The Roman principle under the Republic was, that as soon as a Roman was admitted a citizen of another state he ceased to be a Roman citizen, because a man could not belong to two states at once; wherein we have one among many examples of the precision of Roman political principles. The same principle must certainly be adopted some time into the international law of modern states.

The nations of Europe and the states of the two Americas have all a common religion, which however contains a great number of sects. A person of any religion in the United States of North America may become a citizen, and his opinions are no obstacle to his enjoying any of the honours of the country. But this is not so in England. No man for instance, though an English citizen, can be a member of the House of Commons unless he is, or is willing to profess that he is, a Christian. The declaration to be made by members of the House of Commons, which contains 'upon the true faith of a Christian,' excludes all who will not profess Christianity. Its practical effect at present is to exclude only Jews; for all other persons call themselves Christians, whether they believe in the divine origin of Christianity or not.

A great number of foreigners, particularly from Great Britain and Ireland, and from some of the German states, annually settle in the United States of North America; and it is now alleged that by their numbers they materially affect the elections. It is also alleged that many of them are very ignorant, and for want of previous education and proper habits are incompetent to exercise the functions of an American citizen. It is further alleged that a great many of them are Roman Catholics, who are under a sort of obedience to a foreign prince, the Pope of Rome, and hostile to the principles of the American constitution. For these and other like reasons it is now proposed that a longer term of probation than five years should be required of aliens before they are admitted to the franchise; and a party which calls itself the American Republican party would make the period of probation twenty-one years, as above stated. It is admitted in the argument of their party that if foreigners on settling in the United States are not allowed to have the franchise during the period of probation, they are during that period subjects to the citizens of the United States and not American citizens; which is consistent with what Aristotle says (*Pol.* iii. 1). If the period of probation is extended to twenty-one years, the citizens of the United States will have among them a great number of subjects—a great number of persons who will be as much their subjects as the people of Prussia are the subjects of the king of Prussia. The period of twenty-one years will, as above observed, comprehend the whole life of the great body of immigrants, and this body will be very numerous. The immigrants will enjoy no more privileges than aliens can enjoy in most countries of Europe, but they will have before their eyes the daily spectacle of a large number of citizens who do enjoy rights which they do not. Whether all these circumstances will render the government of so large a body of subjects an easier thing to deal with than the difficulties that are alleged to grow out of the present terms on which the citizenship is given, remains to be seen. The declared hostility of the American Republican party to the Roman Catholic religion, the religion of a great number of the immigrants, is calculated to embitter these immigrants still more if they are deprived of the power of attaining the citizenship. The United States already possess a great number of slaves who are subjects, and a large body of free coloured people who are looked upon as a different caste. To these a party now proposes to add a large body of alien subjects, to add to the elements of discord one element more; and that a more powerful element than all the rest. Undoubtedly the great amount of immigration into the United States is not a pure advantage to that country, but the call for different terms of naturalization seems to proceed more from party and religious feeling than to be founded on sober reflection; such at least is the conclusion to be derived from some of the manifestoes of those who call for a change in the naturalization laws. If we consider the measures proposed, the reasons given for them, and the temper with which they are urged, we must agree with the party which urges them, that the American nation has rapidly grown up 'without political experience adequate to govern their own mighty physical power.'

CLA'DIUM (from κλάδος, a branch or twig), a genus of plants belonging to the natural order Cyperaceæ. It has 1-2-flowered spikelets, 5 or 6 glumes, the lower ones empty and smaller, bristles absent, the nut with a thick fleshy coat, tipped with the slender base of the style. There is but one European species of this genus, the *C. Mariscus*, Common Sedge. It has lateral and terminal repeatedly compound panicles, the spikelets capitate, the stem roundish, leafy, smooth; the leaves rough on the margins and keel. It is not a common plant in Great Britain, except in Cambridgeshire, where in the bogs and fens of that county it is exceedingly common, hundreds of acres being covered entirely with it. It is used in many districts of Cambridgeshire for the purpose of lighting fires. This plant is the *Schænus Mariscus* and *Cladium Germanicum* of many botanists. Several species of Cladium are natives of New Holland.

(Babington, *British Bot.*; Burnett, *Outlines*.)

CLADOCO'RA, a fossil genus of corals allied to Lithodendron, and occurring in the Palæozoic strata.

CLA'DODUS, a genus of fossil Placoid fishes, from the mountain limestone of Armagh, Bristol, &c. (Agassiz.)

CLADO'NIA, a genus of plants belonging to the natural order Lichenes. It has a thallus somewhat shrubby, branched, rarely simple, leafy, with scales, which are often evanescent; branches cartilaginous, rigid, fistulose, all attenuated and subulate, divided, fertile, generally perforated in the axils. Shields sessile, orbicular, convex, capituliform, not bordered, fixed by the circumference, free beneath in the centre, the sides reflexed, uniform within. The genus Cladonia thus defined, with Scyphophorus and Pycnothelia, are included by Acharius and Delisle in the genus Cenomyce. Sir W. Hooker observes of this genus, that 'the determination of the species is attended with the greatest difficulty, on account of their variable character; and in the present state of my knowledge I dare not venture upon introducing others than those published in English Botany. Much attention has been given to this genus by Delisle in the 'Botanicum Gallicum,' who, with Acharius, unites this and the two following genera into one *Cenomyce*, and enumerates 53 species, besides many marked varieties, as natives of France; all of which are most probably natives also of Britain. He would render an acceptable service to British Botany who should undertake a monograph of the British Cladonieæ.' Hooker enumerates only five British species.

C. rangiferina, Rein-Deer Moss, has erect, elongated, roughish, cylindrical, greenish-white, very much branched, podetia, the axils perforated, the branches scattered, often intricate divaricated, the alternate ones drooping, apothecia subglobose, brown, on small erect branchlets. This is a frequent plant in Great Britain, on moors, heaths, and mountains. Its botanical characters are very variable, more especially the colour and the length of the ramifications. This may be accounted for by the wide range of latitude in which it is found, extending from the arctic regions, where it is most abundant, to the tropics. This plant is the principal support of the rein-deer in its native countries, and hence its common name. In Lapland there is no plant so abundant as this, especially in the pine forests, where it covers the surface of the soil for many miles together like snow. On the destruction of the forests by fire this plant continues to grow, and then reaches its greatest luxuriance. In such districts the rein-deer are principally pastured in the winter, and whatever may be the depth of snow, these animals are enabled to obtain their food by grubbing with their noses through the snow. It would be quite impossible that the rein-deer should exist in these climates during the winter, were it not for this apparently insignificant plant. The Laplanders are also in the habit of collecting this lichen with rakes in the rainy season, when it is flexible, and readily separates from the ground where it has grown; they then lay it up in heaps, to serve as fodder for their cows. Dr. Clarke and his companions, during his travels in Lapland, were tempted to eat some of this lichen. 'To our surprise,' he says, 'we found that we might eat of it with as much ease as of the heart of a fine lettuce. It tasted like wheat bran. But after swallowing it there remained in the throat and upon the palate a gentle heat or sense of burning, as if a small quantity of pepper had been mixed with the lichen. We had no doubt that, if we could have procured oil and vinegar, it would have made a grateful salad. Cooling and juicy as it was to the palate, it nevertheless warmed the stomach when swallowed, and cannot fail of proving a gratifying article of food to man or beast during the dry winter of the frigid zone. Yet neither Laplanders nor Swedes eat of this lichen.' This might arise from the fact which Dr. Clarke relates shortly after, namely, 'that when Gustavus III. succeeded to the throne an edict was published and sent all over Sweden, recommending the use of this lichen to the peasants in time of dearth, and they were advised to boil it in milk.' Such an edict would be likely to have the effect of preventing people from eating it, as it would from that time forth be only looked upon as a last resource. Dillenius however states, that when boiled in water it yields no jelly, its substance is very little diminished, and becomes drier than before; and the decoction evaporated yields only a small quantity of an acerb and austere extract. The alimentary secretion of this plant appears to be similar to that of other lichens. It is called Lichenin [LICHENIN, P. C.], and contains the same elements as starch. No nitrogen has been detected. It is however probable that nitrogen will be found to exist in this lichen, as during the winter it supplies the rein-deer with food which must require a nitrogenous compound, in order to maintain its muscular power, unless we have recourse to the supposition that starch or Lichenin, by union with free nitrogen in the system, can be converted into fibrine or other proteinaceous compounds.

C. vermicularis, Vermicelli Lichen, has its podetia spreading horizontally, pure white subulate, simple or slightly branched, branches tapering at each end. It has been found not unfrequent on the loftiest mountains of the North of England and Scotland. The shape of its branches give it the appearance of a bundle of small worms, or of vermicelli. It is a native of South America, where it is used as a stomachic under the name of *Contrayerba blanca*.

C. sanguinea has a leafy, very thick, imbricated thallus, scarlet, and frosted with white beneath; above, green and somewhat gelatinous; the lobes crenulated ascending, podetia nearly solid, cavernous, split into fingered lobes, either wholly or at their apex only; the shields marginal, confluent, scarlet. This pretty form is a native of the Brazils, where it is rubbed down with sugar and water, and is found to be an excellent remedy for aphthæ in children. The remaining described British species are C. uncialis, C. pungens, C. furcata.

(Lindley, *Flora Medica;* Burnett, *Outlines of Botany;* Hooker, *British Flora*, vol. ii.)

CLADYODON, a generic title for some fossil reptiles found in the new red-sandstone system. [THECODONTS, P. C.]

CLAIRON, CLAIRE JOSEPHE LEYRIS DE LA TUDE, a celebrated French actress, whose name frequently occurs in the literary memoirs and correspondence of her day, was born near Condé, in French Flanders, in 1723. She made her early appearances in the Flemish theatres, and those of the neighbouring provinces of France. In 1732 she was called to the Parisian Opera, and soon afterwards to the Comédie Française. Although her name is now seldom mentioned, and her fame is almost forgotten, no actress of any age or country appears to have been the object of a reputation so wide and an admiration so intense. No one can read the letters of Voltaire and his contemporaries, or the memoirs of Marmontel and others, without being struck by the frequent recurrence of her name, associated with enthusiastic eulogies. She was evidently a woman of vicious morals, yet she was proud and unbending in public; and Voltaire, who had obvious motives for esteeming her, from her successful representation of several of his characters, speaks of her in his 'Candide' as a person moving in so high and select a circle, that the boast of having met her in society is put into the mouth of an obscure braggart addicted to telling extravagant fictions. The prevailing character of her acting was the natural, and in this she was distinguished from her rival, Dumesnil, who was considered the representative of art. Mademoiselle Clairon quitted the Comédie Française in 1765. She lived for many years as mistress of the Margrave of Anspach, and died in 1803. Some memoirs relating to her were printed in 1799 by her pupil Mlle. Raucourt; and there are many anecdotes of her in the memoirs of the Margravine of Anspach, and the 'Mémoires de Fleury' (the actor).

CLARE HALL, CAMBRIDGE, was established on the site of a former college called University Hall, which had been founded in 1326 by Dr. Richard Badew, who was afterwards chancellor of the university. University Hall was destroyed by fire in 1342, and was rebuilt, chiefly through the solicitations and exertions of Dr. Badew, by Elizabeth de Burgh, one of the sisters and coheirs of Gilbert, earl of Clare. The new college was called Clare Hall, and she endowed it in 1347 with lands for the maintenance of a master, ten fellows, and ten scholars, the liberal-minded lady stating in the deed of endowment her motives to have been 'a desire for the extension of every branch of useful learning, that there might no longer remain an excuse for ignorance, and to create a firmer concord and closer union among mankind by the civilizing effect of indulgence in liberal study.'

Besides the fellowships on the old foundation, which are called the senior fellowships, three others were founded by the Earl of Exeter in 1612, two by John Freeman, Esq., in 1622, and four from the estates bequeathed to the college by Joseph Diggons, Esq., in 1658. These nine fellowships are called the junior fellowships, but have nearly the same privileges annexed to them as to those on the original foundation.

The nineteen fellowships are open to all persons who may be bachelors of arts, or of a degree higher. The electors are the master and senior and junior fellows, and when the numbers are equal on both sides the master has a casting vote: the elections must take place within ten weeks and three days after a fellowship has become vacant. The master is elected by the fellows within ten days after a vacancy has occurred, and he must be a bachelor or doctor in divinity.

All the senior fellows must profess the faculty of divinity, except two, who, with consent of the master and majority of the fellows, may profess law and physic. Six of the senior fellows must be in priest's orders. Seven of the junior fellows of a certain standing must take priests' orders, but two of the fellowships may be held by laymen.

There are, besides the nineteen senior and junior fellows, three bye-fellowships, of which one was founded by Mr Borage, in 1637, for persons of his own name and kindred, or, in default, a Norfolk man; and two by Mr. Philpot, in 1717, for natives of Kent. These three fellows must take priest's orders within seven years after they become bachelors of arts. They have no voice in college business, can hold no college office, and are incapable of being elected into any other fellowship.

There are four scholarships of 50*l.* a year each, and four of 20*l.* a year each, besides a weekly allowance in the butteries of 3*s.* 3*d.* a week each during residence. There are also, founded by private benefactors, one scholarship of 20*l.* a year, tenable till M.A.; two of a guinea a week during residence; one of 12*s.* a week during residence; one of 40*l.* a year; and upwards of thirty other scholarships and exhibitions, varying in value from 2*s.* to. 6*s.* a week, with allowances in the butteries during residence. The scholarships are open to natives of all parts of the kingdom, except four, two of which are from Wakefield school, one from Hull school, and one open to natives of Hertfordshire only.

There is an annual prize of 10*l.* for the best dissertation on the character of King William III., established by Mr. Greaves, of Fulbourn. Two silver cups of the value of 6*l.* each are given annually, one for regularity of conduct, the other for general learning. There are also awarded annual prizes of books, besides prizes of money not exceeding 40*l.*

There are 16 benefices in the gift of Clare Hall, namely, 2 in Cambridgeshire, 1 in Essex, 1 in Hertfordshire, 3 in Huntingdonshire, 1 in Lincolnshire, 1 in Norfolk, 3 in Suffolk, 2 in Surrey, 1 in Wiltshire, and 1 in Yorkshire.

Clare Hall is beautifully situated on the bank of the Cam, over which it has a stone bridge, leading to a vista between two rows of lime-trees. The buildings occupy a quadrangular court, 150 feet by 111 feet. Clare Hall was rebuilt in its present form in 1638; it is entirely of Ketton freestone, which looks remarkably fresh. The front looking towards the Cam is over-crowded with pilasters of the Ionic and Tuscan orders, and the forms and mouldings of the windows are not handsome, but the general effect is pleasing. The hall is a fine room, 69 feet by 21 feet. The modern library is also a large and well-proportioned room, well filled with valuable books, and the old library contains a good collection of Italian and Spanish books.

The old chapel of Clare Hall was built in 1535, previous to which the members attended divine service in the south aisle of St. Edward's church, which belonged to the college. The old chapel was never consecrated, and no one was ever buried there. The new chapel was begun in 1763, and consecrated in 1769. It is of the Corinthian order, the ornaments are appropriate, the stucco-work of the ceiling is highly finished, and the wainscoting neat. The cupola of the ante-chapel produces a fine effect. The design of the whole chapel was by Dr. James Burroughs, master of Caius College.

Among the eminent men who have been members of Clare Hall may be mentioned Archbishop Tillotson, Dr. Cudworth, and Ruggle, one of the fellows, author of the Latin burlesque comedy of 'Ignoramus,' written in ridicule of the barbarous phraseology of the lawyers, which was twice acted before James I., by members of the University, to his majesty's great amusement.

(Dyer, *History of the University of Cambridge;* Lysons, *Cambridgeshire;* Wilson, *Memorabilia Cantabrigiæ;* *Cambridge University Calendar*, 1845.)

CLASSIFICATION OF PLANTS. [Endogens, P. C.; Exogens, P. C.; Jussieu, P. C.]

CLATHRA'RIA, a genus of fossil plants found in the Wealden strata of Sussex by Dr. Mantell. The stem is reticulated on the surface, and has analogies to Xanthorrhœa and the Cycadeæ. Clathraria Lyellii and Cl. Mantelli (this latter the fruit) are described by Brongniart, ('Hist. des Végét. Foss.').

CLATHRO'PTERIS, a remarkable genus of fossil ferns, the foliation of which is marked with quadrangular network of vessels—a rare circumstance in living ferns—such as Meniscium. Clathropteris meniscioides occurs in the mesozoic sandstone of Hör in Scania.

CLEANTHES (Κλεάνθης) was the successor of Zeno of Citium in the Stoic school, and was himself succeeded by his pupil Chrysippus. As Zeno died in B.C. 268 or 259, the period of Cleanthes is approximatively determined by that fact. [Zeno of Citium, P. C.] Cleanthes was a native of Assus in the Troad, and originally a boxer. He came to Athens with four drachmæ (about 3*s.*) in his pocket, and began to attend the lectures of Zeno. As he had to pay his teacher a small fee, and at the same time to gain his livelihood, he used to draw water for the gardens about Athens in the night and also grind corn. There is a story that he was brought before the Areopagus in order to show what his means of subsistence were, and he proved that he was an honest man by producing as witnesses the gardener and the mealman for whom he worked, whereupon the Areopagus voted him a present of ten minæ, which however Zeno would not allow him to receive. Ten minæ seems rather a large sum for the Areopagus to vote on such occasion; and it is not said whether they had a fund for remunerating persons who were brought before them on groundless charges. Cleanthes attended the lessons of Zeno for nineteen years. He was slow of comprehension, but very laborious, whence he got the name of the second Hercules. Though he did not learn quick, he kept what he got. He was a copious writer; a list of his numerous treatises is preserved by Diogenes Laertius. Nothing is known of his works, except that we may collect that he indulged in the subtleties of discussion; but it does not appear that he did much towards the extension or improvement of the Stoic doctrines; that was done by his pupil Chrysippus: but the stern character of Cleanthes was well adapted to give stability to the doctrines of Zeno. The story of his death is characteristic. He had a swelling in his jaw, and at the advice of physicians he abstained from food, and the complaint began to abate. The physicians told him that he might now take his usual food, but he remarked that he had already gone a good part of the journey, and so he continued fasting till he died, at the age of eighty, or of ninety-nine, according to Lucian and Valerius Maximus.

Cleanthes is the author of a hymn to Jupiter in Greek hexameters, which was first published by Fulvius Ursinus, at the end of the 'Fragments of the Nine Illustrious Women and of the Lyric Poets,' Antwerp, 1568, 8vo. It is printed in Cudworth's 'Intellectual System,' with a Latin poetical version by Duport. The last edition is by Coraes, in his edition of the 'Enchiridion of Epictetus,' Paris, 1826, 8vo.

The hymn of Cleanthes has always been a favourite with Christian philosophers, but the true understanding of it, as Ritter remarks, can only be reached by looking at it from the Stoical point of view.

(Diogenes Laertius, *Cleanthes*; Fabricius, *Biblioth. Græc.* iii. 550; Ritter, *Geschichte der Philosophie*, iii. 521.)

CLEAVAGE, a term employed in geology to indicate a peculiar fossility in certain (especially argillaceous) rocks, which is independent of, and generally meets at a considerable angle, the surfaces of lamination or deposition. Clay slate furnishes the best examples of this phenomenon, which is discussed under the title Slate, P. C.

CLEO'ME, a genus of plants belonging to the natural order Capparideæ. It has a calyx of four almost equal spreading sepals; four petals; a torus somewhat hemispherical; six, rarely four, stamens; a silique dehiscent, stipitate, or sessile within the calyx.

C. gigantea is a shrubby plant, velvety-pubescent and somewhat clammy; the leaves 7-foliate, with 30 or 40 veins on each side of each leaflet. It has whitish-green flowers, with pinkish filaments and yellow anthers. It is a native of South America. It is a beautiful plant, but has a disagreeable odour and an acrid taste.

C. rosea is an herbaceous unarmed smooth plant, with quinate leaflets, the lower and floral ones ternate, the uppermost ones ovate sessile; the silique smooth, the length of the stipes. This plant has beautifully rose-coloured flowers. It is a native of Rio Janeiro.

There are about fifty species of the genus Cleome described, many of them are now referred to the genus Polanisia. [Polanisia, P. C. S.] Most of them are worth cultivating on account of their beauty. The shrubby species do best in a rich light soil. They may be propagated by ripened cuttings in a moderate heat under a hand-glass, or by seed. The seeds of the annual species should be sown on a hot-bed in spring, and when the young plants are of sufficient size they may be planted out in the open border, but not before the middle of May. The biennial species must be kept in the stove; they may be propagated by cuttings, as the shrubby species.

(Don, *Gardener's Dictionary*.)

CLERC, SEBASTIEN LE, a very celebrated French designer and etcher, highly praised by the French critics, was born at Metz in 1637. His father, who was a clever goldsmith, instructed him in the rudiments of drawing and engraving.

Sebastien Le Clerc commenced his career as a civil and military engineer; but, having met with some unjust treatment, he resigned a place which he held under the Marshal de la Ferté, and determined in 1665 to settle in Paris, where, by the advice of Le Brun, he devoted himself exclusively to engraving or etching, an art for which he showed the highest ability. He had also a fertile invention, and great ability as a designer.

In 1668 Le Clerc published a 'Géométrie Pratique' in eighty plates, which procured him the notice of Colbert, who gave him an appointment in the Gobelins tapestry manufactory, with apartments in the factory, and a salary of 3000 francs. Whilst in this situation he married the daughter of Vander Kerkhove, the dyer of the establishment, by whom he had sixteen children; and his family increased so rapidly that he was forced to give up his situation, and to try his fortune by working for the public at large. About 1684 he was elected a member of the Royal Academy of Painting, and appointed Professor of Perspective, an office which he held for thirty years. In 1693 he was nominated Engraver in Ordinary to the King (Louis XIV.); and he was created about the same time a Knight, by Pope Clement XI. He used to sign himself Chevalier Romain. He died at Paris in 1714.

Le Clerc's etchings and engravings are very numerous. They are said to exceed 3000; and his designs are twice as numerous. His works include nearly all subjects except shipping. His master-pieces are, the Academy of the Arts and Sciences, the Entrance of Alexander the Great into Babylon, and the Feeding of the Five Thousand, from his own compositions. A complete list of his works, preceded by a memoir, was published at Paris in 1774, by C. A. de Jombert, entitled 'Catalogue Raisonné de l'Œuvre de Seb. le Clerc.' Heineken also has given a long list of his principal works in his 'Dictionnaire des Artistes,' &c. Le Clerc was the author of several scientific works. He published a 'Traité de Géométrie,' a 'Nouveau Systême du Monde,' a 'Systême de la Vision,' and a 'Traité d'Architecture.'

Sebastien le Clerc, his son, was a good historical painter. He was elected a member of the Royal Academy in 1704, and died in 1767, aged eighty-three. Several of his works also have been engraved.

CLERK OF ASSIZE is an officer attached to each circuit, who accompanies the judges at the assizes, and performs all the ministerial acts of the court. He issues subpœnas, orders, writs, and other processes; draws indictments; takes, discharges, and respites recognizances; files informations, affidavits, and other instruments, enters every *nolle prosequi*, records all the proceedings of the court, and enters its judgments. He is associated with the judges in the commissions to take assizes; and he is restrained by statute 33 Hen. VIII. c. 24, from being counsel for any person on his circuit. He is paid by fees which are charged upon the several official acts performed by him, some, by virtue of established usage, and others, under various statutes, 55 Geo. III. c. 56; 7 Geo. IV. c. 64; 7 & 8 Geo. IV. c. 28; 11 Geo. IV.; and 1 Wm. IV. c. 58. The fees payable on each circuit will be found in *Parl. Paper*, No. 631 of 1843.

(*Parl. Paper*, 1843, No. 631; Wood's *Institutes*.)

CLERK IN ORDERS. [Clergy, P. C.]

CLERK OF THE CROWN IN CHANCERY, is an officer of the crown in attendance upon both Houses of Parliament, and upon the great seal. In the House of Lords he makes out and issues all writs of summons to peers, writs for the attendance of the judges, commissions to summon and prorogue Parliament, and to pass bills; and he attends at the table of the House to read the titles of bills whenever the royal assent is given to them, either by the queen in person or by commission. He receives and has the custody of the returns of the representative peers of Scotland, and certifies them to the House; and makes out and issues writs for the election of representative peers of Ireland and their writs of summons. He is the registrar of the Lord High Steward's Court for state trials and for the trial of peers; and he is also registrar of the Coronation Court of Claims.

In connexion with the House of Commons, he makes out and issues all writs for the election of members in Great Britain (those for Ireland being issued by the clerk of the crown in Ireland); gives notice thereof to the secretary-at-war, under act 8 Geo. II. c. 30, for the removal of troops from the place of election; receives and retains the custody of all returns to Parliament for the United Kingdom; notifies each return in the 'London Gazette,' registers it in the books of his office, and certifies it to the House. By act 6 & 7 Vict. c. 18, he has the custody of all poll-books taken at elections, and is required to register them, to give office copies or an inspection of them to all parties applying, and to prove them before election committees. He attends all election committees with the returns of members; and when a return is to be amended in consequence of the determination of an election committee, he attends at the table of the House to amend it.

He is an officer of the lord high chancellor, not in his judicial capacity, but as holding the great seal; and in this department he makes out all patents, commissions, warrants, appointments, or other instruments that pass the great seal, except patents for inventions and other patents and charters which are passed in the Patent Office. He also administers the oaths of office to the lord chancellor, the judges, the serjeants-at-law, and all other law officers, and records the same in the books of his office. For these several duties he receives a salary of 1000*l.* a-year, under 7 & 8 Vict. c. 77.

(*Parl. Report*, No. 455, of *Session* 1844.)

The office of the Clerk of the Crown is commonly called the Crown Office; but there is also an office in the Court of Queen's Bench called the Crown side of the Court, of which there is a master and other officers.

CLERK OF THE HOUSE OF COMMONS, the chief officer of that House, is appointed by the crown for life, by letters patent. Upon entering office he is sworn before the lord chancellor 'to make true entries, remembrances, and journals of the things done and passed in the House of Commons; in which duties he is aided by the clerk-assistant and second clerk-assistant. These three officers are more commonly known as 'clerks at the table.' The chief clerk signs all orders of the House, endorses the bills, and reads whatever is required to be read in the proceedings of the House. He is also responsible for the execution of all the official business of the House, which is under his superintendence. In the patent he is styled 'Under Clerk of the Parliaments to attend upon the Commons;' whence it is inferred that on the separation of the two Houses, the under-clerk of the Parliaments went with the Commons, leaving the clerk of the Parliaments in the Upper House. His salary is 3500*l.* a year, that of the clerk-assistant 2500*l.*, and that of the second clerk-assistant 1000*l.*; but under act 4 & 5 Wm. IV. c. 70, the salaries of the two first offices will be reduced to 2000*l.* and 1500*l.* respectively, on the first vacancy.

(Hatsell, *Precedents*, vol. ii. p. 251; May, *Proceedings and Usage of Parliament*, p. 157 and Index.)

CLERK OF THE PARLIAMENTS is the chief ministerial officer of the House of Lords. His duties (which are executed by the clerk-assistant and additional clerk-assistant) are to take minutes of all the proceedings, orders, and judgments of the House; to sign all orders, to endorse bills, to swear witnesses at the bar, to wait upon the queen when she comes to give the royal assent to bills, and to take her command upon them; and to signify the royal assent in all cases, whether given by the queen in person or by commission. He is also sent occasionally with a master in chancery as a messenger from the Lords to the Commons in the absence of another master. Besides these and other special duties, he is charged with the general superintendence of the official establishment of the House of Lords. He is paid out of the Lords' Fee Fund, of which no account is ever given.

(May, *Proceedings and Usage of Parliament.*)

CLERK OF THE PEACE is an officer attached to every county or division of a county, city, borough, or other place in which quarter-sessions are held; being the ministerial officer of the court of quarter-sessions. He is appointed by the *Custos Rotulorum* of the county, and holds his appointment so long as he shall well demean himself. In case of misbehaviour the justices in sessions, on receiving a complaint in writing, may suspend or discharge him, after an examination and proof thereof openly in the sessions; in which case the *Custos Rotulorum* is required to appoint another person residing within the county or division. In case of his refusal or neglect to make this appointment, before the next general quarter-sessions, the justices in sessions may appoint a clerk of the peace. (1 Wm. III. c. 21, § 6.) The *Custos Rotulorum* may not sell the office or take any bond or assurance to receive any reward, directly or indirectly, for the appointment, on pain of both himself and the Clerk of the Peace being disabled from holding their respective offices, and forfeiting double the value of the consideration, to any one who shall sue them. (Id. § 8.) To give effect to this provision, before the Clerk of the Peace enters upon the execution of his duties he takes an oath that he has not paid anything for his nomination.

The Clerk of the Peace may execute the duties of his office either personally, or by a sufficient deputy approved by the Custos Rotulorum. He or his deputy must be constantly in attendance upon the court of quarter sessions. He gives notice of its being holden or adjourned; issues its various processes; records its proceedings; and performs all the ministerial acts required to give effect to its decisions. During the sitting of the court, he reads all acts directed to be read in sessions; calls the jurors, and parties under recognizance; presents the bills to the grand jury and receives them again; arraigns prisoners, administers oaths, and receives and records verdicts. Whenever prosecutors decline any other professional assistance, he is required to draw bills of indictment, for which, in cases of felony, he can charge 2*s.* only, but in cases of misdemeanor he may charge any reasonable amount for his service.

In addition to these general duties he has other special duties imposed upon him by different statutes, in regard to the summoning of juries, the appointment of sheriffs and under-sheriffs, the enrolment of rules of savings' banks and friendly societies, the custody of documents required to be deposited with him under standing orders of the Houses of Parliament, and other matters.

By act 22 Geo. II. c. 46, § 14, he is restrained, as being an officer of the Court, from acting as a solicitor, attorney or agent, or suing out any process, at any general or quarter sessions, to be held in the county, &c. in which he shall execute his office.

The Clerk of the Peace is paid by fees. Those chargeable upon prisoners acquitted were abolished by the 55 Geo. III. c. 50, for which he is indemnified by the county. By the 57 Geo. III. c. 91, the justices of the peace for the county are authorized to settle a table of fees, to be approved by the Judges of assize, which may not be exceeded by the Clerk of the Peace, under a penalty of 5*l.* If he take more than is authorized by such table of fees, he will also be liable to be proceeded against at common law for extortion, and to be removed from his office by the court of quarter sessions. The sessions cannot, however, compel the payment of these fees by summary process, nor detain the parties until they be paid, but the Clerk of the Peace is left to his remedy by action. A bill is now before parliament, by which Clerks of the Peace are in future to be remunerated by salaries, payable out of the fees collected.

(Dickinson, *Quarter-Sessions*; Burn, *Justice of the Peace.*)

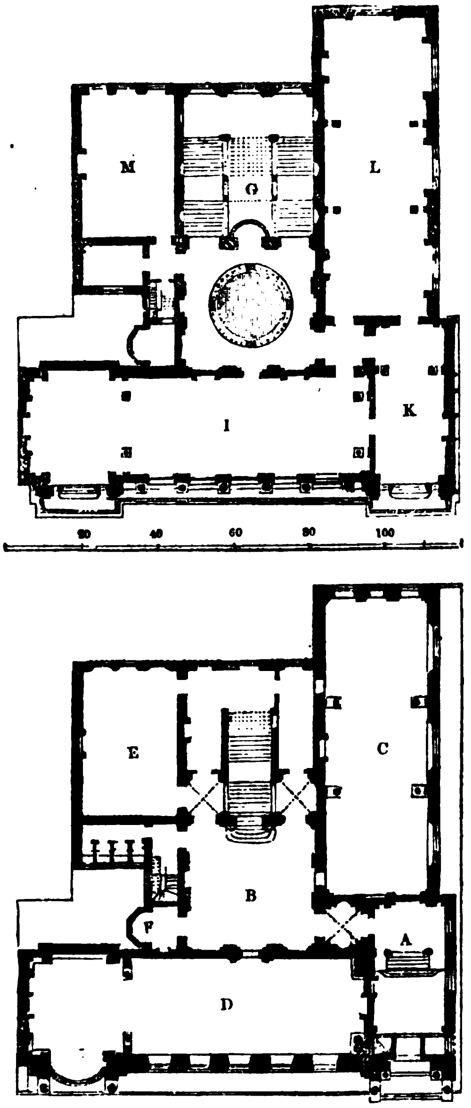
CLERKS AND SERVANTS. [SERVANTS, P. C.]

CLEVELAND, CLEIVELAND, or CLEAVELAND, JOHN, was born in Leicestershire in 1613, and studied at Cambridge, where he became a college-tutor and reader in rhetoric. On the breaking out of the civil war he joined the royal army, and distinguished himself both as an active soldier, and as one of the most severe and biting writers of lampoons on the roundheads. He died in London, in 1658. Those few verses of his, chiefly love-poems, which rise above personalities and temporary interests, possess occasional richness of fancy; but they are deformed by the most perverse conceits anywhere to be found in the circle of that which has been called the metaphysical poetry of the seventeenth century. The most complete edition of Cleveland's works appeared in 8vo. in 1687.

CLUB-HOUSE. As now constituted, the clubs of the metropolis form a peculiar feature in our modern social condition. Unlike the literary and other clubs of the last century, consisting of a comparatively few individuals who held their meetings at stated times, and generally at some tavern, with no apartments of their own; the clubs of the present day—most of them established within the last thirty years—are more upon the footing of what used before to be called Subscription Houses (such as Brookes' and White's)—merely places of rendezvous always open to those who are members of them, and who are subject to no other forms and rules than the being balloted for upon admission. That, in fact, is almost the only thing in their constitution which distinguishes them from public hotels and coffee-rooms, except it be that the accommodations are upon a much more extensive scale, and in a very superior style, yet at the same time at the minimum of cost, owing both to the number of members and the consequent great certain revenue derived from the annual subscriptions alone, and to there being no profit to be made out of what is expended and consumed. To the original character of coffee-room and news-room the modern clubs add that of library and reading-room, and are furnished not only with card, billiard, and smoking rooms, but with baths also. The cuisine and domestic department are equally complete: in short, luxurious refinement is studied throughout; the whole is upon a scale that may be called princely, and would be deemed quite extravagant for a private establishment, except that of a few of our wealthiest noblemen. But the seeming extravagance is only individual economy, because what it would cost each member singly to furnish an ordinary sitting-room is, when clubbed together by a thousand or fifteen hundred persons, sufficient to erect a sumptuous palace. Accordingly, the club-houses—the later-erected ones at least, constitute a new class of buildings in the metropolis, being almost the only ones which answer to the character of *palazzi*—palatial structures, plainly distinguishable from public buildings either for business or amusement. While, too, they eclipse in external appearance almost every town mansion of our nobility, they are upon a far more spacious scale internally, because, except for the domestic part of the establishment, no other apartments are required than what in a private mansion would be called the state and reception rooms,—no bed-chamber floor, and perhaps even second one, over the first floor. The rooms themselves are besides greatly more spacious and lofty than in private town-houses of the very first class, except one or two, such as Mr. Hope's, Stafford House, and Grosvenor House, which have a single room or 'gallery' rivalling in extent a club-house drawing-room. With the exception of the picture-gallery, even the state-rooms in Buckingham-palace are of moderate size in comparison with some of those in the Reform and Conservative Clubhouses, and certainly not more striking in character.

Clubhouses may therefore well be considered a class by themselves—distinct from all other edifices, public and private alike, and from the latter not merely as being larger or more ornate as to design, for that may not in every instance be the case, but for carrying with them an expression not to be counterfeited by clubbing two or three houses together, and uniting them into a single façade, which, however decorated, betrays itself at a glance for what it really is, and the more extensive it is, the more danger of its looking very barrack-like instead of palatial. However they may differ as to design in other respects, with a single exception (the Reform) the clubhouses resemble each other in one particular—in showing only two ranges of windows in their façades,—those of the ground-floor, and of the *piano nobile* or principal floor; a circumstance highly favourable to composition, whether astylar or columnar, and productive of an air of dignity which cannot possibly be obtained by piling up story over story to make a lofty house with comparatively low and moderate sized rooms. Concomitant with the greatness of manner arising from only two ranges of windows, is the other which is derived from *fenestration*, or the spacing of the windows, there being often not more than a single window to every twelve feet or upwards of frontage. What, besides, contributes in no small degree to architectural finish and completeness of design in those instances where it has been adopted, as in the Travellers' and Reform Clubhouses, is the plan of entirely screening out the areas and lower part of the building by means of parapet and balustrading, which, while it effectually conceals what is not intended to be seen, even where it is allowed to be seen, is highly ornamental in itself. In most of the principal clubhouses the basement is exceedingly deep, nearly one-half of the structure being below ground, for in addition to the lowermost or kitchen floor, containing a multiplicity of rooms for various domestic purposes, there is a mezzanine over it and immediately beneath the ground-floor, fitted up with baths and dressing-rooms for members, and here also are placed the rooms for the housekeeper and other superintendents of the respective departments. A great deal of habitable space is also got out of the upper part of the house in such a manner as not to interfere at all with the external design: a modern clubhouse, in short, affords a complete architectural study of every contrivance for convenience and comfort, and for the systematic management of a large domestic establishment.

Notwithstanding that the London Clubhouses have nearly all many points in common, they differ considerably as to architectural pretension and merit. The University (first opened in 1826), the Union (1827), and the United Service (1828), are tolerably characteristic of their respective architects, Wilkins, Smirke, and Nash. The Athenæum, by Burton (opened Nov. 1830), corresponds in its general mass with the United Service, the two buildings occupying the opposite angles of Carlton Place next Pall-Mall; yet though such degree of uniformity is kept up between them, they are almost in contradiction to each other as regards style and taste; the entablature of Burton's building being as remarkable for what was then quite an extraordinary degree of importance and richness, as that of Nash's for its utter insignificance. Even now the Athenæum continues to be the only example we have of continuous sculptural decoration in a deep bas-relief frieze carried along the whole exterior of the edifice. In fact the Athenæum seems to have furnished the hint for the mode of design introduced immediately afterwards (1831) by Barry in the adjoining Travellers' Clubhouse, viz. astylar composition, crowned by a bold and rich *cornicione*, and in which windows are treated as principal features. It was that clubhouse which first brought Barry into notice, and stamped his reputation as an architect of superior taste: its carefully finished ornateness and simplicity of design combined with richness of detail were hailed as welcome novelty after the dull blankness of our pseudo-Greek school, and of Palladianism with mere holes in the walls for windows. Yet happy as was the application of it, the style then brought forward by Barry was so far from being original, that the Pall-Mall front of the Travellers' is, we will not say a plagiarism from, but a tasteful and improved version of the façade of the Palazzo Pandolfini at Florence, as is strikingly evident on comparing it with the latter in Famin's 'Architecture Tocane,' a work tolerably familiar, it may be presumed, to every professional man. It was in the other front of the Travellers' that Barry displayed his originality and produced a most charming and graceful composition, one which he has never since surpassed or even equalled in that style. Owing to its situation, towards the garden, that front is all but quite withdrawn from public view, for though the building itself is visible, all its beauties of detail are completely lost. Fortunately the Travellers' has been made the subject of an architectural monograph, which supplies a series of admirably engraved illustrations, comprising not only plans, elevations, and sections, but plates of the ornamental details, internal as well as external. No less fortunately the elevation of the garden front there shows it in its original state, previous to its being marred by an excrescence now built upon its roof, to answer the purpose of a smoking-room. The Reform Clubhouse (by the same architect) was erected 1839-41, immediately adjoining the preceding, and forms together with that of the Athenæum a rich architectural group and *insula*, extending nearly 300 feet back and front, by 105 in depth. It is strange that while Barry's first clubhouse was spoken of as something altogether original, his second should have been taken to be little more than an express copy of the Palazzo Farnese at Rome, though the difference is much greater than any sort of resemblance, and the only point of similarity is that both structures are crowned by a massive cornicione, and have windows decorated with columns. The Reform constitutes a fine unbroken and uniform mass, all the three fronts being alike, some slight differences of detail excepted. It is also considerably loftier than the two adjacent buildings, having an additional story, not a mere mezzanine one in character, though the windows are of little more than mezzanine proportions. This floor forms quite a distinct part of the interior, with a separate entrance to it from the street, and is let out in private chambers to members of the club. The public apartments of the Reform are far more spacious and sumptuous than those in any other clubhouse of previous date: the inner hall or saloon is a very striking and scenic apartment, occupying the entire height of the ground floor and principal one, and lighted through the cove of its ceiling, which is perforated and filled in with cut glass. The coffee-room on the ground floor, and the drawing-room over it, are each 117 feet by 26.



Plan—Conservative Club, St. James's Street.

Ground Floor.—A, Entrance Hall, 35×19, 19 high. B, Inner Hall, 35×35, ditto. C, Coffee Room, 80×28.6′, ditto. D, Morning Room, 92×26.6′, ditto. E. House Dining Room, 36×23. F. Waiting Room.

Upper Floor.—G, Grand Staircase, 35×36. H, Upper Vestibule, 35×35. I, Evening or Drawing Room, 92×26.6′. 25 high. K, Card Room, 14×19. L. Library, 80×28.6′, 25 high. M, Committee Room, 36×23.

Next to the Reform, though separated from it by an approach to Carlton Gardens, the Carlton Clubhouse, erected somewhat earlier than the other, by Sir R. Smirke, presents a very forcible contrast to it, showing how very little can be made of affectedly pure Greek in astylar composition. That piece of architecture will probably soon disappear, it being intended to rebuild and greatly extend the front by adding to it the two adjoining houses. The new building, it is said, will be in the Elizabethan or Cinquecento style. The next clubhouse in Pall-Mall, the United University, was built rather earlier than the Reform (1836-7), by Sir R. Smirke and his brother Sydney Smirke, in a style to which each seems to have contributed his respective share, it being one in which Greek and Italian elements are shaken up together rather than combined with each other. The interior contains nothing whatever of interest. The new Conservative Clubhouse in St. James's (by Basevi and S. Smirke, 1843-4, opened Feb. 1845), is not only the latest, but in some respects the most splendid of all the edifices of the kind. The façade shows a return to the Palladian fashion of an order raised upon a ground-floor basement; and in regard to the order itself, Corinthian, the design is perfectly satisfactory; the entablature and ornamental sculpture beneath it, between the capitals of the columns and pilasters, give an air of nobleness and richness to the upper part; whereas the basement floor is in very meagre taste, more French than Palladian; and there is so little unity of character, between the upper and lower division, that they seem to be the distinct work of the respective architects. But it is for its interior and its decorations that this clubhouse rivals the Reform, and perhaps throws it a little into the shade: the central hall, staircase, upper hall or saloon, drawing-room, and card-room, are all gorgeously embellished with polychromic encaustic painting, by Sang, the same artist who was employed at the Royal Exchange. Being the first instance of such decoration here, it has attracted much notice, and is certainly a very striking novelty, but not particularly satisfactory after the first impression wears away. The effect would have been much better, if colour had been applied more sparingly to the lower hall and staircase, and the full display of it been reserved for the two evening rooms. In that case the other apartments would not have looked so plain and bare as they now do in comparison with the hall, which raises expectation too highly. The annexed plans of the two principal floors of this building will not only describe it more clearly and briefly than we could do, but also serve to give an idea of the accommodation required in buildings of the kind.

CLU'SIA, a genus of plants belonging to the natural order Guttiferæ, named after Charles de l'Ecluse, or Clusius, one of the most celebrated botanists of the sixteenth century. [CLUSIUS, CAROLUS, P. C. S.] It has a calyx of four imbricate, coloured, permanent sepals, the outer ones smallest, usually doubly bracteate at the base; the corolla of 4-6 deciduous petals; the stamens numerous and free in the male flowers; few, sterile, and connected in the female flowers, the style absent; the stigmas 5-12, radiately peltate, sessile, permanent; the flowers usually polygamous; the ovary surrounded by a short staminiferous nectary; the capsule fleshy, 5-12-celled, opening by valves from the top to the base, with a dissepiment in the middle of each valve; the placenta thick, triangular, central; the seeds eggshaped, surrounded by pulp, suspended from the inner angle of the cells; the embryo straight, inverted; the cotyledons separable. This definition includes the genus *Quapoya* of Aublet. The species are trees and shrubs, usually parasitical, and yielding a viscid resinous juice, of a balsamic flavour; hence they are called in England balsam-trees.

C. rosea, Rose-flowered Balsam-tree, has polygamous flowers, a rose-coloured 5-6-sepaled calyx; the tops of the dense nectaries awl-shaped; 8-12 stigmas; the leaves obovate, obtuse, veinless, sometimes emarginate, on short striated petioles. It is a native of the Carolinas and St. Domingo, and other parts of tropical America. The fruit is green, and of the size of an apple, with eight lines running like the meridians of a globe: when it ripens it opens at these lines, disclosing its scarlet seeds lying in the midst of a pulpy mucilaginous matter, similar to the pomegranate. The whole tree is very handsome, but few fruits offer so beautiful a piece of mechanism. 'It grows on rocks, and frequently on the trunks and limbs of trees, occasioned by birds scattering or voiding the seeds, which, being glutinous, like those of the mistletoe, take root in the same manner; but the roots, not finding sufficient nutriment, spread on the surface of the tree till they find a decayed hole or other lodgment wherein is some small portion of soil: the fertility of this being exhausted, a root is discharged out of the hole till it reaches the ground, where it fixes itself, and the stem becomes a large tree.' (Loudon.) The resin collected from this plant is used as an external application in veterinary medicine, and also is employed for covering boats instead of tallow and pitch.

C. alba has hermaphrodite flowers, a many-leaved calyx; corolla with 5-8 petals; tops of nectaries retuse, or with 5-10 short stamens; stigmas 5-6; leaves like the preceding, but not emarginate. An elegant tree, native of South America, and epiphytical on larger trees. The trunk is frequently a foot in diameter. It abounds in a balsamic juice of a green colour, which becomes brown on being exposed to the air. The fruit is scarlet, and contains its seeds embedded in a scarlet pulp. Birds are very fond of the seeds, and pluck them out of the fruit while hanging on the tree. The Caribbees use the juice for painting the outside of their boats. The flowers are white, but not handsome.

C. Quapoya has stalked diœcious flowers; the calyx of 5 or 6 sepals; the corolla of 5 or 6 yellow petals; the nectary short, 4-5-lobed; stigmas 5; fruits globose; leaves obovate, acute. It is a native of the woods of Guiana, where it is called *Quapoy*. It is a climbing shrub with yellow flowers, and when cut into yields a white transparent juice. *C. panapanari* is a similar plant, yielding a yellow juice. *C. flava* is a tree closely resembling *C. alba*.

All the species grow well in a light sandy loam, and cuttings root freely in sand under a hand-glass in heat. The pots in which the plants are grown require to be well drained with potsherds.

(Don, *Gardener's Dictionary*; Loudon, *Encyclopædia of Plants*.)

CLU'SIUS, CA'ROLUS, or DE L'ECLUSE, or DE LE CLUSE, CHARLES, was born at Antwerp on the 18th of February, 1526, according to Sprengel, 1525. He commenced his education at Ghent, and from thence was removed to Louvain with the object of studying the law. He studied here for about two years, and then went to Marburg, where he became disgusted with the law, and pursued the study of philosophy. During this period he acquired a love for the study of plants, and devoted much of his leisure to this pursuit. At Marburg he formed a friendship with Hyperius, who inspired him with an admiration of Melanchthon, and in 1549 he left Marburg for the purpose of studying at Wittemberg. From Wittemberg he proceeded to Strassburg, and from thence to Montpelier. At Montpelier he became the pupil of Rondelet, and devoted himself to the study of medicine and took his degree of doctor of medicine. He resided for three years at Montpelier, and then proceeded to Paris, where he remained for two years, but was compelled to leave on account of a civil war which broke out at that period. From this time he visited most of the countries of Europe for the purpose of adding to his botanical knowledge. In 1564 he travelled through Germany, from thence he went with Fuggers to Spain, and afterwards visited Portugal. In 1751 he returned to Belgium, and again visited Paris, from whence he went to England, where he remained some time, being much interested with the results of the voyages of Sir Francis Drake and other British sailors. He returned to Antwerp in 1573. Here he occupied himself with publishing the result of his botanical labours. He was invited by the Emperor Maximilian II. to become curator of the botanical garden at Vienna. This office he accepted, and he remained there till 1587, when, through the influence of court intrigue, he was obliged to retire. He then lived at Frankfort in a state of perfect obscurity till, in 1593, in the sixty-eighth year of his age, he was called to the chair of botany at Leyden. This position he held for sixteen years, and died on the 4th of April, 1609.

Few men have suffered more in following a favourite pursuit than Clusius. He has on this account been called 'The Martyr of Botany.' As early as his twenty-fourth year, by excessive fatigue, he contracted a dropsical disease, which it is said his tutor Rondelet cured with chicory. At the age of thirty-nine he broke his right thigh during one of his botanical rambles, and a short time after his right arm. Whilst at Vienna, he dislocated his left ancle, and eight years after this accident he dislocated his right hip. For this he was treated unskilfully, and ever after was obliged to use crutches for his support. The want of exercise in one who had habituated himself to so much brought on other diseases, the most distressing of which was stone in the bladder. During his exertions in the early part of his life, he also contracted a hernia, which troubled him to the end of his days. But his bodily infirmities never diminished his mental activity, and he continued teaching and writing to the very last. His works are very numerous, for he not only published original descriptions of new plants, but he translated into Latin works from the French, Spanish, and Portuguese, and from the Latin into French, thus rendering a most important service in the diffusion of a knowledge of the plants that were known in his day.

The following are his principal works:—1, 'Histoire des Plantes, en laquelle est contenue la Description entière des Herbes, leurs espèces, formes, noms, temperamens, vertus, et operations,' Antwerp, 1557, folio. This was a translation of a work by Dodoens, to which Clusius appended a chapter of his own, on gums, liquors, woods, fruits, and aromatic roots. 2, 'Antidotarium Florentinum,' Antwerp, 1561, 8vo. This was a translation of an Italian work containing an account of the medicines used by the Greek, Arabian, and Florentine physicians. 3, 'Aromatum et Simplicium aliquot Medicamentorum apud Indos nascentium Historia,' Antwerp, 1567, 8vo. This work went through many editions, and was originally a translation of a Portuguese book by Garcias ab Horto, to which Clusius appended many notes and wood-cuts. He also translated into Latin two works of the same kind, the one from the Spanish of Nicolas Monardes, the other from the Spanish of Christopher Acosta. These were published at Antwerp in 1574. 4, 'Rariorum aliquot Stirpium per Hispaniam observaturam Historia libris duobus expressa,' Antwerp, 1576, 8vo. This work was the result of his travels in Spain. It was illustrated with 229 figures of plants, some of which were from the works of Dodoens. 5, 'Aliquot Notæ in Garciæ Aromatum Historiam,' Antwerp, 1582. This little work contained an account of many things he had observed in England, more especially an account of plants, fruits, &c. which had been brought to England by Sir Francis Drake. 6, 'Rariorum aliquot Stirpium et Plantarum per Pannoniam, Austriam, et vicinas quasdam Provincias observatarum, Historia quatuor libris expressa,' Antwerp, 1582, 8vo. This work was of a similar character to the Flora of Spain, and was illustrated with 358 plates. 7, 'Rariorum Plantarum Historia,' Antwerp, 1601, folio. This was a union of the two works on the plants of Austria and Spain, containing many additions from then living botanists, as Penney, Lobel, Plateau, Dortmann, and others. 8, 'Exoticorum Libri X., quibus Animalium, Plantarum, Aromatum aliorumque Peregrinorum Fructuum Historiæ describuntur,' Antwerp, 1601, folio. This work contained descriptions of animals as well as plants, and other objects of interest, which had been discovered by himself and other travellers.

He published many other works of less importance, chiefly translations. The industry with which he collated the labours of others and combined them with his own observations, render his works of importance for reference at the present day. He was not perhaps so philosophic a naturalist as his contemporaries Dodoens and Lobel, but he was more laborious, and exercised a not less important influence than either on the botanical knowledge of his day.

(Bischoff, *Lehrbuch der Botanik*; *Biographie Médicale*: Loudon, *Encyclopædia of Plants*; Adanson, *Famille des Plantes*.)

CLUTCH. [Coupling, P. C. S.]

CLYME'NIA, a group of fossil Cephalopoda, thus named by Count Münster, who has described a considerable number of species from some calcareous bands in the Palæozoic strata of the Fichtelgebirge. Some of these, with several others (in all seven), occur in the strata of Devon and Cornwall, and have been described by Profesor Phillips. See the article Goniatites, P. C.

CLY'PEUS, the generic name given by Klein and Leske to a group of fossil Echinida, frequent in the oolitic formations. Clyp. sinuatus of Leske is the largest British species. Clyp. clunicularis of Smith is now ranked as a Nucleolites.

CNEMI'DIUM, a genus of Spongiadæ, proposed by Goldfuss, for some fossils usually ranked as Mantellia and Siphonia.

COACH-MAKING. The mechanical details involved in the manufacture of a coach or other vehicle depend, for any peculiarity which they present, rather on the choice and combination of materials than on the actual working processes. There are however a few points which merit attention both as to materials and to processes.

The timber employed in coach-building comprises ash, beech, elm, oak, mahogany, cedar, deal, pine, fustic, larchwood, and birch. Mr. Adams ('Treatise on Pleasure Carriages') gives the reasons for the selection among these species of wood, according to the purpose to which it is to be applied. The timber most employed is English-grown *ash*. The 'hedge-row' ash, growing in open spots, is of slower growth, but is much firmer, stronger, and tougher than that of the 'coppice,' and is therefore preferred to it for making the heavy framework of a carriage. Ash is rather a tough and fibrous than an elastic wood, and is well calculated to bear the concussions to which the supporting framework of a coach is exposed; it is best fitted for use when arrived at maturity, but before it has attained its extreme size; it is sometimes white at the heart, sometimes red, and the former is best fitted for the purpose in view; it is sometimes so wrinkled in grain as scarcely to be planed smooth, and is then in its toughest state; it acquires by steaming or boiling a plastic property, which enables it to be bent to a form suited for carriage-timbers. These various qualities, together with the absence of any tendency to twist or warp, render ash better fitted than any other kind of timber for the skeleton framework of a carriage.

Beech is a timber used only in building carriages of an inferior kind, since it cannot well bear alternation of air and moisture. *Elm* is used largely for strong planking. Of the two kinds, 'hedge-row' elm is more employed than 'wych' or 'wick' elm. The grain of this wood is curly and wavy, difficult to work, brittle, and apt to split; but when once brought into workable form, elm possesses great strength, especially for the naves of wheels. *Oak* is not employed to any considerable extent in coach-building: it forms the spokes of wheels [WHEEL, P. C.], and is used in some cases as a thin planking, or 'wainscot.' *Mahogany* is chiefly in request for forming the panels or broad plain surfaces of the body of a coach. In the use of this kind of wood there is a difference between the cabinet-maker and the coach-builder: the former prefers 'Spanish' mahogany, on account of the beautiful curled grain which gives such diversity of light and shade: whereas the latter employs 'Honduras' mahogany, because the curled grain of the Spanish prevents it from being bent into the curvatures required in coach-making. Honduras wood can be procured in planks four feet in width, perfectly straight-grained, and free from knots and blemishes, and is therefore a kind of timber well fitted for bending. *Cedar*, of considerable width and having a coarse grain, is sometimes used instead of mahogany for coach-panels, when they are to be covered with leather: it is too porous to receive a painted surface. *Deal* is employed for the flooring of carriages, and also for panels which are to be covered; wide American pine, cut into very thin boards, is used for the roofing. *Fustic*, a hard yellow wood obtained from Central and South America, is sometimes employed for the naves of wheels which are intended for hot climates, as being less liable to shrink than English timber. *Lancewood*, a yellow, close, straight-grained, elastic but brittle wood, was formerly much used for the straight shafts of carriages; but when curved shafts became general, the employment of this wood for the purpose lessened. American *birch* is much used for flat boarding, on account of its great width, its homogeneous substance, its freedom from rents, the smallness of its pores, its ready yielding to the plane, and the non-appearance of the grain when painted; it is however brittle, and cannot be bent like mahogany for panels. Sycamore, chestnut, and plane-wood, are occasionally used as substitutes for some of the above-mentioned woods.

In working up these varieties of timber, tools and processes are employed similar to those witnessed in many other trades. In the first place, a 'mould' of the coach-body is prepared from the pattern, as in the earlier stage of ship-building; that is, thin pieces of wood are cut out so as to give the size, form, and curvatures of all the separate parts of the coach; and these afterwards act as guides in cutting and shaping the timber. The working-operations are of two wholly distinct kinds, carried on by different sets of workmen: one relates to the 'body,' and the other to the framework or 'carriage;' the former depending more upon delicacy, and the latter upon strength. In bending thin pieces of timber to form curved panels, the wood is wetted on the side which is to be convex, and heated on that which is to be concave: the unequal expansion of the two surfaces gives the curvature, and it is the workman's business to secure this curved form when once obtained. With a few exceptions, the processes connected with coach-body making may be regarded as very similar to those of cabinet-making.

In the making of the carriage which supports the body, the flat surfaces are so few in number that the plane is scarcely employed; after the saw, the chief cutting-instrument is a hand-tool resembling a spoke-shave. The complexity of the framework, and the number of pieces which compose it, depend a good deal on the circumstance whether the carriage has four wheels or only two, and whether drawn by one or two horses. In the Dennet and the Stanhope, two-wheeled vehicles drawn each by one horse, there is very little under-framing. In the Tilbury and the Cabriolet, pliable leathern braces are introduced between the springs and the body of the vehicle. All these four have shafts; but in the Curricle, a two-wheeled vehicle for two horses, there are no shafts: the body is suspended on a frame consisting of two side-pieces and two cross-bars at each end; a pole inserted in this frame passes between the horses, and serves to yoke them to the vehicle. Where there are four wheels, the under-framing is more complicated, since the wheels have to be connected one with another, and also with the body. In some vehicles of this kind, there are elliptical springs beneath the body and the axle; while in others, besides these springs, there are pliable leathern braces to connect the body with the under-framework; in which case the framework which supports the fore and hind springs is connected together by a long central piece of timber called the *perch*. Occasionally this perch is made of iron, and is bent into a form called the 'crane-neck,' as a means of enabling the coach to be turned more readily in a narrow street. The general class of four-wheeled carriages for two horses, such as the coach and the chariot, have double sets of springs: viz. horizontal springs immediately on the axles, to support the carriage and to intercept the concussion; and circular upright springs to sustain the body. If made close, such carriages comprise the varieties of the Coach and the Chariot; if to open occasionally, the Landau and the Landaulet; if to remain permanently open with a leathern hood or head, the Barouche and the Barouchet; and a modification of this latter kind, the Britzscha (Adams, p. 85). All these varieties of form render necessary corresponding changes in the formation of the framework beneath. The form and nature of the springs above alluded to are described in SPRINGS, P. C.

The arrangements of the under parts of the mechanism depend a good deal on the facilities afforded for turning the coach. In a four-wheeled carriage there is an axle connecting the two fore-wheels, and another connecting the two hind-wheels; and if these two axles were so fixed as to remain constantly parallel, the carriage could not turn. In practice, the front axle is made to turn upon a pivot, and the wheels connected with it are made small enough to go under the framework of the carriage during the act of turning. It is for this reason, and this alone, that the front wheels are made smaller than the hinder ones; and as a great disadvantage in draught is thereby occasioned, various contrivances have been adopted for rendering the use of somewhat larger wheels practicable. Sometimes the body of the carriage is raised to a greater height; sometimes a portion of the under part of the body is cut away, to leave room for the turning of the wheel. It was as a means of remedying these inconveniences that Mr. Adams proposed a few years ago the 'aequirotal' construction of carriages. As the inequality in the sizes of the fore and hind wheels is adopted solely as a means of enabling the vehicle to be turned round, Mr. Adams sought for some mode of enabling this turning to be effected even when all the four wheels are of equal size. This he does by having the carriage so divided in the middle as to turn upon a pivot; or rather, the pivot, or perch-bolt, which in a common carriage is placed immediately between the two front wheels, is on the aequirotal principle placed much farther back; by which the fore-wheels have so large a radius in turning that they do not touch the body, and may therefore be made of equal size with the hinder wheels. The mode of adjusting this pivot depends upon the kind of carriage. In a phaeton, which is an open four-wheeled carriage with two seats, the front one higher than the lower, the hinder half of the body is hinged to the front half. In a chariot or a coach, the coach-box is connected with the framework of the front-wheels, and the body with that of the hind-wheels, and there is a pivot which connects the two halves together.

The axles of a carriage form an important part of the manufacture, since they are the medium of communication from the wheels to the body. When this part of the mechanism was made wholly of wood, its general designation was 'axle-tree;' but iron is now more extensively used, and the name 'axle' is given to it. Formerly the axle was made to evolve with the wheels, but now the wheels are generally made to revolve on and not with the axle. There are three parts in the axle; the 'arms,' which pass into the naves of the two wheels, and the 'bed' or central part, which connects the two arms. The adjustment at the nave or centre of the wheel requires very careful management; and it is to this point that Collinge's 'patent axle' chiefly relates. In earlier modes of construction a ring was put within the hollow of the nave, and the end of the arm of the axle worked within this ring; an arrangement which was intended to prevent the too rapid wear of the wood by the friction of the axle. In the present practice however the axles are fitted with iron boxes adjusted to the arms. To lessen the friction arising from the two surfaces working together, black-lead, soap, grease, or oil, are used; and it is partly on account of the ingenious way in which this lubrication with oil is effected that Collinge's 'patent axle' is so much employed. Besides the mechanism for connecting the axle with the wheel, there is contained a little cup for holding oil; and as the wheel rolls along, this oil is pumped or drawn out of its receptacle, and made to lubricate the adjacent surface.

In a well-finished coach, the *leathering* and the *painting* are among the more important processes after the wood and iron work are completed. The former of these is somewhat remarkable. In the common kinds of vehicles the wood and iron are coated with paint laid on to a considerable thickness; but for the better kinds, leather is applied to the roof, and the upper part of the back, front, and sides, previous to the process of painting. A singular example is here shown of the pliability of leather; for one hide, without seam, knot, or joining, is made to cover the whole. 'The hide, which is of a large size and sound quality, is first thoroughly moistened throughout and thrown over the top of the coach, the edges hanging down on all sides. The currier then rubs or presses it down all over the roof, until it lies close and even in every part. He next proceeds to one of the sides, and in like manner rubs and scrapes the leather till all irregularities disappear. The leather is in that soft and pliable state that it will yield to the movement of the tools, and enable the workman to fit it to every part of the coach with perfect closeness. A little consideration must show that a superfluous fold of leather will occur at each corner; yet by working it towards a central point at the back or front, the currier succeeds in erasing or pressing out all irregularities, and in producing a surface sufficiently flat and smooth for the subsequent operations of the painter. The division between the upper and lower portions of a coach is usually covered by beading of some kind or other, and the leather is trimmed or cut to this line of division.' Penny Magazine, No. 625.

A coach receives a far thicker coating of paint than the wood-work of a house, since it could not else admit of the very high polish to which it owes so much of its beauty. The principal plain surfaces, such as the doors and panels, receive ten, twelve, or even fifteen distinct coatings, each one thoroughly dried before the next is applied; and at intermediate times all the roughnesses derived from the paint are smoothed down by pumice-stone, rotten-stone, and other like substances. The paint, which is formed from nearly the same materials as that used for house-painting, viz., mineral colours, linseed oil, and turpentine, is of a white colour for the earlier coats, a yellowish tint for those next applied, and depends for its tint in the later coatings on the taste of the maker. All these several coatings being dried and smoothed, the surfaces receive six or eight applications of copal varnish; and it is the subsequent polishing of this varnish which imparts the smooth, lustrous, and beautiful appearance to the panels and plain surfaces.

The number of coach-makers (in all branches) in Great Britain in 1841 was 12,603, of whom 11,668 were in England, 93 in Wales, 801 in Scotland, and 41 in the islands of the British seas.

COAL-MINING AND COAL-TRADE. Since the publication of Coal and Mining, P. C., several Reports made by Government Commissioners have afforded valuable information concerning coal-mining, in reference both to the amount and distribution of the coal raised, and to the relation between the miners and their employers.

From one of these reports (*Parliamentary Papers*, 1843, vol. xiii. p. [illegible]) the following is stated to be the condition of the collieries on the Tyne, Wear, and Tees, as ascertained on the 5th of March, 1843. The colliery proprietorships are ranged under four classes, according to the scale of the operations. The 1st class comprises four great concerns, headed respectively by the Marquis of Londonderry, the Earl of Durham, Lord Ravensworth, and the Hetton Coal Company. The capital sunk in each of these concerns is supposed to be not less than half a million sterling; they each comprise from six to twelve separate mines, and all the necessary engines, waggons, horses, &c.; and they are believed to realize a profit on an average from 35,000*l.* to 45,000*l.* per year each. The 2nd class comprises companies or partnerships whose sunk capital ranges from one to two hundred thousand pounds. The 3rd class includes those concerns which have only a single pit each, and whose capitals are from forty to sixty thousand pounds. The 4th class, humbler but more numerous than any of the others, comprise those which have a capital ranging from eight to thirty thousand pounds. The first three of these classes agree to that uniformity of price which constitutes the 'Limitation of the Vends,' before explained in Coal, P. C., p. 297. The 4th class are generally engaged in the coasting-trade, and for the supply of steam-coal to London and the local manufactories. Smaller than, and distinct from all these, are several concerns which chiefly engage in land sale, and do not enter the general markets.

In Durham there are more persons employed under ground in coal-mines than in cultivating the surface.

Statistical tables are given, in the report above alluded to, concerning the force and amount of operations at the collieries. Omitting the items, the sum totals may be here given:—

Collieries on the Tyne, Wear, and Tees, March 5, 1843.

	On the Tyne.	On the Wear and Tees.
No. of collieries . . .	41	29
No. of pits	92	100
Average depth, in fathoms .	85	75
No. of men and boys employed	12,833	12,937 (in 27 collieries)
Engine-power in pumping water	4,838 horses	9,707 (in 23 collieries)
Engine-power in raising coals .	4,782	
Coal raised per annum . .	2,468,481 tons	2,335 486 (from 22 collieries)
Highest price at that date .	10*s.* 1½*d.* per ton	11*s.* 6*d.* per ton.
Lowest price at that date .	7*s.* 1*d.* „	8*s.* 6*d.* „

The same report gives an explanation of the difference of system observable in the collieries of the northern counties and those of the Midland districts. In these latter, especially in South Staffordshire, the 'Butty' system is extensively acted on. This consists in the miners being the servants, not of the proprietor or lessee of a colliery, but of a contractor called a 'butty,' who engages with the proprietor of the mine to deliver the coal at so much the ton; hiring the labourers himself, using his own horses, and supplying all the tools necessary for working the mines. These butties have in general been working miners, who, by the accumulation of some little capital, or by the assistance of relations, are enabled to engage a pit, with or without partnership with other persons, and to enter into a bond to raise the coal at a given price per ton. 'The butty,' says Mr. Tancred, the commissioner who prepared the report, 'has become the middleman or task-master, and the pit's company his hired labourers, from whom it is his interest to squeeze out as much profit by any and all means as circumstances will allow. The man of property, who possesses the royalty, sinks the pits, and erects the machinery, and whose position therefore in society would ensure in general humane and liberal treatment of his labourers, is by the intervention of a butty entirely disconnected with them; he neither hires nor dismisses them from his mine, but hands the whole concern over, as far as the employment of the labouring classes is concerned, or any interest in their welfare as his servants, to an inferior.' The miners entertain a bitter dislike to the 'butty' system, and many of the proprietors are endeavouring to abolish it.

In the Northumberland and Durham district, the relation between the proprietors and the miners is more direct and intimate. No middlemen or contractors are employed; the overseers, viewers, and other intermediate officers are paid by regular salaries; and the working colliers receive in cash from the proprietors, once a fortnight, the amount of their earnings. There is a bond or agreement between the parties, differing from the 'butty' system of Staffordshire, and also from the 'tutwork and tribute' system of the Cornish mines. [Mining, P. C., p. 246.] This bond is annual, and by its terms the miner is ensured a minimum amount of wages, generally to the extent of seven or eight days per fortnight, which the owners are bound to pay the men whether the mine be working or not; beyond this minimum, whatever work the miners may do is paid for at a stipulated price. The wages are paid for the quantity of coals raised—so much per score of 20 pecks. If the coal-owners wish to force up the London prices by sending a deficient supply, they limit the working to the minimum quantity, which they are empowered to do by the terms of their agreement with the pitmen; and it is as a means of preventing this system of monopoly from throwing the miners entirely out of work, (which it might occasionally do if unchecked) that the minimum has been established.

In the reports issued by the Commission for inquiring into 'Children's Employments,' published among the parliamentary papers in 1842, are many details as to the sex and ages of the persons employed in coal-mines. From these it appears that females as well as males, and children as well as adults, are (or rather then were) so employed. The actual numbers could not in every case be ascertained; but the relative proportions of young persons to adults, employed under-ground in coal-mines, were, in 1841, nearly as follow (*Parl. Pap.*, 1842, vol. xv. p. 38)—one thousand adult males being taken as the standard of comparison.

England.

	Adults.		13 to 18.		Under 13.		Proportion of young persons to 1000 adult males.	Proportion of young persons to the whole number.
	Males.	Females.	Males.	Females.	Males.	Females.		
Leicestershire . .	1000	..	227	..	180	..	407	two-sevenths
Derbyshire . . .	1000	..	240	..	167	..	407	two-sevenths
Yorkshire	1000	22	352	36	246	41	675	upwards of one-third
Lancashire . . .	1000	86	352	79	195	27	653	upwards of one-third
South Durham. .	1000	..	226	..	184	..	410	two-sevenths
Northumberland and N. Durham	1000	..	266	..	186	..	452	nearly one-third

In the west of Scotland the proportion of children and young persons to adults was smaller than in England; in the east of Scotland it was larger; and in Wales it was about the same. From the following table it appears that the employment of females in coal-mines had extended much more largely in Scotland than in England:—

Proportion of Females to Males working in Coal-mines.

	Adults.	From 13 to 18.	Under 13.
Yorkshire . .	1 to 45	1 to 28	1 to 25
Lancashire . .	1 to 12	1 to 13	1 to 37
Mid Lothian . .	1 to 3	1 to 5½	1 to 20
East Lothian . .	1 to 3	1 to 3½	1 to 10
West Lothian .	1 to 5	1 to 7	1 to 10
Stirlingshire . .	1 to 4½	1 to 8	1 to 10
Clackmannanshire .	1 to 5	1 to 5	1 to 11½
Fifeshire . .	1 to 5½	1 to 10	1 to 30
Glamorganshire .	1 to 53	1 to 53	1 to 83
Pembrokeshire .	1 to 2½	1 to 8½	1 to 53

The statements made in the reports above referred to, respecting the sex, age, and usual condition of the persons employed in coal-mines excited (as is well known) great attention about three years ago, and led to the introduction of a bill which received the royal assent on August 10, 1842. By the provision of this Act (5 & 6 Vict. c. 99) the following changes were made:—

From the time of passing the act, no female, other than such as were so employed previously, was to work in any mine or colliery; and that after three months from that date, no female under eighteen years old should be so employed; nor any female whatever after March 1, 1843. After this latter date, no males were to be employed under ten years of age. No person to be apprenticed under ten years of age, nor for longer than eight years (except in the case of engine-wrights and others who are only occasionally at work under ground). Where there are vertical or other shafts, no steam or other engine to be intrusted to the care of a person under the age of fifteen; in the case of a windlass or gin worked by a horse or other animal, the driver to be considered the person in charge. After three months from the passing of the act, proprietors of mines or collieries not to pay workmen their wages at any tavern or public-house. To enforce the observance of these regulations, the following arrangements were made:—Inspectors of mines and collieries, appointed by the Secretary of State for the Home Department, are empowered to enter and examine any such works, and to report concerning them to the government; any proprietor violating the law as to the age and duration of apprenticeship, is subjected to a fine varying from 5*l.* to 10*l.*; parents or guardians misrepresenting the age of children so employed are fined 40*s.*; a neglect of the clause as to the care of the shafts, and also of that relating to the payment of wages, subjects the offender to fines varying from 5*l.* to 50*l.*

It was found, as might have been expected, that many young persons were for a time thrown out of employment when this act came into operation; but the evils resulting from the former system were too great to be overlooked.

The traffic in coals, as regards the London trade, the coasting-trade, and the exports, was illustrated by a few tables in Coal-Trade, P. C., bringing down the details to 1835. A few additional details reaching down to a date seven years later, are here given.

Coals, Culm, and Cinders exported from the United Kingdom.

Years.	Tons.	Declared Value.
1835 . . .	736,060	£244,898
1836 . . .	916,868	332,861
1837 . . .	1,113,610	431,545
1838 . . .	1,313,709	485,950
1839 . . .	1,449,417	542,609
1840 . . .	1,606,313	576,519
1841 . . .	1,848,294	675,287
1842 . . .	1,999,504	734,000

Of the quantities exported in 1841 *and* 1842 *there were shipped from*

	1841.	1842.
Newcastle . .	750,585 tons	866,281 tons
Sunderland . .	408,515	364,886
Stockton . .	169,345	180,808
	1,328,445	1,411,975

being more than three-fourths of the entire quantity exported. Of this quantity there were exported to

	1841.	1842.
France . .	451,003 tons	515,975 tons
Germany . .	173,437	170,038
Holland . .	173,378	180,434
Denmark . .	151,146	145,286

being rather more than half the entire quantity exported.

Coals brought into the Port of London.

	Coastwise.	By Inland Navigation.	Total.
1840 .	2,566,899 tons	22,188 tons	2,589,087 tons
1841 .	2,909,144	33,594	2,942,738
1842 .	2,723,200	31,519	2,754,719

Coals shipped Coastwise from one port of the United Kingdom to another.

	1841.	1842.
From Newcastle . .	2,397,977 tons	2,350,480 tons
Stockton . .	1,483,618	1,501,596
Sunderland .	937,995	859,231
Newport . .	506,078	503,308
Swansea . .	450,119	471,241
Whitehaven & Maryport	451,370	442,638
38 others ports .	1,422,742	1,720,975
	7,649,899	7,649,469

In 1835 the coal duties were repealed. Mr. M'Culloch, in the supplement to his 'Dictionary of Commerce,' published next after this change, says, 'We are glad to have to state that the duty on coal exported in English ships is repealed; and that the duty on all descriptions of coal exported in foreign ships is reduced to 4*s.* a ton. The increased exportation of coal this measure has occasioned cannot fail of being highly advantageous. Ships that might otherwise have had to go out in ballast, have now an opportunity of taking with them what may prove a profitable cargo, at the same time that the cost of conveying the mineral abroad operates as a premium in favour of our own manufacturers. The fact, too, that there is in South Wales alone a supply of coal sufficient to meet the present demand of the empire for more than 2000 years, shows the futility of imagining that the measure can be injurious by its hastening the exhaustion of the mines.' In 1842 however coal was again subjected to a duty, which on large coal exported in British ships amounted to 2*s.* per ton, and on coal and cinders exported in foreign ships not entitled to the privileges conferred by treaties of reciprocity, the duty was 4*s.* per ton. This duty gave a check to the rapidly increasing foreign trade in coal, which had trebled since 1835, encouraged the opening of foreign coal-mines, and produced only a comparatively trifling addition to the revenue. In 1845 the duty was repealed. This change took place in March. Two months afterwards another alteration was made of great importance: the regulations which the coal-owners of the north of England had acted upon since about 1771, and by which they regulated the supply of the London market, were abolished. The opening of this market to the coal-fields of the midland counties, by the extension of railways, probably led to this change.

The question respecting the available store of coal in this island has been lately much canvassed. Mr. T. Sopwith, in an Essay recently published (*The National Importance of Preserving Mining Records*, 1844), remarks, 'The opinion that our stores of coal are all but inexhaustible rests wholly on assumed data, and not upon an accurate and detailed statistical accounts, such as alone could warrant a confident opinion. This question will ere long become a subject of serious concern, unless some measures are taken to found our calculations on a solid basis. It an easy matter to assume that a considerable thickness of available coal extends over hundreds of square miles; but the different opinions formed by men of the highest respectability and talent, strongly prove how meagre and unsatisfactory are the only data on which their estimates are founded. It is not however the mere quantity of coal that is to be considered. Especial regard must be had to its quality, depth, thickness, extent, and position. Many of the inferior seams can only be worked in conjunction with those which, by their superior quality, repay the expense of working them at depths varying from three hundred to six hundred yards; and it may readily be conceived that inferior coal only could not be profitably raised from pits equal in depth to three or four times the height of St. Paul's Cathedral, unless the price of such inferior coal was raised to more than the present price of the best coal. . . . . It is not the exhaustion of mines, but the period at which they can be profitably worked, that merits earnest and immediate attention.' These remarks from a man who is well acquainted with the subject are worth more than the vague assertions made by some geologists and writers on statistics. In this as in other branches of industry we must not only consider the possible amount of supply, but also the price at which the thing can be brought to market.

Coal is one of the items included in the new Customs Tariff of the present session (1845).

COBÆA'CEÆ, a small natural order of plants, separated by D. Don from Polemoniaceæ. It has a leafy 5-cleft equal calyx; an inferior campanulate regular 5-lobed corolla, imbricate in æstivation; five unequal stamens rising from the base of the corolla, with 2-celled compressed anthers; superior 3-celled ovary, surrounded by a fleshy annular hypogynous disk; the ovules several, ascending; simple style; trifid stigma; the fruit capsular, 3-celled, 3-valved, with a septicidal dehiscence; the placenta very large, 3-cornered in the axis, its angles touching the line of dehiscence of the pericarpium; the seeds flat, winged, imbricated in a double row, their integument mucilaginous, fleshy albumen, and a straight embryo; the cotyledons foliaceous; the radicle inferior. The species are climbing shrubs, with alternate pinnated leaves, the common petiole being converted into a tendril. G. Don observes that this order is readily distinguished from Bignoniaceæ and Pedalineæ by the flowers being regular and pentandrous, and in the presence of albumen in the seeds; and from Polemoniaceæ by habit and its winged seeds. Lindley places the genus Cobæa, which is the only one of the order, in Polemoniaceæ, and says 'the differences of importance between the one and the other appear to consist in the former having an unusually large lobed disk, a septicidal dehiscence, and climbing habit. Distinctions, I fear, of too little moment to be admitted as of ordinal value.'

There are two species of Cobæa, *C. scandens* and *C. lutea:* the former has large campanulate flowers, with a short tube of a dark dirty purple colour; the latter has yellowish flowers, about half the size of those of *C. scandens*. The *C. scandens* is a great favourite in our gardens, and is a rapid-growing and abundant-flowering climber. It will grow in the open air, in summer, and should be trained against a south wall, or against a house, when it flowers profusely. It is adapted for conservatories and greenhouses. It may be propagated by seeds or cuttings.

(Don, *Gardener's Dictionary*; Lindley, *Natural System*.)

COBALT PYRITES. [COBALT.—*Arseniate of Cobalt*, P. C.]

COCCO'LOBA, a genus of plants belonging to the natural order Polygonaceæ. It has a 5-parted calyx, eventually becoming succulent; the filaments 5, inserted into the base of the calyx, and forming a short ring by their union; the styles 3; stigmas simple; the nut 1-seeded, bony, covered with the succulent enlarged calyx; the embryo in the middle of the albumen.

C. uvifera, Sea-side Grape, has cordate, roundish, shining leaves. It is a tree twenty feet in height, with flexuose branches. The leaves are very beautiful, being of a full bright glossy green colour, with the principal nerves of a deep red. As the fruit advances to maturity it becomes surrounded by the succulent perianth, which forms an obovate reddish purple berry, not unlike a small pear. The nut in the inside is roundish, very acute, 3-lobed at the base, and attached by the centre. The embryo has foliaceous cotyledons. The leaves, wood, and bark of this plant are powerfully astringent, and a decoction of them is evaporated to form the substance called Jamaica kino. The astringency depends on the presence of tannin, but there is in addition present in the wood a red colouring-matter which is used as a dye. The wood is also valued for cabinet-work. The fruit is eatable, and is exposed for sale in the West Indian markets, but is not valued much. It is a native of the sea-coasts of most of the West Indian Islands and the adjoining shores of America. There are several other species of Coccoloba natives of the West Indies. They are all of them evergreen trees. They grow freely in a light loamy soil, and ripened cuttings taken off at the joint and placed under a hand-glass in a pot of sand will root freely. They require a stove.

(Loudon, *Encyclopædia of Plants*; Lindley, *Flora Medica*.)

COCCONEIS. [INFUSORIA, FOSSIL, P. C. S.]

COCCO'STEUS, a genus of fossil fishes, with a tuberculated scaly covering, from the old red-sandstone of Gamrie, Cromarty, Caithness, and the Orkney Islands. (Agassiz.)

COCHIN, a town in Hindustan, on the western coast of the peninsula, in 9° 51′ N. lat. and 76° 18′ E. long., is the place where the first European settlement was formed in the East Indies. In 1503 the Portuguese fleet, under the conduct of Alfonso and Francisco Albuquerque, obtained from the sovereign of Cochin permission to erect a fortress there in recompense for the assistance they had given him in his wars with the Zamorin of Calicut. The country in the neighbourhood being very fertile, the Portuguese carried on an advantageous trade until the town was taken from them by the Dutch in 1663. The trade continued to flourish under the Dutch government, so that in the time of Stavorinus, more than seventy years ago, it was for them what Bombay is for the English, the emporium of the western coast. In the beginning of the war between Holland and England, in 1795, it was taken possession of by the British, to whom it was finally ceded in 1814. Since this place has been in the hands of the English its trade has considerably diminished, in spite of the many great advantages which the place possesses.

There is hardly any place in Hindustan except Calcutta better situated for trade than Cochin. It is the best port in the presidency of Madras, and the only port for ship-building, and there are no places throughout the whole extent of the western coast which afford shelter to large vessels except Bombay and Cochin. But its chief advantages as a place of trade are derived from the fertile country in its vicinity, and its extensive means of communication by water. In this part of Hindustan is found a very remarkable system of inland navigation, called the Backwater. This is a lagoon of a peculiar description. It extends from Chowgaut (10° 40′) on the north to Trivanderan, the capital of Tranvancore (8° 30′) on the south, a distance of one hundred and seventy or eighty miles, and terminates within fifty miles of Cape Comorin. A continuation of it is in progress of formation, and is in fact navigable for boats during the rains, from Chowgaut to Cotah, sixteen miles south of Tellicherry, a farther distance of about ninety miles. The Backwater runs nearly parallel to the sea, sometimes at the distance of a few hundred yards, at others of four or five miles. Its breadth varies from twelve and fourteen miles to two hundred yards; its depth from many fathoms to a few feet. Into this Backwater, as into a grand trunk, all the rivers discharge their water, which descend from the mountains that lie farther east, and during the force of the monsoons this volume of water is very great. There are six channels of communication between the Backwater and the sea, but only one is navigable for ships, and this is that on the southern bank of which the town of Cochin is built. There is a bar at its mouth, but the depth of water on it is seventeen or eighteen feet at high-water of spring-tides. Without the bar there are no dangers. Though the coast of Malabar in general cannot be approached by vessels during the south-west monsoon, the only month in the year in which the harbour of Cochin cannot be entered is perhaps July. The anchorage without is good, and the gales during the south-west monsoon rarely blow with such violence as is experienced in this season in the harbour of Bombay. Within the bar, the Backwater expands into a fine æstuary, three, four, and six miles wide, at least twelve miles long, and deep enough for the largest vessels. Country vessels of sixty or seventy tons' burden can load and discharge at the water's edge, and ships at a cable's length.

The country through which this water-communication extends is not inferior in fertility and productions to any part of Hindustan of equal extent. The narrow strip of land between the Backwater and the sea is indeed sandy, but its lower tracts are thickly overgrown with coco-nut palms, which yield a great quantity of fruit. The country east of the Backwater is low and level along its banks, and produces rich crops of rice. Farther inland it rises into low hills, partly covered with high forest-trees and partly with grass; but the valleys between them are exceedingly fruitful, and produce in abundance, and of the best quality, all the numerous productions for which the coast of Malabar is famous. This is evident from the great number of valuable staples, such as cotton, hemp, oils, pepper, ginger, turmeric, cardamoms, betel-nut, copra (coco-nut kernels cut into slices and dried for exportation), ivory, gold-dust, iron, and drugs. Indigo grows spontaneously, and the cane, coffee, clove, nutmegs, pimento, and raw silk succeed very well. The hills are covered with forests. Timber of all kinds, some more valued by the natives for maritime purposes even than teak, and considered hardly inferior by Europeans, is to be had in unlimited abundance and at the lowest price. Much timber is sent to Bombay, but hardly any vessels are built at Cochin for European merchants. The Imaum of Muskat however has perceived the value of this harbour for ship-building, and most of his vessels have been built there. There are also a few country vessels annually built. The trade of this place, though it has much declined, is still considerable. Europeans rarely visit this port; but an active commerce is carried on between it and Bombay in country vessels, especially in timber. The trade with Arabia and the countries surrounding the Persian Gulf is more important. As these countries have no forests, they receive from Cochin all the timber required for repairing their different craft. Rice, coco-nuts, copra, and spices are exported to them to a great extent. There is also some commerce carried on with Singapore, to which place pepper and other spices, with fish-maws, are exported for the Chinese market. In the vicinity of Cochin a number of Catholic and Indian Christians are found, and also many Jews.

(Stavorinus, *Voyages to the East Indies*; Buchanan, *Journey through Mysore, Canara, and Malabar*; and Brown, *On the Natural Advantages of Cochin as a place of Trade*, in London Geog. Journal, vol. iii.)

COCHIN, CHARLES NICOLAS, called Cochin fils, a celebrated French designer and etcher, was the son of C. N. Cochin the elder, and was born at Paris in 1716, and died there in 1788. His father, likewise an able engraver, was his instructor, and Cochin early displayed a peculiar aptness for art, and general quickness of ability. In 1749 he made a tour through Italy with the Marquis de Marigny, and in 1756 published a critical account of the various works of Italian art, as a species of amateur's companion in a journey through Italy —'Voyage Pittoresque d' Italie,' in 3 vols. 8vo. The work became popular among his own countrymen: Cochin published a third edition of it in 1773. Some years before the appearance of his 'Voyage Pittoresque' Cochin published an account of the antiquities of Herculaneum, 'Observations sur les Antiquités d' Herculaneum, &c., par MM. Cochin et Bellicard,' which went through two editions: the second contains many etchings of antient works of art and other objects of antiquity.

Cochin was knight of the order of St. Michel; keeper of the Royal Collection of Drawings; and secretary to the Royal Academy of Painting and Sculpture.

He was one of the best and most productive of the French engravers; his prints amount to upwards of fifteen hundred, comprising almost every variety of subject, from original designs, and from the works of other masters, chiefly French: among the best are the fourteen large etchings of the sea-ports of Vernet. A 'Catalogue Détaillé' of his works was published by Jombert in 1770, and copied by Heineken into his Dictionary, with the addition of some works executed after 1770. The sixteen large prints made from the drawings of Attiret and others, sent from China, though not engraved by Cochin, were executed under his direction. [Attiret, P. C. S.]

Cochin was the author of some other literary works besides those already mentioned. He published in 1757, 'Reflexions sur la Critique des Ouvrages Exposés au Louvre;' and 'Recueil de quelques pièces concernant les Arts, avec une Dissertation sur l'effet de la Lumière et des Ombres relativement à la Peinture;' in 1763, 'Les Misotechnites aux Enfers;' and in 1765, 'Lettres sur les Vies de Slodtz et de Deshayes,' and 'Projet d'une Salle de Spectacle.'

(Heineken, *Dictionnaire des Artistes*, &c.; Huber, *Manuel des Amateurs*, &c.; *Biographie Universelle.*)

COCHLEA'RIA (from *cochleare*, a spoon, the leaves of the species being hollowed out like the bowl of a spoon), a genus of plants belonging to the natural order Cruciferæ, the suborder Pleurorhizeæ, the tribe Alyssineæ. It has sessile ovate-globose or oblong silicles, with ventricose very convex valves, with a prominent dorsal nerve; many seeds not margined; the calyx equal at the base, spreading; the petals entire; the stamens toothless. The species are annual or perennial herbs, usually smooth and fleshy, but sometimes pubescent. The flowers are mostly white.

One of the most common species of this genus, as formerly defined, is the common Horse-radish (*Cochlearia Armoracia*). This species however is now referred by some botanists to a new genus, *Armoracia*, and is described by Babington, in his 'Manual of British Botany,' as *A. rusticana*. The genus Armoracia differs from Cochlearia in its globose pouches or silicles being destitute of a prominent dorsal nerve. The Horse-radish, though described in books on British Botany, can scarcely be considered a native of Great Britain, as the wild specimens are evidently escapes from gardens. For the medical properties of Horse-radish see Cochlearia Armoracia, P. C. S.

C. officinalis, common Scurvy-Grass, has the radical leaves cordate, reniform, stalked; the stem leaves sessile, oblong-sinuate, half-embracing the stem; the pouch globose or ovate. It is a native of Great Britain, in muddy places near the sea-coast. This plant varies much in size, and two or three varieties have been described. The *C. grœnlandica* of Smith and Withering appears to be nothing more than a diminutive variety of this species. In France the Scurvy-grass is called *Cranson officinal*; in Germany *Löffelkraut*. When fresh it has a peculiar smell and a bitter acrid taste, which are quite lost by drying. The fresh plant is a stimulant, and possesses the antiscorbutic virtues of the whole order. It has however a peculiar reputation in the disease called scurvy; hence its common name. It is sometimes used as a salad. When cultivated, the seeds should be sown in July, in drills eight inches apart, and when the plants are up they should be thinned to about six inches apart. Those plants which are taken out may be placed in new beds. They will all be fit for use in the following spring.

C. danica has the leaves all stalked, the radical ones cordate, somewhat lobed; the stem-leaves 3-5-lobed, subdeltoid uppermost, mostly shortly stalked; the pouch roundish, elliptical. It is found in Great Britain, in a few places on the sea-coast. It is a more abundant native of the sea coasts of the north of Europe, and is a native of Kamtchatka.

C. anglica, English Scurvy-Grass, has the radical leaves stalked, ovate-oblong, entire; the stem-leaves oblong, entire or toothed, mostly sessile, the upper ones embracing the stem; the pouch oval, oblong veined. It is a native of muddy sea-shores about the mouths of rivers, especially in Great Britain; but is found in Norway and Lapland, and other parts of Europe.

There are several other species of Cochlearia described; they are however most of them insignificant plants, inhabitants of northern climates. In their cultivation, the smaller perennial sorts do best in pots, but the larger ones may be grown in an open border in a moist situation. The annuals and the biennials are best propagated from seeds. The following directions for the cultivation of horse-radish, by Mr. J. Knight, are extracted from a paper in the first volume of the 'Horticultural Society's Transactions.' 'Horse-radish thrives best in deep, soft, sandy loam, that is not very dry in summer nor inundated in winter; the situation must be open. During winter trench the ground three feet deep, and in the following February procure the sets, in the choice of which take the strongest crowns or leading buds, cutting them about two inches long. Mark out the ground, four feet beds, and one foot alleys, then take from the first bed nine inches of the top soil, laying it upon the adjoining bed, after which take out an opening at one end of the bed, in the common way of trenching, 15 inches deep from the present surface, then level the bottom, upon which plant a row of sets across the bed at nine inches apart each way, with their crowns upright; afterwards dig the next trench the same width and depth, turning the earth into the first trench over the row of sets, thus proceeding trench after trench to the end for as many beds as are wanted. The plant must be kept clear of weeds during summer, and as soon as the leaves decay in autumn, let them be carefully raked off with a wooden toothed rake; in the following February, eighteen inches of the earth of the unplanted bed must be laid as light as possible and equally over the beds that are planted, then trench and plant the vacant beds as before directed. The following autumn the first planted horse-radish may be then taken up by opening a trench at one end of the bed to the bottom of the roots, so that the sticks or roots of horse-radish may be taken up entire and sound, which for size and quality will be such as have not been seen. The following February, the one-year-old crop will require additional earth as before directed, which must of course be taken from those beds which are now vacant, which, when done, if the ground appears poor or unlikely to produce another vigorous crop, they must have a coat of manure. Upon every alternate bed, which is not planted, a dwarf annual crop may be grown, such as spinnach or radishes.'

(Don, *Gardener's Dictionary;* Babington, *Manual of British Botany;* Loudon, *Encyclopædia of Plants.*)

COCHLE'ARIA ARMORA'CIA, *Medical Properties of.*—Horse-radish is a cruciferous perennial herbaceous plant, growing in Alpine meadows, and along the banks of rivers, as well as on the sea-coast in the south and south-eastern parts of Europe. The root is the officinal part, and is always obtained from cultivated plants, as it is enjoined to be used in a fresh state. The root is solid, fleshy, tapering, from one to two feet long, and when bruised or scraped into shreds, emits a highly acrid penetrating odour, which causes a secretion of tears when received by the eyes: put in contact with the skin, it speedily causes rubefaction. The taste is more or less acrid, according to the season of the year or the age of the plant; young plants possess much mucilaginous starchy and saccharine matter, by which the pungency is lessened.

The analysis by Gutzet shows its composition to be acrid and very volatile oil, bitter resin, extractine, sugar, gum, starch, woody fibre, vegetable albumen, acetic acid, with acetate and sulphate of lime. A little sulphur is stated to exist in it. The volatile oil is the active principle. This is of a pale yellow colour, heavier than water, and so volatile that a single drop of it can fill a large room with a penetrating odour of horse-radish. In this respect it resembles the volatile oil of mustard. The taste is at first sweetish, afterwards burning and acrid. It has a sensible effect on the brain. When applied to the skin, it causes violent inflammation and rubefaction. [SINAPI, P. C.] It is sparingly soluble in water; freely in alcohol. The outward application of horse-radish causes vesication; the internal application causes sensible warmth of the stomach, with augmented power of digestion. A warm infusion excites vomiting, in the same way as mustard does. This kind of emetic is useful to rouse the stomach from the insensibility consequent on narcotic poisons being taken, but it must not be forgotten that violent or even fatal inflammation of the stomach may ensue if vomiting do not occur, and the stomach-pump is a more certain means of emptying that viscus.

Horse-radish is well known as a condiment taken with beef, fish, and other kinds of food difficult of digestion. Its powers are heightened by associating it with vinegar, as in the horse-radish sauce.

The officinal preparations are the Infusum Armoraciæ Comp. This, when made with boiling water as ordered in the Pharmacopœia, soon spoils, notwithstanding that some compound spirit of horse-radish is added to it. It would be much more advantageous to make it with cold water, especially as its power depends upon a principle of such remarkable volatility. The compound spirit is employed as an adjunct to diuretic and other medicines. Horse-radish scraped down into shreds and digested in red wine forms a vinum armoraciæ, which is eminently useful in warding off a relapse of intermittent fever, when the employment of it is persevered in for some time.

(Dierbach, *Die Neuesten Entdeckungen in der Materia Medica*, i. p. 81.)

COCHLIODUS, a genus of Placoid fishes, from the carboniferous limestone of Armagh and Bristol. (Agassiz.)

COCHLOSPERMUM.' [WITTELSBACHIA, P. C.]

COCK, or STOP-COCK, a kind of valve contrived for the purpose of permitting or arresting at pleasure the flow of a liquid through a pipe. The contrivances adopted for this purpose are very various, but those in most common use consist of a short tube of brass, intersected by a nearly cylindrical plug, capable of being turned on its axis at pleasure, and so perforated or cut that, while in one position it completely prevents the passage of fluid through the pipe, it may be so turned as to permit the fluid to pass through it, and consequently to flow through the pipe as though there was no plug to intercept its progress. In addition to the differences in the construction of the plug or valve itself, many varieties are required in the form and arrangement of cocks, to meet the various circumstances under which they are applied. Those which, under the name of *taps*, are employed for drawing off the contents of barrels, simply need to be driven into the holes provided for them, which, before the barrels are broached, are filled with corks to prevent the escape of their contents. This kind of cock, which has been selected for illustration in the following figures, usually terminates in a curved *nose*, or spout, from which the liquor may be conveniently received in a jug or other open vessel; but where it is desired to transfer the liquor from the cask immediately to bottles, the nose is prolonged into a long slender tube, which will enter the neck of a bottle, and obviate the necessity for a funnel. Longitudinal furrows should be cut on the outside of the tubular nose, to allow the escape of air from the bottle as the fluid enters. Other cocks of similar character are adapted for insertion in metallic cisterns or boilers, and fitted with a flange to bear against the outer face of the cistern, and a nut, wormed on to the portion of the tube of the cock which passes into the cistern, by which they may be screwed up firmly. Others again are adapted for soldering to the end of a leaden pipe, such as the service-pipe for laying water on to a house. Some stop-cocks, again, have no nose or spout, but are made alike at each end, for the purpose of being soldered between two lengths of leaden pipe.

Fig. 1 represents, in section, one of the most common kinds of cock or tap, constructed for insertion in a barrel, as represented by the dotted lines at *d*; *a* is the end driven into the barrel, and perforated with a number of small holes, through which the surrounding liquor passes into the interior of the cock, but which, by their minute size, prevent the entrance of foreign bodies which may be floating in it; *b* is the nose or spout, through which, when the cock is opened, the liquor runs out into the vessel placed to receive it; *c c* is a nearly cylindrical plug, rather smaller at the lower than at the upper end, accurately turned, and ground into the opening formed through the cock to receive it, and having a vertical slit or passage formed transversely through its axis, which may, according to the position of the plug, either coincide with or be made to lie across and be totally disconnected from the tubular passage through the cock. This point is more fully explained by *Figs.* 2 and 3, which represent horizontal sections of the plug and its socket or barrel, *Fig.* 2 showing the plug in the position represented in *Fig.* 1, in which position it completely intercepts or closes the passage through the cock, and *Fig.* 3 showing the plug as turned one quarter round, so as to cause its passage to coincide with that of the tube of the cock. The upper end of the plug is prolonged into a T-shaped head or handle, by which it may be conveniently turned; and it is usual to add a stop-pin, indicated by dotted lines in the upper part of the plug in *Fig.* 1, which, by limiting the motion of the plug, lessens the risk of leaving it improperly turned off. The plug, which is inserted from above, is secured in its proper position by slightly riveting its lower extremity, so that, while it may be turned round freely upon its axis, it cannot be withdrawn from the cock without considerable force. When, by wear or corrosion, the plug becomes too loose, and thereby occasions the cock to leak, the riveted end may be filed, and the plug driven out and reground. As it is reduced in size by this operation, it must of course be driven further in; and to provide for this contingency the slit or passage through the plug is usually made, as represented in *Fig.* 1, somewhat longer or deeper than would be necessary merely to coincide with the tube or bore of the cock. The projecting block of metal in front of the nose of the cock preserves it from being injured by the force required to drive it into the barrel.

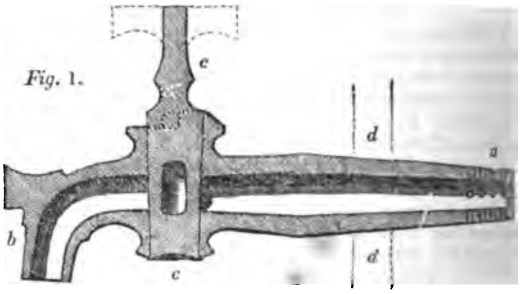


Fig. 1.

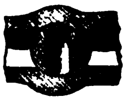


Fig. 2.

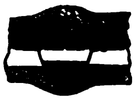
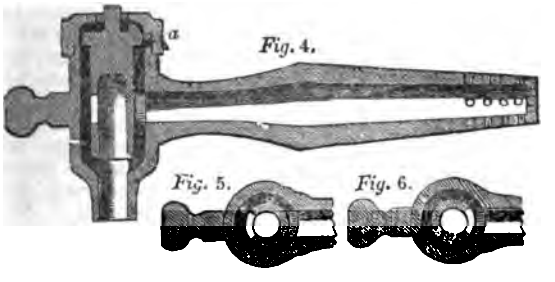


Fig. 3.

One of the first improvements on this contrivance which claims notice is that of securing the plug in its place by means of a screw in its lower end, instead of by riveting; by which arrangement the plug may be readily withdrawn for the purpose of cleansing the cock. Of the many improved cocks in which the common form of the plug is departed from, that represented in *Fig.* 4 is highly ingenious. In this the bo zontal tube or bore of the cock opens into a vertical cylindrical chamber or barrel which is lined with a hollow cylinder of cork, and within the cylinder of cork is another hollow cylinder of metal, which constitutes the moveable plug of the cock.



Through one side of this hollow plug a circular hole is formed in such a way that in one position of the plug it will coincide with the horizontal passage of the cock, which is continued through the cork lining of the vertical chamber, and thereby allow the liquor to escape by the vertical nose or spout, while by turning the plug half round the solid side of the plug is exposed to the passage of the cock, so as effectually to close it. The cork is represented in the cut by a dark tint, and in this, as in the case of the common cock, separate cuts are given to show the transverse section of the plug, *Fig.* 5 showing it in the same position as *Fig.* 4, so as to close the passage, and *Fig.* 6 representing it as turned round to open the passage. For the sake of variety this cock is represented without the usual T-shaped handle, the top of the plug being so formed as to be turned by a moveable key, which is inserted through a hole in the brass cap which is screwed on to the top of the vertical chamber of the cock. To guard against the possibility of opening the cock without the key, by unscrewing this cap, it is secured by the insertion of a little screw at *a*, which, from its position, cannot be removed while the cock is fixed in a barrel, although it may be easily taken out when it is desired to open the cock for the purpose of cleaning the interior. If kept from grit, which would cause the cork to wear away, a cock of this description will work for a very long time without leakage; the wetness of the cork causing it to swell so as to keep every part water-tight, without impeding the smooth and easy action of the cock. Another kind of cock, in which the elasticity and impermeability of cork is usefully applied, has no cork lining to the cylinder, but has what may be termed a skeleton plug of metal, one side of which is filled with a semi-cylindrical piece of cork, while the other is left open to allow the liquor to flow through it.

In many cocks the principle of the revolving plug is altogether departed from. The simplest of these is a kind of cock described by Hebert (*Engineer's and Mechanic's Encyclopædia*, vol. i. p. 381), consisting simply of a curved tube of which the end driven into the barrel is closed by a flat disc of metal, covered with a leather washer, which may either be drawn into close contact with the end of the pipe, or pushed back from it to allow the liquor to enter, by means of a slender rod which passes longitudinally through the horizontal part of the cock, and through a hole just above the nose, which hole, as well as the part of the rod passing through it, is wormed. A transverse handle being fixed on the projecting end of the rod affords the means of screwing it in or out, so as either to open or close the passage at pleasure. A very superior though more complicated cock on this principle has the disc-valve applied to the lower end of a vertical pipe, like that by which the liquor escapes in the cock represented in *Fig.* 4; and, instead of working the valve by means of an internal rod, the screw of which must be exposed to the action of the liquor, has two screwed rods, outside the passage for the liquor, which are moved simultaneously by the application of a key of the ordinary kind. In this and other cocks of similar character, leather has been found to act imperfectly, from its liability to become hard and horny when frequently wetted, and, though we are not aware of its adoption by any manufacturer of cocks, caoutchouc has, we believe, been applied successfully as a substitute for it. Another kind of cock, of which there are several varieties, has a solid conical valve, capable of being either pressed into its seat, which must be ground with great accuracy, or removed from it to allow the liquor to escape, by means of a screw. In all cocks in which pressure is communicated to a valve, of whatever form, by means of screws, particular caution is required when, as is often the case in large cocks, a lever handle or key, fixed on to a squared axis, is employed; as the purchase afforded by such a handle is apt to lead to the application of too great force, by which the valves are injured. Another ingenious but hitherto not very successful class of cocks consist essentially of two concentric plates or discs pierced with openings, which may be made to tally with one another when it is desired to allow the liquor to flow through the cock, but which may, by a small change in their relative positions, form a perfect barrier to the fluid, by the solid portions of one disc being brought to cover the openings in the other, on the plan of the well-known ventilating apparatus employed to admit or exclude a current of air from a flue.

In drawing off liquors from a close barrel it is necessary not only to open a passage by which the liquor may escape, but also to admit air to occupy the place of the liquor abstracted. This is commonly effected by means of a conical plug of wood called a vent-peg, which is inserted in a small hole in the upper part of the barrel, so as to prevent the access of air when it is not required, but which may be taken out while liquor is being drawn off. A very convenient substitute for the common vent-peg, intended especially for small beer-barrels, is manufactured in brass. It consists of a small tube of brass, which is screwed into the peg-hole, closed by a valve which is kept in its place by a spring, but capable of being opened by pressing the finger on a small lever while the cock is open. Cocks have been contrived to avoid the necessity of using a vent-peg, by causing an entrance for air to be opened by the action of opening the cock. Hebert represents, in the work above referred to, two contrivances of this character, each of which has a small pipe to conduct the air, which is admitted, by the act of turning the cock, through an aperture provided for the purpose, to the upper part of the barrel, above the surface of the liquor; the pipe being in the one case outside the barrel, while in the other it is carried up inside the barrel or vessel. The latter plan is considered preferable for large fixed vessels in breweries and distilleries, because the air-pipe, being enclosed, is shielded from injury. Taps are manufactured for small beer-barrels, under the name of siphon-cocks, in which this object is effected without the aid of an air-tube, a contrivance being added to the cock itself, by which, whenever the cock is opened, a small current of air is caused to enter an aperture near the nose of the cock, and to pass along a little tube fixed longitudinally in its bore, from the inner end of which it bubbles up through the liquor.

The common mode of securing liquor-taps from improper opening by the use of a moveable key in lieu of the fixed T-shaped handle, is very imperfect, owing to the facility with which a key of the kind usually employed is imitated, and the comparative ease with which the plug may be turned round without a key, especially in the case of a cock resembling *Fig.* 1, in which the plug may be turned round by the application of a strong fork to its lower end. Owing also to the friction unavoidable in large cocks, their keys are necessarily made too large to be convenient for carrying in the pocket. In some cases an apparatus is put on to the cock after use, and secured by a padlock, which completely prevents the opening of the cock, but it is both cumbersome and expensive, and very inconvenient in use, as it must be removed every time the cock is opened. Mr. W. Russell, in a communication to the Society of Arts, published in the thirty-seventh volume of their 'Transactions,' pp. 94-100, describes a very superior contrivance of his own invention, in which a pin is pressed by a spiral spring into a cavity in the plug, so as to prevent its turning, and drawn back, when it is necessary to open the cock, by means of a small tubular or pipe-shaped key, the interior of which is cut with a female screw to receive a worm cut upon the outermost end of the stop-pin, which is of course inclosed in such a manner as to be inaccessible excepting by means of the key. The same paper contains a description, fully illustrated by engravings, of another apparatus on the same principle, but rendered still more secure by the addition of a box of guards resembling those which constitute the peculiarity of Bramah's lock. [LOCK, P. C. S.] One of the advantages of Mr. Russell's contrivances is their applicability to cocks of the ordinary construction at a moderate expense; and another is the portability of the key required to secure even the largest cock, such locking key not being employed to open the cock itself.

Some of the superior kinds of cocks are manufactured in fine brass, and others, intended for use with vinegar or other corrosive liquors, of a white alloy less liable to be injured by acids; but the greater part are formed of a peculiar alloy known by the name of *tap-metal*, which is defined by Holland (*Manufactures in Metal*, in Lardner's 'Cabinet Cyclopædia,' vol. iii. p. 169) as inferior brass, or rather 'copper, so saturated with lead, that on exposure to but an inconsiderable degree of heat the latter ingredient readily oozes through the pores of the mass.' 'Crude lead,' observes this authority, 'does not amalgamate with copper in the composition of cock-metal; it is therefore arsenated, or "killed," as the workmen term it, as in the method of preparing it for shot.' Cocks are cast in moulds, with a core, the plug and the barrel being formed separately, and the vertical perforation in which the plug works (to which the name of the barrel is in some cases confined) is afterwards turned smooth by means of a quadrangular steel rinder. To make this tool cut smoothly, and to prevent its cutting angles from removing the metal too rapidly and in an irregular manner, slips of wood are applied to its flat sides, so as to fill the cylinder without interfering with the cutting, or rather, scraping angles. A very superior mode of cutting or boring the barrels of cocks, or any similar hollow cones, by an ingenious addition to the common lathe, was communicated to the Society of Arts in 1810 by Mr. Charles Williams, and is described in the twenty-eighth volume of their 'Transactions,' pp. 196-198. The barrel having been thus bored, and the plug turned to fit it, the two are ground together with a little fine sand and oil. To remedy some of the defects of brass cocks, it has been attempted to manufacture them of cast-iron, and Holland refers to a patent obtained in 1806 by Mr. Cawood, of Leeds, for a plan of making cocks of soft cast-iron, and afterwards fitting them with bushes and other parts of brass or bell-metal, attached by soldering. Cocks manufactured by this method, Holland observes, 'are not liable, as is often the case with those cast of the usual compound metal, either to become cloggy, or to expand and contract considerably with each change of temperature.' 'They are moreover,' he adds, 'readily renewed in the parts exposed to wear.' The best cocks for corrosive liquors are those known as Ridgway's porcelain cocks, which are made of the strongest porcelain or stoneware. Hebert gives a cut of one of these cocks, the construction of which, excepting in the absence of the cylinder of cork, closely resembles that of the cock represented above in *Fig.* 4. We see no reason why the cork cylinder should not be added whenever such cocks are used for liquors which would not act upon the cork; and probably the application would be found even more advantageous than with metal cocks, owing to the greater difficulty of rendering so hard a material as stoneware perfectly true and water-tight.

The *four-way cock* is an ingenious contrivance resembling in some respects the cocks above described, yet sufficiently distinct to be noticed separately from the kind of cock to which this article chiefly relates. It consists of a plug perforated with two distinct passages, and mounted in a barrel into which four separate pipes or channels open; and its object is to connect the four passages with each other in alternate couples, either by a continuous revolution upon its axis, or by an alternating motion through one-fourth part of a revolution. *Figs.* 7 and 8, in which a four-way cock is represented in section in two different positions, will illustrate this action. In these diagrams *a*, *b*, *c*, and *d* represent four pipes between which it is desired to establish a communication which shall afford the means of connecting at pleasure the pipes *a* and *b*, and *c* and *d*, or, by a simple movement of the cock to disconnect these, and connect *a* and *d*, and *b* and *c*. This beautifully simple apparatus has been adopted by several of the inventors and improvers of the steam-engine, as a means of alternately admitting steam to and allowing it to escape from each end of the engine-cylinder. Referring to the above figure, the pipe marked *a* may be supposed to be the steam-pipe communicating with the boiler, *c* the waste-pipe for the exit of steam after it has impelled the piston, and *b* and *d* the pipes communicating with the top and bottom of the cylinder, respectively. In the position of the cock represented in *Fig.* 7 the steam-pipe is placed in communication with the top of the cylinder, while the lower end of the cylinder communicates, through the waste-pipe *c*, with the atmosphere, so that the piston will be impelled downwards; but the movement of the valve or cock upon its axis to the extent of 90° brings it into the position of *Fig.* 8, in which the steam from the upper part of the cylinder may escape by returning through the pipe *b*, by which it entered, to the waste-pipe *c*, while fresh steam will be admitted underneath the piston by the connexion of the pipes *a* and *d*. The piston will consequently rise, and by so doing will set in motion the apparatus for returning the cock to its first position, ready for a repetition of the process. The great improvement of slide-valves, which work with less friction than four-way cocks can do when of large size, and admit of more ready adjustment in the admission and cutting-off of the steam, has led to the disuse of four-way cocks for this purpose, excepting, in a few cases, in very small engines.

Fig. 7.

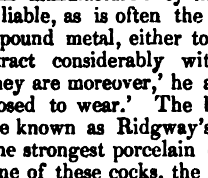
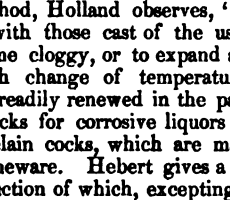


Fig. 8.



COCOA. [CACAO, P. C.; THEOBROMA, P. C.]

CODEX. [CODE, P. C.]

COELACA'NTHUS, a genus of fossil fishes, which occurs in the coal formation and the magnesian limestone of the north of England. (Agassiz.)

COELLO, CLAUDIO, a celebrated Spanish painter, born at Madrid in the earlier half of the seventeenth century. His father Faustino Coello, who was a Portuguese bronze-worker, wished to bring up his son to his own business, and placed him with Francisco Rizi to learn to draw. Rizi however, who soon perceived the great abilities of young Coello, persuaded his father to allow him to become a painter. By the instruction of Rizi, and by copying a few of the pictures of Titian, Rubens, and Vandyck in the palace at Madrid, Coello became a very able painter, and produced several excellent altarpieces while still with Rizi. He executed also several works in fresco in company with Josef Donoso, especially on the occasion of the marriage of the king Charles II. with Maria Louisa of Orleans. In 1680 he was appointed cabinet painter to that king in the place of Carreño, deceased, with a salary of twenty ducats per month.

In consequence of the death of Rizi, Coello was ordered by the king to paint the great altarpiece for the sacristy of the Escurial, in place of one which had been commenced by Rizi. The subject was the procession and ceremony of the Collocation of the Host on the altar of the Sacristy, 'Colocacion de la Santa Forma,' which took place in 1684 in the presence of Charles II. and his officers of state: the picture contains upwards of fifty portraits, and was completed by Coello in about three years, to the utmost satisfaction of the king. It is Coello's masterpiece, and one of the finest productions of the Spanish school, combining the design of Cano, the colouring of Murillo, and the effect of Velazquez. Cumberland speaks in the highest terms of this picture; he calls it an amazing composition, and says that it maintains its rank, though in company with the productions of Raphael, Titian, and the greatest Italian and Flemish masters. 'I do not remember,' he continues, 'ever to have seen such a striking effect of clairobscure and force of perspective. In the group of persons who form the grand procession of the Collocation there are to be found the portraits of the king and all the principal nobility of his court, executed to the life itself; everything is traced with the most masterly and determined pencil. Such a majestic and orderly solemnity is observed in the arrangement of his figures, as bespeaks the art of the composer, and suits the dignity of his subject; all the accompaniments are in such perfect harmony, and the colouring of the parts so rich and glowing with such forcible and clear relief, that it forms the most ravishing spectacle that art can form.' In Cumberland's opinion, Coello's style very much resembles that of Paul Veronese. Coello died of jealousy and vexation in 1693, in consequence of the arrival of Luca Giordano at Madrid by the invitation of the king to paint in fresco the great staircase and other principal parts of the Escurial. Giordano arrived in May, 1692, and Coello died eleven months afterwards, having from the time of Giordano's arrival, with one exception, resolutely adhered to a determination to paint no more. The Martyrdom of St. Stephen, for the Dominican convent at Salamanca, was the only work that he finished, of all he had on hand, after the arrival of Giordano at Madrid.

There are several altarpieces and frescoes by Coello at Madrid, and some at Saragoza and other places.

(Cean Bermudez, *Diccionario Historico*, &c.; Cumberland, *Anecdotes of Eminent Painters in Spain.*)

COELN, WILHELM VON, or William of Cologne, a celebrated old German painter, of the latter part of the fourteenth century, called also Meister Wilhelm. There are several documents which satisfactorily prove the existence of this painter, but there are no data by which any of his works can be identified: many paintings in distemper of the old Cologne school are attributed to him, upon no other grounds than conjecture; but none but the best productions of that school are awarded to him.

The exact date of his birth is not known, but the place appears to have been Herle, a village near Cologne, whence he is also called in some documents Wilhelm or Wilhelmus de Herle. He was settled in Cologne, with his wife Jutta, as early as 1370; and there is a passage in the Annals of the Dominican monks of Frankfort, which testifies to his great reputation: ten years later, it says—'in that time, 1380, there was at Cologne a most excellent painter, to whom there was not the like in his art; his name was Wilhelm, and he made pictures of men which almost appeared to be alive.'

There were celebrated painters at Cologne however long before this period, for Wolfram of Eschenbach, who lived at the commencement of the thirteenth century, in speaking, in his poem of 'Parcival,' of the beauty of a knight on horseback, says that no painter of Cologne or Maastricht could make a better picture than the knight on horseback was:—

Von Chölne noch von Mastricht
Dechein Sciltere entwurf 'en baz,
Denn als er ufem orse saz.

Of the works attributed to Meister Wilhelm, the following are the principal:—the picture over the tomb of Cuno von Falkenstein in the St. Castors-Kirche at Coblenz, painted in 1388; the large altarpiece of the church of St. Clara at Cologne, which is now in one of the chapels of the cathedral; it is in twenty-six compartments illustrating the life and passion of Christ; the Sancta Veronica, formerly in the Boisserée collection, now belonging to the king of Bavaria, and in the Pinakothek at Munich, and of which there is a beautiful lithograph by Strixner; and a Crucifixion, and a half-length Madonna and infant Christ, in the Wallraf Museum at Cologne.

Meister Wilhelm was also supposed to have been the master of the so-called Dom-bild, or Cathedral-picture, which was formerly the altarpiece of the chapel of the Rath-haus of Cologne, but is now in the cathedral, and is at present generally attributed to Meister Stephan, the supposed scholar of Meister Wilhelm. There are also in the Pinakothek at Munich (cabinet i.) four other pictures of various saints, mostly on gold grounds, besides the Sancta Veronica, attributed to this painter. They are all remarkable for richness of colour and extreme diligence of execution, in the heads in particular, which all have a true nobility of expression. Technically, likewise, they are very remarkable works; for though in water-colours, in a species of tempera, they are equal, or even in some respects superior, in impasto to the best of oil paintings, and very similar in effect: they are however Gothic in design; and in the extremities, especially the fingers, are totally devoid of proportion and modelling. Except for this last-mentioned defect, they would bear a perfect resemblance to the works of the so-called school of Van Eyck; for even in the vehicle in which the colours have been mixed there is no apparent difference, and, as already stated, that they are by Wilhelm von Cöln is a mere conjecture.

There is no other record of Stephan von Cöln, the Dombild Meister, than a note in the journal 'Tagebuch' of Albrecht Dürer, which attributes this celebrated picture to him. It was painted in 1410, and is the most valuable picture of the old school of Cologne. It consists of a centre and two revolving wings, painted on both sides. The outside of the wings represents the Annunciation; the centre represents the Adoration of the Three Kings; and on the interior of the wings are patrons of Cologne, St. Gereon and St. Ursula, with their companions in martyrdom. There are three other works of this school, which from their similarity of style are attributed to this master: the altarpiece formerly in the Benedictine Abbey of Heisterbach, near Bonn now existing only in parts; the altarpiece formerly in the church of St. Lawrence, at Cologne, likewise divided into parts and scattered; and a picture of the Madonna and Child, with Angels, in a private collection at Cologne.

(Fiorillo, *Geschichte der Zeichnenden Künste in Deutschland*, &c.; Passavant, *Altkölnische Malerschule*, in his 'Kunstreise durch England und Belgien;' Dillis, *Verzeichniss der Gemälde in der Königlichen Pinakothek zu München*.)

COELOPTY'CHIUM, a genus of Spongiadæ, proposed by Goldfuss, for some fossils of the chalk.

COGNO'VIT is a plea, in an action at law, whereby the defendant acknowledges or confesses the justice of the plaintiff's demand against him (*cognovit actionem*). By this plea a trial is avoided and judgment is entered up for the plaintiff. But where the action is for damages, this judgment is not final, as the amount of damages remains to be assessed by a jury, under a writ of inquiry, which is executed by the sheriff, by the agency of his under-sheriff. When the jury have assessed the damages, the sheriff returns the inquisition, which is entered upon the roll in the form of a *postea*, and the judgment is then complete, the defendant's plea having already confessed the cause of action, and the damages having been assessed by a jury. If the action be for the recovery of a specific amount, as in an action of debt, the judgment entered up upon a plea of *cognovit actionem* is conclusive against the defendant, as it confesses the entire declaration. On this account it is a common practice for a debtor to strengthen the security of his creditor by executing a warrant of attorney to an attorney named by the creditor, authorising him to confess a judgment by a plea of cognovit in an action of debt to be brought by the creditor against the debtor for the specific sum due to him. But in order to prevent fraud, it is provided by 1 & 2 Vict. c. 110, § 9, 10, that such warrant of attorney or cognovit is of no force unless there be present an attorney of one of the superior courts, on behalf of the party who gives it, expressly named by him, and attending at his request, to inform him of the effect of the instrument before he executes it, and who must subscribe as a witness to the execution, and declare himself to be the attorney for the party. In order to make this process effectual as against the assignees of the debtor, if he should become bankrupt or insolvent, warrants of attorney and cognovits must be filed in the Court of Queen's Bench within twenty-one days after execution, or judgment must be signed or execution issued thereon within the same period.

(3 Geo. IV. c. 39; 6 Geo. IV. c. 16, § 108; 1 & 2 Vict. c. 110, § 60, 61; 6 & 7 Vict. c. 66. Harrison, *Digest of Reported Cases*, titles 'Bail,' 'Warrant of Attorney;' Stephen, *Comm.* vol. iii. p. 634.)

COHESION, MAGNETIC, is that power by which two magnetical bodies adhere together, as iron to a piece of loadstone.

The nature and laws of this power have been stated under MAGNET and MAGNETISM [P. C.], and it is intended here to notice merely the means employed to increase its intensity.

Loadstone is frequently combined with substances which have small or no attractive powers; and the poles, or points of contrary nature with respect to attractions and repulsions, being irregularly distributed, counteract in part one another's effects: thus a mass of loadstone often exhibits a comparatively small adhesive force; and it happens at times that, when the mass is broken in pieces, some of the portions, containing a considerable quantity of the attractive material favourably disposed, exercise a greater power than was exhibited by the entire mass. It is found that a piece of loadstone will seldom suspend more than 5 or 10 times its own weight, though some small specimens have been obtained which are said to have suspended more than 200 times their weight.

If a piece of iron be placed in contact with either pole of a magnetized bar, the force of the coherence is that which is due to the direct action of that pole only on the contrary magnetism of the iron: the intensity is at least doubled when the substance to be suspended can be placed at once in contact with both poles; and this is frequently effected by giving to the magnetized bar the form of a horse-shoe, so that the opposite poles may be near one another: but the most effectual method of increasing the power of a magnetic body is that of *arming* it.

Preparatory to arming a piece of loadstone the situation of its axis, that is, of a line joining its poles, must be determined by trial: the loadstone is then reduced to the form of a cube or parallelepiped nearly, having two opposite faces perpendicular to the axis; and these faces are ground very smooth. Two plates of soft iron equal in length and breadth to these sides are applied to the latter so as quite to cover them, and are connected together by a bar of soft iron which is attached to them at the upper end of each (supposing the two plates to be in vertical positions): to this bar is affixed a hook or ring by which the whole apparatus may be suspended.

The inferior extremity of each plate is formed with a foot which projects under the loadstone, so that the latter may rest upon both; and horizontal bands of copper or silver usually surround the loadstone and side pieces in order to keep the whole together. Under the feet is applied a bar or plate of iron, touching both; and this is provided with a ring or hook from which is to be suspended the weight to be held by the attractive force of the loadstone. Artificial magnets have been armed in a similar manner.

The attractive powers situated in the poles of a natural or artificial magnet seem to be diffused over the two surfaces in which those poles are situated; and the plates of iron which cover those surfaces, serving to condense the powers, cause them to act with united energies in the two feet of the apparatus, by which means the power is greatly increased. The feet of the side plates should not however be made to approach each other too nearly; since in such position they would diminish each other's attractive powers.

It is found that a magnet when armed exerts a force more than one hundred times as great as that of the magnet in its natural state; and it has been ascertained that, after as much weight has been applied as the armed magnet will suspend, if at certain intervals of time other weights be added, the magnet will suspend two or three times as much as before.

Daniel Bernoulli discovered by experiment that the attractive forces of magnets vary in proportion to their superficies and not to their masses; a circumstance in accordance with Mr. Barlow's discovery respecting the magnetic attractions of iron spheres.

COIRE. The manufacture of cordage, mats, matting, coarse canvas, and sailcloth, from the fibres of vegetables, has been known to the inhabitants of nearly all countries with which we have any acquaintance. *Coire*, or cocoa-nut fibre, is one of the materials so employed.

So far however from the source from which the material is obtained being alike in all plants, it differs considerably. In flax and hemp, the fibrous material is furnished by the stem, deprived of its ligneous centre or core. In the Spanish broom the fibres are furnished by the young pliant branches of a shrub; and these fibres are occasionally wrought both into cloth and into cordage. The stalks of the hop-plant, and also of the common nettle, are made to yield fibres applicable to a similar purpose; and so likewise may be those of the bean-plant and of the mallow. In other cases it is rather the bark of a tree than the stem of a young plant, that yields the fibres. Such is the case with the paper-mulberry tree, the bark of which is so prepared by the natives of Tahiti as to yield fibres fitted for a kind of cloth. Such is likewise the case with the linden-tree, the bark of which, prepared in a suitable way, is used for the manufacture of mats, baskets, bags, and thatching: it was estimated three or four years ago that fourteen million mats are made annually in Russia from this material, that for this purpose the bark of a million trees is required, and that a traffic equal to half a million sterling is thus created. Two other examples of the same kind are furnished by the maho-tree (*Hibiscus tiliaceus*) and the *Theobroma augusta*, two East Indian plants, the stalks of which are steeped and disentangled from the fibres of the inner bark. Another class of materials for similar purposes are furnished by the leaves of certain plants. The *Phormium tenax*, or New Zealand flax, has leaves which produce such fibres. The enormous leaves of the *Agave*, or American aloe, yield fibres capable of answering a similar purpose; and so likewise do several species of the *Bromelia*.

But *Coire* differs from all these in its origin. It is the fibre of the husk of the cocoa-nut; bearing some such relation to it as the downy fibres of cotton do to the seeds of the cotton-plant. The inhabitants of Ceylon make great use of it for this purpose. Mr. Marshall, a medical gentleman, who resided many years in Ceylon, published a few years ago a 'Contribution to a natural economical history of the cocoa-nut tree,' from which we gain information as to the mode in which the coire is prepared. The nut is gathered before being completely ripe; and in order to remove the husk, an iron spike or sharp piece of hard wood is fixed in the ground, and the nut is forced upon the point in such a manner as to separate the rind from the shell; one man can clear about a thousand nuts in a day by this means. The rind of the nut is soaked in water for several months, then beaten upon a stone with a piece of heavy wood, and afterwards rubbed with the hand until the intermediate substance is completely separated from the fibrous portion. The rind of forty average nuts supplies about six pounds weight of the fibre. This fibre constitutes the coire, which is then ready for use in the same way as hemp or other fibrous materials.

In the early part of the present century, Dr. Roxburgh communicated to the Society of Arts an account of a series of experiments which he had undertaken, to test the relative strength of coire and other kinds of fibre; from which it appears that this material possesses great tenacity. Indeed Dr. Roxburgh remarks, that 'coire is certainly the very best material yet known for cables, on account of its great elasticity and strength.' The material is very buoyant, and well suited for making ropes of large diameter. Mr. Marshall states, that until chain-cables were introduced, all the ships which navigated the Indian seas had cables made of this substance; that the fibres are rather improved than injured by immersion in sea-water; but that the smoothness and elasticity of the coire-cordage, though very advantageous to running-rigging and the light lines of a ship, render it less fitted for standing-rigging.

There has been a branch of manufacture introduced within the last few years in England, in which coire is employed rather differently than in the above-described instances. This is for the production of rugs, druggets, mats, matting, mattresses, and similar coarse goods. Dampièr mentioned two or three centuries ago the production of cloth from such a material; for he says, in his 'Voyage Round the World,' 'I have been told by Captain Knox, who wrote the "Relation of Ceylon," that in some places of India they make a sort of coarse cloth of this husk of the cocoa-nut, which is used for sails. Myself have seen coarse sailcloth made of such a kind of substance.' Besides the actual weaving or plaiting of this material into textile fabrics of a coarse kind, it is used as a stuffing for mattresses, pillows, and cushions. Dampier alluded to the use of the fibres to caulk the seams of ships; and Mr. Marshall speaks of the employment of them in India in stuffing mattresses, cushions for couches, and saddles, as a substitute for horse-hair. The availability of the material for such a purpose seems to depend upon these qualities:—that the coire is very indestructible; that it does not harbour vermin, as horse-hair would in a warm climate; and that it is free from offensive smell.

COKAINE, or COKAYN, SIR ASTON, was born in 1608, at the country-seat of his father, a Derbyshire esquire of old lineage and considerable property. After having been educated at both universities, he was entered for form's sake in the inns of court, and travelled on the Continent. He was a Roman Catholic and royalist; and both of these characters exposed him to much suffering in the civil war. In the latter part of his life he was obliged to part with his estates, reserving a small annuity for his support. He died at Derby, in 1684. He published four plays, which, with other poems, were collected, in 1669, in two volumes, small octavo, now very rare. The plays and the poems are equally worthless, but Sir Aston's name deserves some notice for his close intimacy with the dramatic poets of his time, and for the information furnished, in regard to the history of the drama, by those commendatory verses which make up a large proportion of his compositions. It has been justly regretted that he did not set down in distinct prose the facts of which he was in possession, instead of hinting at them briefly and obscurely in snatches of wretched doggrel.

COKE, or, as it is sometimes written, **COAK,** is coal divested of its gaseous and more volatile constituents by partial combustion in close chambers, or in heaps from which the free access of air is excluded. Being composed almost entirely of carbonaceous matter, coke is a fuel much purer and better adapted for use in smelting and various other furnaces than raw or uncoked coal; and as it is divested of those constituent parts which produce most dark-coloured smoke, it is especially preferred in cases in which it is necessary to avoid the emission of smoke, as for the furnaces of locomotive engines. The introduction of railways has occasioned a very large demand for coke for this purpose, though its use in the manufacture of iron has been diminished in some degree by the adoption of the hot-blast for furnaces, by the aid of which uncoked coal may be used in lieu of coke.

The simplest mode of coking coal, which is still occasionally followed, is to lay the coal in large flattened heaps, often containing thirty or forty tons each, in the open air, covering it with ashes and earth to confine the heat, so that the mass of coal may be slowly burnt in a smothered manner; men being employed during the process, to renew the covering wherever the fire may begin to burn through too fiercely. Dr. Ure, in describing various modes of making coke in Germany (*Dictionary of Arts*, &c., art. 'Pitcoal, Coking of'), represents both circular and oblong coking *meilers* or mounds of this character, the former being piled round a central chimney built of loose bricks, towards which small horizontal flues are laid among the lumps of coal forming the mound; while in the latter vertical flues or chimneys are provided by the insertion, while the mounds are forming, of wooden stakes, which, when the whole pile is completed, are withdrawn, their place being filled up with readily combustible materials, to aid in igniting the mass of coal. The exterior of these meilers is covered with *slack*, or coal dust, and clay.

The best and most economical method of making coke is in close ovens, which are built in various forms. In the account of the Butterley Iron-Works in No. 764 of the 'Penny Magazine,' a view is given of the range of coke-ovens connected with that establishment, about one hundred in number, each being a brick structure eight or ten feet high, with a flat roof in which is an opening for introducing the coal, and with another opening in front from which to remove the coke. The ovens being placed side by side in a continuous range, a railway is laid along their flat roofs by which the coal is brought close to the charging-holes, while another, running on a lower level, in front of the openings by which the coke is taken out, affords facilities for its removal. Dr. Ure, in the article above referred to, gives details of various forms of coke-ovens, of which we can only notice the very excellent kind adopted by the London and Birmingham Railway Company for making coke at the Camden-Town Station, for the use of their locomotive engines. Each of these ovens is, internally, of an elliptic form, measuring twelve feet by eleven in the clear, and surrounded by brick-work three feet thick. The internal height is not stated, but according to the section there given it appears to be about four feet, the floor being flat, bedded upon a thick stratum of concrete, and the roof in the form of a flat dome. In the front of each oven is an opening about three feet square, covered by a cast-iron door lined with fire-bricks, which slides up and down by means of chains and counterweights. At the back of the roof is an opening, capable of being wholly or partially closed by a sliding damper communicating with a horizontal flue which conducts the smoke to a high chimney serving for the whole range of ovens. The ovens are charged through the front opening with about three tons and a half of coals, upon the top of which a little straw is thrown. The oven being very hot from its preceding charge, smoke begins immediately to rise from the mass, while the straw becomes ignited by radiation from the dome. By the active combustion thus excited on the surface of the coal the greater part of the smoke is consumed, all that arises from the half-ignited coals having to rise through the fully-kindled coals on the surface, which are freely exposed to the access of air, both the furnace door and the flue being for a time left fully open. As the operation proceeds, the fire burns regularly downwards, and the doors and dampers are gradually closed. After a calcination of upwards of forty hours the doors and dampers are perfectly closed, by which means the mass is partially cooled, and forms itself into prismatic concretions, somewhat resembling columnar basalt, and when sufficiently cooled the furnace is opened, and the mass of coke is broken up with iron bars and thrown out upon the pavement to be extinguished by sprinkling water over it. When the coking is conducted in this manner a very small quantity of unconsumed gas and soot escapes, and the coals, if good, yield about 80 per cent. of compact glistening coke, weighing about 14 cwt. per chaldron. In ordinary coking-ovens the loss in weight is about 25, instead of 20 per cent., but the bulk of the coal is increased about 25 per cent. by the process.

The production of coke in the manufacture of coal-gas is alluded to under Gas-lighting, P. C., pp. 86, 87. Various plans have been tried for converting the furnaces of steam-engines into coke-ovens, so as to make profitable use of the immense heat which is usually wasted in the manufacture of coke; but a description of such would involve much detail, and perhaps be rather premature, as we are not aware whether any have been brought into operation on a sufficiently extensive scale to afford grounds for an accurate judgment upon their merits, though some, tried experimentally, have bid fair to realize considerable advantages.

COKE, J. W. [Leicester, Earl of, P. C. S.]

COLEBROOKE, HENRY THOMAS, the late very eminent Oriental scholar, was the third son of Sir George Colebrooke, Bart., and was born in 1765. His mother was Mary, only daughter and heiress of Patrick Gaynor, of Antigua, Esq. He never was at any public school, but was educated at home by a private tutor. In his twelfth year he was sent to France, and he remained in that country till he was sixteen. His own inclination at this time was to enter the church; but the position of his father, who was one of the directors of the East India Company, naturally led to the selection of another career for him, and in 1782 he was appointed to a writership in India. For the first three years after he went out he resided at Calcutta, and was attached to the Board of Accounts; he was then transferred to the revenue department at Tirhoot. During his residence at this station he acquired a fondness for field-sports, which he retained while he lived. In 1789 he was removed to Purneah; and having been soon after appointed a member of a commission deputed by the government to investigate the resources of Bengal, he drew up, in conjunction with Mr. Lambert, a merchant of Calcutta, and printed for private circulation, in 1794, a very able tract, entitled 'Remarks on the Agriculture and Commerce of Bengal, by a Civil Servant of the Company,' which, besides a mass of new and valuable information, announced some propositions much beyond the current ideas of the time; among others, that of a free trade between India and England. Colebrooke's portion of this treatise was reprinted and published at London, in 1806, under the title of 'Remarks on the Husbandry and Internal Commerce of Bengal;' and an account of it may be read in the Edinburgh Review, No. 19 (for April, 1807), pp. 27-40. (See also No. 8, p. 314; and No. 40, p. 477.) Some time before this Mr. Colebrooke had begun to study the Sanscrit; and, having now undertaken the translation of the collection or digest of Hindu law formed under the superintendence of Sir William Jones, he had finished his task before the close of the year 1796; and the work was published, under the title of 'A Digest of Hindu Law on Contracts and Successions, from the Original Sanscrit,' in 3 vols. 8vo., at Calcutta, in 1797. Soon after the foundation of the College of Fort William, he was appointed to the Professorship of the Sanscrit Language; which he appears to have held till he was removed to a judicial situation at Mirzapore. He was subsequently promoted to be Chief Judge of the courts of Sudder Dewannee Adawlut and Nizamut Adawlut; and he was for a time President of the Board of Revenue, and a member of the Supreme Council of Bengal. He was also for some years a Director of the Asiatic Society of Bengal; and many of the most valuable papers in their transactions (The Asiatic Researches) were contributed by him; particularly, 'On the Duties of a Faithful Hindu Widow,' in vol. iv.; 'Examination of Indian Classes,' in vol. v.; three 'Essays on the Religious Ceremonies of the Hindus, and of the Brahmans especially,' in vols. v. and vii.; 'On the Sanscrit and Pracrit Languages,' and others, in vol. vii.; a highly curious discourse 'On the Vedas, or Sacred Writings of the Hindus,' in vol. viii.; 'Observations on the Sect of Jains,' 'On the Indian and Arabian Divisions of the Zodiac,' 'On Ancient Monuments containing Sanscrit Inscriptions,' and others, in vol. ix.; a very elaborate disquisition 'On Sanscrit and Pracrit Poetry' (or rather prosody), in vol. x.; and 'On the Notion of the Hindu Astronomers concerning the Precession of the Equinoxes and Motions of the Planets,' in vol. xii. To the Transactions of the Royal Asiatic Society of Great Britain, after his return to his native country, he contributed a 'Discourse,' read at the institution of the Society (15th March, 1823), and other papers, in vol. i.; and five papers 'On the Philosophy of the Hindus,' in vols. i. and ii.; and he was also an occasional writer in the Asiatic Journal. He likewise published at various times the following separate works:—A Collection of Compositions in Sanscrit, for the use of the Students of the College of Fort William, including the Hitopadesa [Bidpai, P. C., iv. 388], with Introductory Remarks, 4to., Calcutta, 1804; 'Grammar of the Sanscrit Language,' folio, Calcutta, 1805; 'Amera Cosha, or Dictionary of the Sanscrit Language, by Amera Sinha, with an English Interpretation and Annotations,' 4to., Calcutta, 1808; 'Two Treatises on the Hindu Law of Inheritance, translated from the Sanscrit,' 4to., Calcutta, 1810; 'Algebra, with Arithmetic and Mensuration, from the Sanscrit of Brahmegupta and Bhascara,' 4to., Lond., 1817; a tract 'On the Import of Colonial Corn,' 8vo., Lond., 1818; and 'Miscellaneous Essays' (or reprints of previously published papers and prefaces), 2 vols. 8vo., Lond., 1837. He also, in conjunction with Professor Wilson, translated from the Sanscrit, for the Oriental Translation Fund, 'Sankhya Karika, or Memorial Verses on the Sankhya Philosophy, also the Bhashya, &c.,' 4to., Oxford, 1837. Mr. Colebrooke, who held, along with his two brothers, the patent place of Chirographer in the Court of

Common Pleas, died at his house in York Terrace, Regent's Park, London, on the 18th of March, 1837. His son, the present Sir Thomas Edward Colebrooke, has since succeeded to the title and the large fortune of his father's elder brother, Sir James Edward Colebrooke, Bart., who died at Tunbridge Wells, on the 5th of November, 1839.

('Memoir' (which is however extremely imperfect) in *Gentleman's Magazine* for September, 1837, stated to be in part abridged from a communication read by Mr. Colebrooke's son before the Royal Asiatic Society; Colebrooke's various publications; *Asiatic Researches; Edinburgh Review.* See also ALGEBRA, P. C., p. 325; HINDU LANGUAGES, P. C., p. 226, *et seq.;* SANSCRIT LANGUAGE AND LITERATURE, P. C., p. 397, *et seq.;* VEDA, P. C., p. 171, *et seq.;* VIGA GANITA, P. C., p. 318, *et seq.*)

COLERIDGE, HENRY NELSON, the son of Colonel Coleridge, a brother of the poet [COLERIDGE, P. C.], was born at the beginning of this century. He was educated on the foundation at Eton, and in due course was elected scholar, and subsequently fellow, of King's College, Cambridge. He took his degree of B.A. in 1823. The scholars of King's having the somewhat questionable privilege of obtaining their degrees without examination, Mr. Coleridge's name is not found amongst the candidates for classical or mathematical honours; but he was well known in the University as one of great talents and rich acquirements, and he gave public evidence of his taste and scholarship, in 1820 and 1821, in the first of which years he obtained two out of the three of Sir W. Browne's medals, namely, that for the Greek ode and that for the Latin ode, and in the second year was again the successful candidate for the Greek ode. In 1823 he was a contributor, in conjunction with W. S. Walker, W. M. Praed, T. B. Macaulay, J. Moultrie, and others of his university, to 'Knight's Quarterly Magazine.' His papers, which bear the signature of 'Joseph Haller,' on 'The English Constitution,' 'The Long Parliament,' 'Mirabeau,' &c., are distinguished for a soundness of opinion, and a liberal and comprehensive view of historical questions, which are evidence of the extent of his acquirements beyond the ordinary range of university reading. Having fallen into ill health, Mr. Coleridge, in 1825, accompanied his uncle, the Bishop of Barbadoes, on his outward voyage. Upon his return to England in the same year, he published a most lively and amusing narrative of his tropical experiences, under the title of 'Six Months in the West Indies.' In his introductory 'Reasons for going abroad,' he gives the following account of himself: 'The doctors disagreed. According to four first-rate opinions, I groaned at one and the same time under rheumatism proper, rheumatic gout, gout proper, and an affection in the spinous process. . . . . I went simply and sheerly on my own account, or rather on account of the aforesaid rheumatism; for as every other sort of chemical action had failed, I was willing to try if fusion would succeed.' The concluding chapter tells the favourable result: 'I am de-rheumatized. Whether I ate, drank, or sweated it out, I cannot say; but the fact is, I am well and flexible in all my limbs, and if the West Indies cured me, I am very much obliged to the West Indies for the favour.'

His restored health opened to Mr. Coleridge a course of honourable action. He was called to the bar by the Society of the Middle Temple, on the 24th November, 1826, and, during the ensuing fourteen years, gradually advanced to a good practice in the Court of Chancery. During this period he assiduously cultivated his literary tastes, and more especially dedicated all his leisure to the society of his illustrious uncle, whose conversation was a perpetual store of the most varied knowledge. The daughter of the poet, a most accomplished lady, herself an authoress, became his wife soon after he was called to the bar. In 1830 Mr. Henry Coleridge published an 'Introduction to the Study of the Greek Classic Poets.' Until the death of S. T. Coleridge, in 1834, his nephew most assiduously devoted himself to the grateful task of noting down with all reverence fragments of this extraordinary man's eloquent talk, or more properly declamation. In 1835 some of the results of this labour of love were given to the world in 'Specimens of the Table Talk of the late Samuel Taylor Coleridge,' in two small volumes. It has been objected that these fragments, in which Coleridge's opinions are arranged under particular subjects, give no just notion of the character of his talk. His nephew anticipates the objection: 'I know better than any one can tell me, how inadequately these specimens represent the peculiar splendour and individuality of Mr. Coleridge's conversation. How should it be otherwise? Who could always follow to the turning-point his long arrow-flights of thought?' Yet the book must always possess a deep interest. Of its literal truth as a record of Coleridge's opinions, however it may fall short of giving an adequate notion of his mode of expressing them, no one can doubt. The 'Table Talk' was followed in 1836 by two octavo volumes of 'The Literary Remains of S. T. Coleridge,' also edited by his nephew; and a third volume of the same series was published in 1838. The care and judgment with which this difficult undertaking is executed, have given to these fragmentary materials—'Sibylline leaves,—notes of the lecturer, memoranda of the investigator, outpourings of the solitary and self-communing student,'—a permanent value. In 1837 Mr. Henry Coleridge republished 'The Friend'—his uncle's little-known periodical work—one of the most remarkable books in modern literature. In 1840 he also edited 'Confessions of an Inquiring Spirit,'—a series of letters on the inspiration of the Scriptures, left by Mr. Coleridge in MS. at his death. In this mass of materials, which we owe in great part to the unwearied industry of Mr. Henry Coleridge, amidst the short leisure of a laborious profession, will be found the best evidence of Coleridge's claims to a lasting reputation as a critic and a philosopher.

We have little to add to this imperfect notice. In 1842 Mr. H. Coleridge had a return of the painful maladies which had received a temporary relief in 1825. For many months he was prostrate on a bed of sickness, enduring pain with a most exemplary fortitude and cheerfulness, and supported by that strong religious feeling which formed a principal feature of his character. He died on the 26th of January, 1843, and was buried by the side of his uncle, in Highgate old church-yard.

COLIN, ALEXANDER, the sculptor of the excellent marble alti-rilievi of the celebrated tomb of the emperor Maximilian I. in the Kreuzkirche at Innsbruck. Colin was born at Mechlin in 1526, and in 1563 was invited by the emperor Ferdinand I. to Innsbruck, to complete the alti-rilievi of his grandfather's tomb, which had been commenced by the brothers Abel. They were completed by Cólin, with the help of assistants, in three years, for on one side of the monument is 'Alexand. Colinus Mechliniensis, sculpsit, anno 1566.'

The sculptures consist of twenty-four marble tablets, fixed into the four sides of the tomb, and record all the principal acts and victories of the emperor Maximilian. The figures are small, but they are executed with great skill and extreme care. The tomb is surrounded by twenty-eight colossal bronze statues of heroes of the middle ages: it is altogether one of the most magnificent monuments in Europe, and has often been mentioned in the very highest terms by old and modern travellers. The bronze statues were executed by a founder of the name of Hans Lendenstreich, and Godel and Löffler, two other Tyrolese sculptors and founders. Colin executed also the two monuments of his patron the archduke Ferdinand of the Tyrol and his first wife Philippa, in a chapel in the Hofkirche at Innsbruck: the latter bears the date of 1581. They are both extremely costly and elaborate works. There are other works by Colin in Innsbruck and its vicinity; some in wood, and of very minute and excellent workmanship. He was court sculptor to the emperor Ferdinand I. and to his son the archduke Ferdinand of the Tyrol, and died at Innsbruck in 1612.

(Von Lemmen, *Tirolisches Künstlerlexikon.*)

COLLATIO, or MOSAICARUM ET ROMANARUM LEGUM COLLATIO, or LEX DEI, is a compilation, probably made in the sixth century of our æra. It consists of a comparison between the Law of Moses and the Roman Law, in sixteen titles. Each title has certain legal rules at the head from the Law of Moses, headed thus, 'Moses dicit;' to which are subjoined, by way of comparison, rules of Roman law taken from the five Roman jurists—Papinian, Paulus, Gaius, Ulpian, and Modestinus—and from the three compilations which preceded that of Justinian—the Gregorianus Codex, Hermogenianus Codex, and Theodosianus Codex. The value of the Collatio consists solely in the extracts which it contains from the source above mentioned. The last and best edition of the Collatio is by Blume, in the Bonn edition of the Corpus Juris Ante-Justinianei, and in the separate edition of 1833, 8vo. The first edition is by P. Pithou, Paris, 1573, 4to. It is also printed in Schulting's Jurisprudentia Vetus Ante-Justinianea, Leyden, 1717.

COLLE, RAFFAELLINO DAL, a celebrated Italian painter, born at Colle, near Città San Sepolcro, but in what year is not known, generally considered as one of the scholars and assistants of Raphael in the Farnesina and in the Vatican; but he was certainly, according to Vasari, the assistant of Giulio Romano in Rome, and probably at Mantua, and also of Vasari himself at Florence in 1536, upon the occasion of the visit of Charles V., when Vasari had the direction of the decorations ordered by the authorities in honour of the emperor's visit. As Vasari did not write the life of Raffaellino, little is known about him. He appears to have been chiefly employed in the neighbourhood of Città San Sepolcro, at Urbino, Perugia, Pesaro, Gubbio, Cagli, and Città di Castello, in which places he executed several fine altarpieces, which still exist, and exhibit him as one of the best disciples of the Roman school. Notwithstanding his own reputation, he did not disdain to enter into the service of Vasari in 1536, when he made, from the designs of Bronzino, cartoons for the tapestries of Cosmo I. Another more striking instance of humility, or good fellowship, is recorded of him, which happened at San Sepolcro: Il Rosso arrived in the city at a time when Raffaellino was about to execute a work which he had undertaken to paint, and he surrendered his commission to Il Rosso as a mark of his esteem for his ability. The date of his death is not known.

(Lanzi, *Storia Pittorica*, &c.)

COLLISION, or PERCUSSION OF BODIES, is that part of Dynamics in which are contemplated the effects arising from the impact of a moving body on one which is either at rest or in motion.

The effects will evidently depend upon the directions of the motions, with respect to a line joining the centres of gravity of the two bodies, and upon the natures of the bodies themselves. If the directions coincide with such line, the bodies having spherical forms, so that the point of contact may be in the same line, and the plane of impact perpendicular to it, the impact is said to be direct; but if the directions are otherwise, the impact is said to be oblique.

All bodies in nature have certain degrees of softness by which their particles yield to the force of impact: all have at the same time certain degrees of hardness by which they resist the effort to penetrate each other; and they have certain degrees of elasticity by which their particles, after being displaced, tend to recover their original positions: these properties exist in bodies in different degrees.

In the case of direct impact, the body struck, if previously at rest, is put in motion; and, if in motion, its movement is merely accelerated or retarded; but in the case of oblique impact, both bodies being in motion, their velocities and the directions in which their centres of gravity were moving are changed, and there may be produced rotatory motions about those centres.

When a body in motion strikes another, whether at rest or in movement, the particles of the first body, at the place of contact, have their forward motions retarded; in consequence of which the particles immediately behind approach closer to those in front than they were before the impact, and thus a condensation takes place. This condensation gives rise to an exertion of the force of elasticity, which acts against the succeeding particles, retarding the motions of these last and giving rise to a new condensation and a new exertion of elasticity against the next succeeding particles; and so on. The like actions must be understood to take place in the body struck; and these actions continue in both bodies till the latter have attained the state of greatest compression; when, for a moment, both may be conceived to move with a common velocity. After this, the force of elasticity overcoming the force of compression, the particles of both bodies gradually return to a permanent state; which, if the elasticity were perfect, would be the same as that in which they were before the impact: the force of restitution thus causing the bodies to separate as if repelled from each other. A certain interval of time elapses between the instants of first contact and separation, but this is so short as to be scarcely sensible.

If the striking bodies have spherical forms so that the contact may take place, at the first instant, in a point, their surfaces about that point will have their figures changed; and if the bodies have different degrees of hardness, an indentation may take place in that which is the least hard, the other penetrating to a certain distance in it. When the bodies are soft, like balls of wet clay, the change of figure produced by collision is manifest; but when two balls possess an elasticity which is nearly perfect, they so far recover their original figure after impact, that the change is not perceptible: it may be rendered evident however on covering one of the spheres with ink and suffering it to impinge on the other, the latter then receives a stain which, instead of being a point, is a circle of sensible magnitude; and this proves that the surfaces must have been flattened at the point of impact.

In order to account for the effect of percussion in impelling a body, a wedge for example, being much greater than that of mere pressure, it may be observed that both effects depend on the product of the mass of the impelling body and its velocity: but, when a body moves in consequence of pressure, the velocity is extremely small; therefore, in order that the effect of simple pressure may be equal to that of percussion, the mass imposed must be very great. It is evident, however, from what has been said, that the two forces are of the same nature. It should be added, here, that the shock produced in a material, when divided by a wedge, or penetrated by a nail, either of these being driven with a force produced by a sudden blow of a hammer may, by displacing the particles of the material, diminish their cohesive power; and this may be, in part, the reason that the effect of percussion often exceeds that of a weight many hundred times greater than that of the hammer.

The force of elasticity is very different in different bodies: spheres of glass are those in which the force of restitution (after impact) approaches nearest to the force of compression; and, in such spheres, the ratio between the forces is as 15 to 16: in spheres of ivory the ratio is as 8 to 9; and in spheres of steel, as 5 to 9. In investigations relating to collision the force of elasticity is represented by a fraction whose numerator and denominator have to one another the ratio of the force of restitution to that of compression; and, if a body were perfectly elastic, this force would, of course, be represented by unity.

The bodies upon which experiments on collision are usually made are generally of a spherical form; in order that when they impinge upon one another directly it may be indifferent at what part of the surfaces of the bodies the contact takes place: the bodies are usually suspended by a string or rod from fixed points; and they are made to impinge upon one another while describing circular arcs, in a vertical plane, about the point of suspension. The absolute momentum, or quantity of motion in a body, is represented by the product of its mass and the velocity with which it is moving: but the effects of the collision of two bodies depend on their relative velocity, or that with which they approach to, or move from, one another; this is, the sum of the absolute velocities when the bodies, in approaching each other, move in opposite directions, and the difference when they move in the same direction.

The formulæ for the velocities of two bodies, elastic or inelastic, after collision, may be readily determined by the following process:—Let m and m' be the masses of two bodies in motion with different velocities and in the same direction: let V and V′ be the velocities at the moment of impact; v and v' the velocities after impact. Then mV and $m'V'$ will be the momenta of impact, mv and $m'v'$ the momenta after impact. Also let P represent the force of percussion, or the momentum lost by the striking body and gained by the body struck in consequence of the impact. Then $\frac{mV - P}{m}$ and $\frac{m'V' + P}{m'}$ will express the accelerative force of impact; and, by Dynamics, these are respectively equal to $\frac{dv}{dt}$ and $\frac{dv'}{dt}$ (t being the duration of the shock).

From the equations thus formed we have by addition,

$$mdv + m'dv' = (mV + m'V')\,dt.$$

This being integrated, and the constant determined by the condition that when $t = 0$, $v = V$, and $v' = V'$, we get

$$m\,(v - V) + m'\,(v' - V') = (mV + m'V')\,t;$$

or, considering the second member as zero on account of the smallness of t, we obtain

$$v = \frac{mV + m'V' - m'v'}{m}, \text{ or } v' = \frac{mV + m'V' - mv}{m'} \quad . \; . \text{ (A)}$$

When the bodies are inelastic, they move together, after impact, with the same velocity: in this case $v = v'$; consequently

$$v = \frac{mV + m'V'}{m + m'}.$$

From the above equations for $\frac{dv}{dt}$ and $\frac{dv'}{dt}$ there may be obtained that which has been designated, for the collision of perfectly elastic bodies, the 'Preservation of Active Forces.' Thus, subtracting the latter from the former, we have

$$dv - dv' = \left(\frac{mV - P}{m} - \frac{m'V' + P}{m'}\right) dt:$$

but, if m follow m', and move with greater velocity, the space described by the former during the shock will be equal to the space described by the latter in the same time together with the depths of the two impressions. Let s and s' be the spaces, x and x' the depths of the impressions for the two bodies respectively; then

$$s = s' + x + x' \text{ and } ds = ds' + dx + dx':$$

but, by Dynamics, $v = \frac{ds}{dt}$ and $v' = \frac{ds'}{dt}$;

whence $dt = \frac{dx + dx'}{v - v'}$.

Representing the coefficient of dt in the above equation by X, and substituting this value of dt, the equation becomes

$$(v - v')\, d\,(v - v') = X\,(dx + dx');$$

which being integrated, gives

$$\tfrac{1}{2}\,(v - v')^2 + \text{const.} = \int X\,(dx + dx').$$

But, at the commencement of the shock, when $x = 0$ and $x' = 0$, the velocities are V and V′; therefore the complete integral is

$$\tfrac{1}{2}\,(v - v')^2 - \tfrac{1}{2}\,(V - V')^2 = \int X\,(dx + dx').$$

Again, at the end of the shock, $x + x' = 0$, and the second member of the equation is zero; therefore

$$v - v' = \pm\,(V - V').$$

In this equation substituting first the value of v, and subsequently the value of v' (at (A) above), we get

$$v' = \frac{2mV \pm (m'V' - mV')}{m' + m} \text{ and } v = \frac{\pm 2m'V' + mV - m'V}{m' + m} : .(B)$$

Note, the lower signs are to be used when the bodies move in contrary directions. After squaring these equations, if the first result be multiplied by m' and the latter by m, we shall obtain, by addition,

$$mv^2 + m'v'^2 = mV^2 + m'V'^2;$$

which is the equation alluded to. It must be observed that the equation does not hold good when the bodies are inelastic; in this case there is always a loss of active force by collision.

By making $V' = 0$ in the equations for v and v' (at (B) above) we may obtain the velocities of two elastic bodies after impact, when the body struck was previously at rest; and in this case, if $m = m'$, or the bodies have equal masses, it will be found that, after the impact, the striking body remains at rest and the body struck moves with a velocity equal to that of the former body at the instant of impact; it follows that, if several equal spheres are placed in contact in one straight line passing through all their centres; on causing the first to be struck by an equal body moving in the same line, the effects of the impact will be destroyed in all the bodies except the last, which will move with a velocity equal to that of the striking body.

It is easy to prove by Dynamics, that the velocity of the common centre of gravity of two bodies m and m' before impact is expressed by $\frac{mV + m'V'}{m + m'}$, and after impact by $\frac{mv + m'v'}{m + m'}$: but, from the above equations at (A) or (B) we have

$$mv + m'v' = mV + m'V':$$

hence it follows that the velocity of the common centre of gravity of two bodies is not altered by collision.

If two spherical bodies move in any plane in different directions and come in contact with each other, their motions after collision may be determined by the parallelogram of forces. Each velocity at the moment of impact being resolved into two, one in the direction of a line joining the centres of the spheres, and passing through the point of contact, and the other in a direction at right angles to this line; the velocities of the bodies in the latter direction will, after the impact, be the same as before; and the velocities, after impact, in the direction of a line joining the centres may be found by the formulæ above for v and v', from the resolved velocities in the same direction before impact. Consequently, compounding these velocities, in the two directions, for each body, there is obtained the velocity of each body and the direction of its motion after the impact.

If an elastic spherical body impinge in any direction on a plane, the movement of the body after impact may also be determined by the parallelogram of forces. For the reaction of the plane being supposed to be in a line perpendicular to the plane, and passing both through the point of contact and the centre of the sphere, also the force of elasticity in the reaction being known; let a line in the direction of the ball's motion before impact be taken to represent its velocity, and let it be resolved into two velocities passing through the centre of the ball, one perpendicular to the plane and the other parallel to it: then, after impact, there may be conceived to exist two forces, one parallel to the plane and (neglecting friction) equal to the resolved force in the same direction before impact, and the other perpendicular to it, being the force of recoil (which if the elasticity were perfect would be equal to the force perpendicular to the plane before impact); therefore, by composition, the velocity and direction after impact may be obtained. It is evident that, in the case of perfect elasticity, the angles of incidence and reflexion are equal to one another. On this principle may be found the direction in which a ball must be impelled that, after reflexion from a plane or from any number of given planes, it may strike an object.

For investigations concerning the magnitude of the impression on a body struck, the duration of the shock, and the ratio of percussive force to that of gravity, see Atwood's 'Treatise on Motion,' Gregory's 'Mechanics,' and Whewell's 'Mechanics.' Also, for the effects of the collision of bodies, whatever be their forms, see Poisson's 'Traité de Mécanique,' No. 465, &c., seconde edition.

COLLISION OF SHIPS. [Ships, P. C., p. 402.]

-COLLO'MIA (from κόλλα, glue), a genus of plants belonging to the natural order Polemoniaceæ. It has a campanulate calyx, 5-cleft or somewhat 5-parted; the lobes lanceolate or linear, equal, entire; the corolla salver-shaped, with a slender exserted tube, and a spreading 5-parted limb; the segments oblong, entire; the stamens inserted towards the middle of the tube; the anthers ovate-roundish; the cells of the capsule 1-2-seeded. The species are annual herbs, with alternate leaves and dense heads of flowers. They are all natives of America.

C. linearis is an erect branched plant, clothed with glandular hairs; the leaves ovate lanceolate, quite entire, opaque reniform, the upper ones downy beneath; the calyx cup-shaped, 5-parted; corolla more than twice as long as the calyx; the cells of the capsule 1-seeded. This plant is a native of North America, from Lake Winnepeg to the Western Ocean. The corolla has a reddish tube and a rose-coloured limb. The seeds of this as well as the other species are covered with a testa, which is composed of a spiral tissue held together by inspissated mucus. On the seeds being placed in water the gum of the mucus is dissolved and the spiral fibres start up on the surface of the seed.

The species of Collomia are showy plants, and may be easily cultivated in any common garden soil. The seeds should be sown in an open border in spring.

(Don, *Gardener's Dictionary*.)

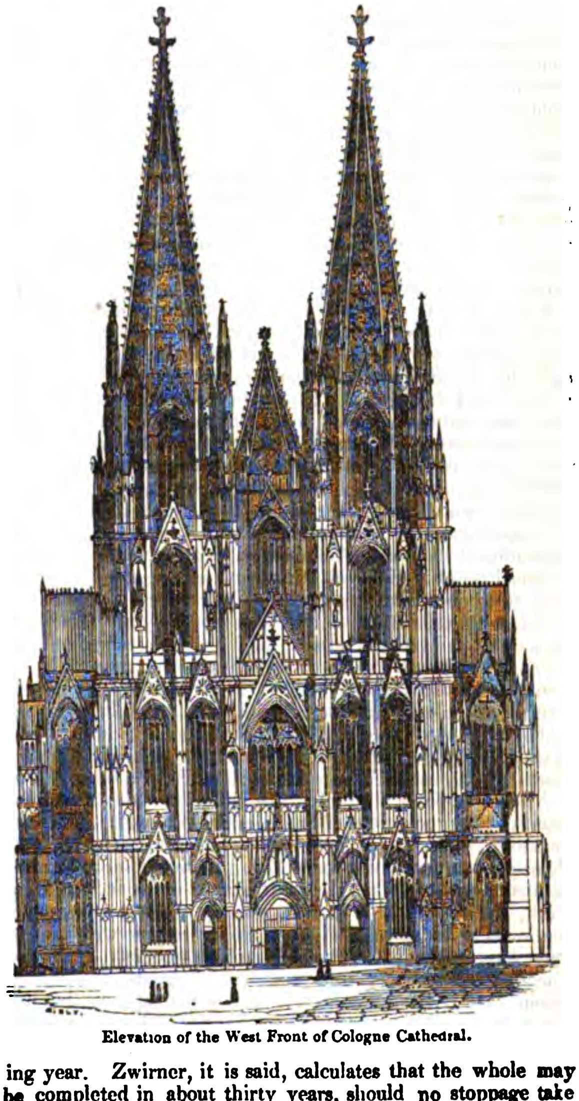
COLLUMPTON. [Devonshire, P. C.]

COLOCYNTHUS. [Cucumis, P. C.]

COLOGNE CATHEDRAL. The resumption, after the lapse of four centuries, of the works of this colossal edifice, and most celebrated monument of German Gothic architecture, with the intention of fully completing it on the scale originally proposed, is an undertaking not only so vast in itself that it would formerly have been treated as a chimerical project, but one that would have been scoffed at as an insane attempt to revive and reinstate a barbarous style from which the progress of art and good taste had at length emancipated Europe. The time is not very remote when the study of Gothic architecture was looked upon as a merely antiquarian one, for which the professional man had no occasion, and the public no sympathy, whereas it has now become popular, and the taste for it a passion. To the former neglect, if not spoliation and destruction of Gothic edifices, or if not neglect, the tasteless disfigurement of them by modern additions and improvements, has succeeded a degree of veneration and zeal for them which is one of the characteristics of the nineteenth century. Cologne is by no means a solitary instance of the kind: the work of restoration and completion has been going on for some time upon the Continent. In Germany the cathedrals of Bamberg, Magdeburg, and Regensburg (Ratisbon) have been restored or embellished, and that of Speyer (Spires) is about to be similarly treated, and also that at Aachen (Aix-la-Chapelle). In France, the abbey church of St. Denis has been reinstated in its pristine magnificence—its walls and pillars, statues and sculptures, profusely decorated with gilding and colours. Even in Italy some attention is beginning to be paid to monuments of mediæval architecture: the interior of the Duomo of Florence has lately undergone complete repair (1838) by Baccani, and it is now at length seriously intended to complete the exterior of that structure by erecting a façade. As to what has been or is being done here at home, it will suffice to mention in evidence of the movement in favour of our olden architecture and art—the interior of the Temple church in London, and the new Palace of Westminster.

The structure which preceded the present cathedral of Cologne was founded by Charlemagne in the ninth century, and erected 816-71. Three centuries afterwards it acquired great repute throughout Christendom, for possessing the relics of the so-called Three Kings or Magi, which had been brought from Milan by the Emperor Frederic Barbarossa when he took that city by storm, in 1170; and highly improbable, not to say utterly impossible, as it was that the bones of all those three persons should ever have been collected together and brought over from the East, the legend was a profitable one for Cologne: the city became the resort of pilgrims from all parts of Europe, and most costly presents were offered up at the shrine of the Three Kings. During this prosperous state of affairs for both the place and the church, the structure itself suffered greatly by a fire which broke out in the adjoining one of St. Mary, about 1220, and destroyed both the towers of the cathedral, which were only of timber; wherefore it was determined by the then archbishop Engelbert to erect a new edifice, but his death shortly after (1225) frustrated the scheme for many years, till it was revived by Conrad von Hochstaden (archbishop from 1237 to 1261), and accelerated by the occurrence of another fire in 1248, the 15th of August of which year is recorded as the date of the laying the foundation stone of the new edifice. Who was the architect who conceived a pile upon such an extraordinary scale both as to magnitude and magnificence, will probably ever remain an historical enigma. That honour has been claimed by some for a certain Gerard von Trond, but though there is direct evidence of his having been honourably rewarded for his services, by the chapter, in 1257, it is exceedingly doubtful whether he was more than the superintendent of the works. The design itself has been attributed by some to the celebrated Albertus Magnus (1193—1280), who is said to have been no less eminent as an architect than as a schoolman, and to have erected the choir of the Dominican church at Freiburg and that of the Dominican church at Cologne. Of so colossal a pile the mere foundations and substructure—extending in some places to the depth of fifty feet—were a gigantic work, and the further advance of the building was retarded for many years by dissensions between the archbishop and the citizens, by the papal interdict on Cologne, and the removal of the episcopal residence to Bonn. It was not until the close of the century that the works were resumed, but when they were, they were prosecuted with energy, and the choir was consecrated and opened for service, September 27, 1321. But it was not long before the zeal began greatly to relax: there were complaints of gross peculation on the part of those who had the administration of the funds furnished by the pious; and another cause of hindrance was that fresh dissensions broke out between the clergy and the townspeople. In the meanwhile however much was done in adorning the choir and its chapels, and among other sumptuous embellishments were the statues of the twelve apostles, of silver gilt. This part of the edifice, at least that forming the sanctuary and containing the shrine of the Three Kings, had a narrow escape from destruction in October, 1434, when a violent hurricane flung down one of the largest pinnacles, an enormous mass of stone, from the east end of the church, which not only crushed in the vault of that chapel, but injured the shrine itself. This was of course attributed to the malice of the Evil One, who had left the imprint of his talons on the stone itself. The occurrence seems to have been ominous, for about three years afterwards (1437) the works came to a stop when the southern tower of the west front had been carried up about 200 feet, or the intended height of the nave, but not half its own altitude. From that period all idea of continuing the fabric seems to have been abandoned. The choir was suffered to remain a stupendous fragment at one end, and the tower another at the opposite extremity. Nothing further was done until about the middle of the last century (1743-5) when it had become necessary to put the choir into repair. All that was then and afterwards done, further than absolute necessity required, was of more injury than service, for there existed neither feeling for nor intelligence of Gothic architecture, and accordingly all the alterations were in a vile and discordant taste.

Whatever regret may have hitherto been felt at the condition of a structure so glorious even in its incomplete and maimed condition, it has perhaps been a piece of singular good fortune for Cologne cathedral that no earlier attempt was made to complete it after the decline of the Gothic style, for in that case it would almost to a certainty have proved a very heterogeneous mass; whereas now, we, or at least our posterity, may behold an edifice as thoroughly consistent throughout, if not more so than had it proceeded without interruption for a century later. In 1816 Schinkel was commissioned by the present king, then Crown-Prince of Prussia, to survey and report upon the condition of the cathedral; and in 1824 the restoration of the choir was begun by Bau-inspector Ahlert of Cologne. In 1829 he commenced the repairs of the exterior of the choir and its flying buttresses. Ahlert died in 1833, and was succeeded by Ernst Zwirner (the restorer of the abbey of Altenberg near Cologne), who has prosecuted his important task with earnest affection, and with a most scrupulous fidelity to the character of the original work in regard to the execution of the details. After the interior of the choir had been fully reinstated by him, and embellished with carving and statues, polychromy and gilding, the first stone of the *Neu-bau*, or works for completing the rest of the structure, was laid with great solemnity by the King of Prussia, September 4th, 1842, since which considerable progress has been made with them, four compartments of the south aisle having been finished in 1843, and three others in the following year. Zwirner, it is said, calculates that the whole may be completed in about thirty years, should no stoppage take



Elevation of the West Front of Cologne Cathedral.

place; yet considering the enormous mass of the two western towers, and their height, 500 feet from the ground to the summit of their spires (several feet loftier than those of Strassburg or Vienna), the promise seems a bold one. Fortunately the original design for the façade is still in existence: in 1814 an old parchment roll, three feet wide and fifteen in length, which had been found concealed in a garret-loft, was brought to Moller, the architect, and well known author of the 'Denkmale Deutscher Baukunst,' who on examining it found it to be the elevation of the portal and north tower of the façade of Cologne, masterly drawn, and in excellent preservation. Only two years afterwards, Sulpiz-Boisserée (who has published a magnificent work on Cologne cathedral) had the good fortune to discover at Paris the drawing for the other tower, also upon parchment, but in less satisfactory condition. Though it shows no more than the general composition and principal features of the west front as intended to be executed, the cut is, so far, a useful illustration of the building, which is all that can be expected upon a scale of not more than an inch to 100 feet. One thing to be observed in regard to it is that it is not a view, but an *elevation*, consequently more is shown than belongs to the front itself, namely the transepts projecting out beyond the body of the structure, and the smaller central tower and spire over the intersection of those main divisions of the plan, and which therefore will not be visible at all in a direct front view of the west façade. The lower part of this front is in five divisions, corresponding with those of the interior,—a central nave and four lateral aisles, which arrangement is continued around the choir, with this difference, that at the east end of the latter what would else be the outer aisle is divided into seven distinct chapels surrounding the polygonal portion, or apse. The principal dimensions of the edifice are nearly as follows: Exterior, extreme length 500 feet; breadth of nave and choir, including buttresses, 200 feet; length of transept 300; breadth of transept 140; height of transept tower, and spire, 340; of west ditto, 500; extreme height of roof and gable of west front, 210. Interior: extreme length, exclusive of west towers, which are distinct from the nave, 380; length of nave to transept, 175; ditto to choir, including transept, 230; of choir from transept to altar end, 115; width of centre aisle of nave and choir, 50; height of ditto, 180. From this it will be seen that the proportions express stupendous loftiness to such a degree as to occasion deficiency of length. Compared with its height, the exterior of the nave for instance, between the west tower and transept, is exceedingly short, and there is an evident want of greater expanse as to length.

COLONIAL AGENTS. Most of the British colonies have agents in England, whose duties do not appear to be very accurately defined. The act of 1843, appointing an agent for Jamaica, recites, 'that it is necessary the inhabitants of this island should have a person in Great Britain fitly qualified and fully empowered to solicit the passing of laws and to transact other public matters committed to his care for the good of the island.' In this case the salary of the agent is 1000*l.* per annum. A person called 'the agent-general' acts for the crown colonies; but where there is a local legislature the appointment is generally made by it. Previously to the separation of the North American colonies, most of them had a special agent in England for the management of their affairs, to whom a salary was given. They were appointed by the Assemblies, and sometimes confirmed by the governor. Sometimes, as in Massachusetts, the legislative council and the Assembly had each its own agent. The persons generally selected were distinguished lawyers or merchants, usually the former, and often members of parliament. William Knox, under-secretary of state, was agent for Georgia in 1764; John Sharpe, M.P., was agent for Massachusetts in 1755; Charles Garth, M.P., acted for South Carolina from 1765 to 1775, and his correspondence during this period contains a full account of the proceedings of the Imperial Parliament. Richard Jackson, M.P., acted for Connecticut, Massachusetts, and Pennsylvania, about the year 1774. Edmund Burke was appointed agent, by the House of Assembly alone, for New York, December 21, 1770, with a salary of 500*l.* a year, and continued to act until 1775, when all intercourse with the colony was suspended. The House of Assembly of Lower Canada several times appointed special agents, the last of whom was Mr. Roebuck, M.P., who in that capacity, but not at the time an M.P., was heard at the bar of both Houses of Parliament in opposition to the Bill to suspend the constitution of Lower Canada.

(Pamphlet *On the Nomination of Agents formerly appointed to act in England for the Colonies of North America*, 1844.)

COLONNA, FRA FRANCESCO, a learned Dominican and architectural writer of the fifteenth century, was author of a very singular, strangely rhapsodical, mystical, and fantastical work, with the equally fantastical title of 'Hypnerotomachia Poliphili,' first printed by Aldus in 1499. This extraordinary production, which is a sort of romance, or rather vision, interwoven with descriptions of imaginary edifices, has drawn forth the most opposite opinions, being treated as contemptuously by some as it has been extravagantly extolled by others. While Milizia, Nagler, and many more speak of it as a mere tissue of absurdities, others, who ought to be competent judges of it in that respect, praise it as a work highly deserving to be studied by architects. As such the present Professor of Architecture at the Royal Academy earnestly recommended it in one of his recent lectures (1845), representing it to be equally calculated to inspire with a passion for architecture, as Robinson Crusoe with a yearning after adventures from sea. From this it would naturally be inferred that the work must be at all events attractive and engaging, and abound with highly graphic and picturesque descriptions; whereas it is precisely the reverse,—so obscure in many parts as to be scarcely intelligible at all, and written in a Babel jargon of Italian, Latin, and other languages and dialects. He must be exceedingly clever, observes Tiraboschi, who can, I will not say understand the book, but even tell in what language it is composed. Apostolo Zeno again says of it, 'Some persons fancy that it contains many profound mysteries of science and knowledge, and have accordingly studied it, if with no great profit, certainly with vast patience.'

Another edition of the 'Hypnerotomachia' was published at Venice by the younger of the Aldi in 1545. It has been twice translated into French, first by Beroalde de Verville (folio, Paris, 1600); and again by the architect Legrand, under the title of 'Songe de Polyphile,' in two volumes, 12mo. printed by Didot, 1804, and reprinted by Bodoni in a splendid quarto, 1811. Legrand intended to illustrate it by a separate atlas of engravings to it, which had they appeared would doubtless have been of very different character from the wood-cut figures of the original and the copies from it. Those in Beroalde de Verville's translation are said to have been designed by no less an artist than the celebrated sculptor Jean Goujon; but as far as they are at all architectural in their subjects, which is the case with but few of them, they do not materially differ from the earlier ones, and like them are so exceedingly rude as to drawing and design, that they are now more likely to disgust than attract those who, in consequence of the laudatory character given by some to the work, might turn to it with the hope of deriving an architectural treat from it. Among those who hold it up for admiration is Temanza [TEMANZA, P. C.], who speaks of it at considerable length in his Life of Colonna.

After this bibliographical notice of the singular work which has obtained for him so much repute of contradictory kinds, the history of the writer himself may be briefly told. He was born at Venice about the year 1433, and in his youth fell in love with Ippolita, the niece of Teodoro Lelio, bishop of Trevigi, in the Venetian territory; and she is the lady whom he has celebrated under the abridged name Polia, in his allegorical romance, and who is supposed to have died shortly after her uncle, in 1466. Colonna then took the Dominican habit, and entered the monastery of Santi Giovanni e Paolo at Venice, where he died in July, 1527, at the age of ninety-four.

COLOPHO'NIA, (in French the wood is called *Bois de Colophone*,) a genus of plants belonging to the natural order Burseraceæ. It has an urceolar bluntly 3-lobed calyx; five roundish-ovate petals inserted under the disk, imbricated in the bud; six stamens, one-half shorter than the petals, equal in length to the calyx; the disk 6-lobed. It is to a genus thus defined that De Candolle refers the tree producing the *Bois de Colophone* of the Isle of France, and calls it *C. Mauritiana*. In his description of the tree, he says the fruit is unknown. Lindley, in his 'Flora Medica,' gives *Colophonia Mauritiana*, De Cand.; *Bursera paniculata*, Lam.; *Amyris Zeylanica*, Retz; and *Balsamodendron Zeylanicum*, De Cand., as synonymes of *Canarium commune*. This last is described as a small tree, with 7-11 leaflets on long stalks, ovate-oblong, acute or shortly acuminated, quite entire, smooth; stipules oval; the panicles of flowers terminal, divaricating; the flowers 2-3 together, almost sessile, when young covered over by broad ovate concave silky bracteola the calyx silky externally; the drupes oblong, black. The bark of this plant yields a limpid oil, with a pungent turpentine smell, which congeals into a buttery camphoraceous substance. It possesses the same properties as Copaiba. Don says, 'When the nuts are mature they contain a sweet kernel, which does not become rancid, and which resembles a sweet chesnut; they are eaten both raw and dressed by the inhabitants of the Moluccas, Banda, and New Guinea; and an oil is expressed from them, which is used at the table when fresh, and for lamps when stale; bread is also made from them, cakes, biscuits, &c., for the table. Eaten fresh they are apt to bring on diarrhœas and dysenteries, and to occasion an oppression at the breast.' The same tree is also said to yield East Indian Elemi. It is a native of the continent of India, and of the islands of the Eastern Archipelago.

(Don, *Gardener's Dictionary*; Lindley, *Flora Medica*.)

COLOUR, ACCIDENTAL. [ACCIDENTAL COLOUR, P. C. S.]

COLOURS, COMPLEMENTARY, are such as being blended together give rise to the perception of whiteness.

Sir Isaac Newton having, in a dark room, received upon a glass prism a pencil of light from the sun, intercepted the refracted pencil by a glass lens; then on placing a screen of white paper, at first immediately beyond the lens, he observed that the solar image was strongly tinted with all the prismatic colours, violet, indigo, blue, green, yellow, orange, and red [DISPERSION, P. C.]: on removing the screen farther from the lens, the different bands of colour approached towards the axis of the latter; and at the focus of the lens, by the complete mixture of the colours, a white spot was formed. Afterwards, on intercepting at the surface of the lens the violet, blue, and green rays, the spot on the screen ceased to be white, and assumed a colour compounded of the yellow, orange, and red rays which remained: again, on intercepting the red and violet rays, the colour became compounded of the remaining rays, yellow, green, and blue, and so on.

Thus, if a tint complementary to any one of the seven prismatic colours were required, so that by the mixture of the two a perfect whiteness might be produced, that tint should be compounded of the six which remain when the given colour is removed; but a degree of whiteness which approaches as near the perfect state as may be in general necessary is obtained by the mixture of blue, yellow, and red; and consequently a colour complementary to one of these may be produced by the mixture of the two others merely. The colour complementary to red is therefore a green composed of yellow and blue; that which is complementary to orange (a mixture of red and yellow) is blue: the colour complementary to yellow is violet, which is compounded of red and blue. The corresponding colours in the columns of reflected and transmitted tints [COLOURS OF PLATES, P. C. S.], among which are black and white, the former resulting from the absence of all reflected or transmitted rays, are complementary to one another.

If a circular plate of metal or of stiff cardboard be divided, by lines drawn from the centre, into seven sectors whose breadths are proportional to the numbers 125, 75, 133, 167, 167, 111, 222, which are nearly the proportions that the breadths of the several bands of colour, beginning with the red, bear to one another in the solar spectrum; and these spaces be coloured conformably to those bands; upon making the plate revolve rapidly about an axis passing through its centre, white light will be produced by the blending of the several coloured rays. Again, if any one of the sectors be covered with black paper; on making the plate revolve, the colour of the light produced by the rays from the uncovered sectors will be complementary to that of the former sector.

COLOURS OF PLATES are those variously tinted rings or bands which appear when light is transmitted through or reflected from the surfaces of a lamina formed of any transparent medium. When the laminæ are extremely attenuated, the colours are said to be those of 'Thin Plates;' if the thickness exceeds a tenth of an inch, they are designated the colours of 'Thick Plates:' and when between two plates of glass there is interposed a film of some liquid, the colours are called those of 'Mixed Plates.'

The colours of thin plates were first examined by Sir Isaac Newton; and this philosopher, in order to observe them conveniently, placed two convex lenses of long foci (14 and 50 feet) in contact with each other at their vertices, keeping them together by means of three clamps at intervals on their circumferences, so that there was between them a very thin plate of air concave on its upper and lower sides. On bringing the pair of lenses to an open window, and receiving the rays of light from the sky by reflexion from them, there were observed, the plates being gently pressed together, seven series of coloured rings or bands about a black spot in the centre: beyond the seventh band the colours could scarcely be distinguished. The diameters of the bands being measured, where the colour in each was the brightest, Newton found that those diameters were proportional to the square roots of the series of odd numbers 1, 3, 5, 7, &c.: at the places where the colours were the least bright, the diameters were found to be proportional to the square roots of the series of even numbers 2, 4, 6, 8, &c. The radii of the curvatures of the lenses being known, Newton computed the thicknesses of the plate of air at the circumferences in which the colours of the bands had the greatest and least degrees of brightness; and he found (*Optices*, lib. ii.) that, at the most luminous part of the ring nearest to the centre, the thickness was equal to $\frac{1}{178000}$ inch: the thickness at the most obscure part of that ring was equal to $\frac{2}{178000}$ inch. Hence, from the law above mentioned, the thicknesses of the air at the most and least luminous parts of the succeeding rings may be obtained; those thicknesses being considered as proportional to the semidiameters of the rings.

If lenses whose surfaces have different curvatures are employed, it is always found that like tints are produced in the circumferences of circles at places where the intervals between the surfaces are equal, the eye being similarly situated, or a line supposed to be drawn to it from the centre making equal angles with a plane passing through all the rings; and this circumstance serves to show that the tints depend wholly on the distances between the lenses. If the angle made by the line drawn to the eye be diminished, the diameters of the rings will be increased, the tints remaining the same; and Newton has given a rule for determining, when the angles of incidence are oblique, the interval between the lenses at the place where any particular tint is produced.

When the rings are formed by homogeneous light they are found to be more numerous than when the light is mixed; they are also of the same colour as the light, and are separated from one another by narrow spaces which are quite black. The diameters of the rings in the corresponding bands, at the places where the colours are the brightest, are different when the bands are formed by homogeneous lights of different colours, being least when the light is violet, and greatest when red; and Newton computed, from the measured diameters of the rings of different colours, the intervals between the lenses at the places where the brightest parts of the first rings from the centre are formed: these distances are found to be equal to $\frac{1}{79250}$ inch for extreme red rays, and $\frac{1}{118000}$ inch for extreme violet rays, or to half the lengths of an undulation for the different kinds of light.

The order and the dimensions of the coloured rings are the same, whether air occupy the space between the lenses or whether the latter be in the exhausted receiver of an air-pump: but when a transparent medium, as water, of greater refractive power than air is interposed between them, the tints are fainter and the diameters of the rings are less; or smaller distances between the lenses are requisite in order to produce the same tints: it is ascertained that, with different media, these distances are inversely proportional to the refractive indices.

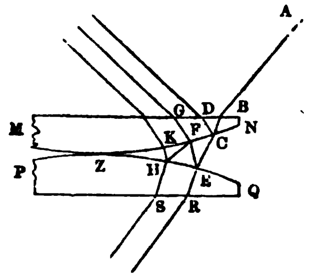
Corresponding rings of colour were observed by Newton in thin plates surrounded by media less dense than the plates: thus a bubble of soap-water exhibits, by the gradual subsidence of the fluid, rings of colour exactly conformable to those between glass lenses; and, before the bubble bursts, a dark spot, about half an inch in diameter, is formed at its upper part. The like phenomena have been observed in thin plates of mica and in bubbles of glass blown so thin as to burst.

Newton also examined and described the phenomena of the coloured rings or bands between lenses when the light is transmitted through the latter. These rings are less bright than those which are formed by reflexion; but when the obliquity of the transmitted rays to the plane of the rings is considerable they are sufficiently distinct: in the centre is a white spot, and the colours of all the rings are exactly complemental to those of the corresponding rings which are seen by the reflected rays. Newton's arrangement of the coloured tints in the first and second rings or bands, reckoning from the centre, is given in the following table, with the thicknesses of the plates of air, water, and glass, at the places where the tints are produced. The unit of measure is one millionth part of an inch.

Number of the Band.	Reflected Tints.	Transmitted Tints.	Air.	Water.	Glass.
I.	Very black	. .	$\frac{1}{2}$	$\frac{3}{8}$	$\frac{10}{31}$
	Black	White	1	$\frac{3}{4}$	$\frac{20}{31}$
	Nearly black	. .	2	$1\frac{1}{2}$	$1\frac{2}{7}$
	Blue	Yellowish red	$2\frac{2}{5}$	$1\frac{4}{5}$	$1\frac{11}{20}$
	White	Black	$5\frac{1}{4}$	$3\frac{7}{8}$	$3\frac{2}{5}$
	Yellow	Violet	$7\frac{1}{9}$	$5\frac{1}{3}$	$4\frac{3}{5}$
	Orange	. .	8	6	$5\frac{1}{6}$
	Red	Blue	9	$6\frac{3}{4}$	$5\frac{4}{5}$
II.	Violet	White	$11\frac{1}{6}$	$8\frac{3}{8}$	$7\frac{1}{5}$
	Indigo	. .	$12\frac{5}{6}$	$9\frac{5}{8}$	$8\frac{2}{11}$
	Blue	Yellow	14	$10\frac{1}{2}$	9
	Green	Red	$15\frac{1}{8}$	$11\frac{2}{3}$	$9\frac{5}{7}$
	Yellow	Violet	$16\frac{3}{7}$	$12\frac{1}{3}$	$10\frac{2}{5}$
	Orange	. .	$17\frac{2}{3}$	13	$11\frac{1}{6}$
	Bright red	Blue	$18\frac{1}{3}$	$13\frac{3}{4}$	$11\frac{5}{6}$
	Scarlet	. .	$19\frac{2}{3}$	$14\frac{3}{4}$	$12\frac{2}{3}$

This table, extended so as to include the seventh band of reflected tints, constitutes that which is called Newton's Scale of Colours.

It was to explain the phenomena of coloured rings or bands that Newton proposed the hypothesis of 'Fits of Easy Reflexion and Transmission' [UNDULATORY THEORY OF LIGHT, P. C., p. 511], and on that hypothesis the phenomena may be very satisfactorily accounted for. The following expressions for the places of the rings are, however, obtained from the principles of the undulatory theory.



Let MN PQ be two plates or spherical lenses, either plano or doubly convex, in contact with each other at Z; and let AB be the direction of a pencil, or of a wave of light incident upon the first or upper plate: this will be refracted in some direction as BC, and at the point C part of the pencil will emerge and fall on the other plate in some point E, where it will be partly transmitted through that plate in the direction ER, and partly reflected in the direction EF. Another part of the refracted pencil BC will be reflected at C in the direction CD, some of it emerging at D, and the rest being reflected back into the plate. The reflected pencil EF will also be, in part, transmitted through the upper plate in some direction as FG, and, in part, reflected in the direction FH: at the point H a portion will be transmitted in the direction HS, while another is reflected in the direction HK, and so on. Thus it is easy to perceive that the rays in the incident pencil will, by their interferences, produce the phenomena of coloured rings, both by reflexion and transmission, about the point of contact of the two lenses.

In Airy's 'Mathematical Tracts' (Undulatory Theory, article 65) it is shown that, if β be the angle of incidence at B, γ the corresponding angle of refraction, a the co-efficient of the formula for a vibration in the incident pencil, e the multiplier of the same co-efficient for the refracted vibration, and D the distance between the plates; the formula for the intensity of the reflected light is

$$\frac{4a^2e^2 \sin.^2 \frac{\pi}{\lambda}V}{(1-e^2)^2+4e^2 \sin.^2 \frac{\pi}{\lambda}V}$$

where $\pi = 3{\cdot}1416$, λ is the length of a wave, which, it may be observed, is equal to twice the length of a 'Fit' for each kind of light, and V represents 2D cos. β.

From this formula it is manifest that when $D = 0$, the intensity of reflected light vanishes, whatever be the value of λ; therefore, when two plates are in contact, and for a like reason when a soap-bubble is at the point of bursting, a black spot appears. The reflected light vanishes when $V = 0$, or when it has any of the values $\frac{2}{2}\lambda$, $\frac{4}{2}\lambda$, $\frac{6}{2}\lambda$, &c.; consequently, between two lenses, at distances from the point of contact whose squares are in the proportion of 2, 4, 6, &c., there will be dark rings. Also the intensity of the reflected light is greatest when $V = \frac{1}{2}\lambda$, $\frac{3}{2}\lambda$, $\frac{5}{2}\lambda$, &c., or when the squares of the distances from the point of contact are in the proportion of 1, 3, 5, &c.; and both these series of distances are conformable to observation. In the same tract (article 67) it is also shown that the intensity of light refracted through the second plate is expressed by

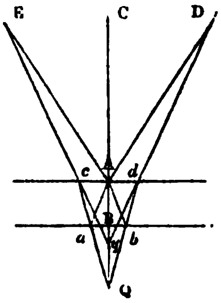
$$\frac{a^2\,(1-e^2)^2}{(1-e^2)^2+4e^2 \sin.^2 \frac{\pi}{\lambda}V}$$

The sum of the two expressions is always equal to a^2, which proves that the reflected and refracted tints are complementary to one another, conformably to observation.

Sir Isaac Newton also discovered that when a slender pencil of light issuing from the sun is reflected from the concave surface of a glass mirror of the kind called concavo-convex; on receiving the reflected pencil on a screen at the focus of the mirror, a hole being made in the screen to let the pencil pass through, four or five concentric rings of colour are produced: these are called the colours of thick plates, and they are similar to those which are formed by transmission through thin plates of air, as above mentioned. The reflected rings were produced whether the back, or convex surface, of the glass were silvered or not, but in the latter case they were very faint: they were not produced by reflexion from a metallic speculum.

When the light was homogeneous all the rings were of one colour, and the squares of the diameters of the most luminous parts of the rings were in the proportions of the numbers 2, 4, 6, &c., while the squares of the diameters of the darkest parts were as the numbers 1, 3, 5, &c. On using glass mirrors of different thicknesses, Newton found that the diameters of the rings were inversely as the square roots of the thicknesses of the mirrors.

The cause of these coloured rings, as explained by Sir Isaac Newton, is a scattering of the rays in a pencil of light when it enters a refracting medium, as glass, with a polished surface.



Thus, if a pencil of rays proceeding from C fall perpendicularly on the surface of glass, the greater part of the rays pass directly through the medium to B, and are reflected from thence back in the line BA to C; but many of the rays, on entering the glass at A, are scattered (on account of irregularities in the polished surface) in different directions, as Aa, Ab: these rays are reflected at the opposite surface of the glass in directions such as ac, bd, as if they came from a certain point Q; and, in passing from the glass to the air, they are refracted as if they came from a certain other point q; at the same time many of the rays reflected in the direction BA, on arriving at A, are scattered (as the incident rays were scattered at the same point) in different directions, as AD, AE, so as to meet the rays reflected from such points as a and b. Now, when the difference between the lengths of the lines diverging from A and Q is equal to a multiple of $\frac{1}{2}\lambda$, or half an undulation, the waves of light are in opposite phases, and consequently destroy each other's effects; while, in the intervals between these, coloured spaces form themselves by the mixture of the waves: as this takes place conically about the axis CA, it is evident that the interferences will form a number of concentric dark rings on a screen placed so as to receive the light at the places of convergence. If the medium from which the light is reflected be a concavo-convex mirror, it is evident that the interfering rays from a number of incident pencils diverging from the centre of curvature will cause the coloured spaces between the dark rings to have considerable brightness.

By an analysis which may be seen in the 'Treatise on Light,' by Sir John Herschel ('Encyclopædia Metrop.,' art.

670, &c.), it is shown, on the undulatory hypothesis, that the law of the diameters of the alternate bright and dark rings is conformable to that which was determined by Newton.

If a pencil of light from the sky pass through a circular aperture and fall nearly perpendicularly upon a plate of glass with parallel surfaces, and if after transmission the rays be allowed to fall on a plate of glass of equal thickness but inclined to the former at a small angle; the direct image of the aperture, after transmission through the second plate, will be free from colour; but, besides this image, there will be others which are produced by the light passing through the second plate after two, four, &c. internal reflexions. All these lateral images except the first are so faint as to be scarcely visible, but that first is observed to be traversed by fifteen or sixteen parallel fringes or bands; the three which are nearest to the centre consist of blackish and white stripes, and the others are bright bands of red and green light: the fringes are always parallel to the common sections of the surfaces of the plates.

These phenomena were first observed by Sir David Brewster, and an account of them is given in the 'Edinburgh Philosophical Transactions,' vol. vii. The cause is ascribed to the fact that some of the rays in the several reflexions, after traversing the plates and the interval between them, will differ so much in length of route as to be incapable of interfering with one another; while others will differ in this respect by very small quantities, and therefore, by their interferences, may produce colours. Sir John Herschel calls such bands *Isochromatic lines*, or lines of equal tint.

Dr. Young, looking at a luminous object through two plates of glass, having a little moisture between them (mixed plates) observed about it fringes of colour like those which are seen in thin plates; and he found, on receiving the rays reflected from the glass, that fringes were formed in the same directions as the others, but many times larger. When a lens of long focus was laid upon a piece of plate glass, with a little grease between them, he observed, on looking at the edge of a bright object, a series of concentric rings, in which the tints on one side of the diameter corresponding to the edge of the object were complementary to those on the other side: the diameters of the rings were found to vary with the refractive power of the fluid, diminishing as that power increased.

The fluids between the plates were water intermixed with globules of air, oil mixed with water, and the like; and Dr. Young ascribes the formation of the colours to the interference of the waves of light in consequence of the difference of velocity with which they move in the two different kinds of fluid between the plates.

COLQUHOUN, PATRICK, a statist and political economist, was born at Dumbarton on the 14th of March, 1745. He appears to have in his youth struggled with difficulties which prevented his receiving a liberal education. At an early period of life—apparently when he was little more than sixteen years old—he endeavoured to push his fortune in the colony of Virginia. In 1766 he returned to Scotland and settled in Glasgow, where he subsequently became instrumental in the establishment of a coffee-house or news-room, the Exchange, the Chamber of Commerce, and various other public institutions. He afterwards visited the Continent with the view of making his countrymen acquainted with the species of textile fabrics which would give our manufactures the best chances of success in the continental markets; and the subsequent rise and progress of our muslin trade are said to have been produced by his exertions on that occasion. In 1789 he settled in London, where he soon afterwards directed his attention to the important question, whether the various police systems of the metropolis were as efficient as they might be made towards the accomplishment of their legitimate end—the suppression of crime. He was one of the three stipendiary justices of peace appointed in 1792. In 1796 he published his well known work, 'A Treatise on the Police of the Metropolis, explaining the various crimes and misdemeanours which at present are felt as a pressure on the community, and suggesting remedies.' In a letter to Lord Colchester, in 1798, Bentham states that 7500 copies of this work had then been sold. Although changes both in the police regulations and the state of society have superseded the information contained in this work, it is still frequently referred to, and its statistical data, and views of the proper principles of police regulations, had much influence in the furtherance of that reform of the metropolitan police which took place so many years after the book was published. In 1800 he drew, with the assistance of Bentham, of whom he was a valued friend, the Thames Police Act—40 Geo. III. c. 87, a measure now understood to have been suggested by Mr. Harriot. In the same year he published 'A Treatise on the Commerce and Police of the River Thames: containing an Historical View of the Trade of the Port of London: and suggesting means of preventing the depredations thereon, by a legislative system of River Police.' Mr. Colquhoun was a great promoter of the system of charity-schools, holding the opinion, which is every day obtaining additional adherents, that the education of the people is the main protection of society from those social evils which penal legislation can but partially cure when they have broken out. He died on the 25th of April, 1820. There is a memoir of him in the 'Gentleman's Magazine,' and he is frequently mentioned in Bentham's works.

COLUMBA, commonly called the Apostle of the Highlanders, or Scoto-Irish, is believed to have been one of the earliest teachers of Christianity in Scotland, and is known in history as the founder of the abbey and college of Iona in the Western Isles. He was a native of Ireland: his biographers give his pedigree with great precision, but even if its precise accuracy could be trusted, its repetition here would afford the reader nothing more valuable than a series of strange names. He is said to have been born in the year 521. According to the best collations of recent investigators, he arrived in Scotland in the year 563. The island of Hi, or Iona, where he established himself with his disciples, may be presumed, from the vestiges of a worship earlier than Christianity still extant there, and commonly called Druidical remains, to have been a seat of the pagan worship of the day, and it is probable that Columba desired to attack the lion in his den. The greater part of the neighbouring west coast of Scotland was peopled by the Scots, who had emigrated from Ireland; the districts south of Iona, and the broad tracts of comparatively level land stretching eastward, were inhabited by the people called Picts. Columba is said to have established an equal influence with both races. In the much debated question whether the Picts were of Celtic or Teutonic origin, a passage in Adamnan's Life of Columba gives perhaps the most distinct, though very limited, evidence that exists on the subject. It states that Columba, who as an Irishman must have been of the same Celtic origin as the Scots or Irish Dalriads who surrounded him on the west coast, required an interpreter when he communicated with the king of the Picts. The Life of Columba by Adamnan is a work frequently consulted by investigators into the early history of Christianity in Britain. An accurate list of the various shapes in which this little book has been reprinted will be found in the Life of Adamnan in the Biographical Dictionary of the Society for the Diffusion of Useful Knowledge. A translation of this work, with critical comments, was published in 1798, with the title 'The Life of St. Columba, the Apostle and Patron Saint of the antient Scots and Picts,' by John Smith, D.D., a work full of very absurd blunders. Adamnan's Life contains few biographical facts which can be depended on, but it is a very curious memorial of the manners of the day. Even the dreams and miracles with which it is crowded are instructive when critically examined. Columba is believed to have been the founder of the Culdees [CULDEES], and in connection not only with them, but with the pagan rites which he superseded, his memory is traditionally preserved in the highlands of Scotland. There is a Highland proverb, of which the translation is—'Earth, earth, on the mouth of Oran, that he may blab no more.' The tradition connected with this is, that Oran was one of the followers of Columba, who, as a sacrifice at the building of Iona, was buried, whether alive or dead is not stated. This tradition, which is given as the version of the pagan priests, says that Columba opened the grave three days afterwards, and Oran told him that hell was not such a place as he reported it to be. Whereupon Columba, to prevent his impiously communicating the idea to others, called out to those who were with him in the words of the proverb. Columba is said to have died in the year 597. There is an account of his life in Chalmers' 'Caledonia,' i. 311, and in Jamieson's 'Account of the Culdees.'

CO'MARUM, a genus of plants belonging to the natural order Rosaceæ. It has a concave 8-10 parted calyx in two rows, the five exterior sepals being smallest; 4-5 petals; the receptacle ultimately large, fleshy, spongy, and persistent; the style lateral near the summit of the nut, the seed ascending. There is but one species of this genus, *C. palustre*, Marsh Cinquefoil. It has an ascending stem, is about one foot high, has pinnate leaves, dark purple flowers, and numerous carpels seated on the dry spongy receptacle. This plant is a native of Great Britain. It is found in marshes and peaty bogs. The fruit is called in Scotland Cow-berries. The roots dye wool of a dirty red colour, and possess a sufficient amount of tannin to render them available for making leather. In gardens it will grow in any moist soil, and may be increased by dividing at the root.

(Babington, *Manual;* Don, *Gard. Dict.*)

COMB. Combs are generally made of a thin plate of wood, horn, tortoise-shell, ivory, bone, or metal, which may be either flat or curved, having one or two of its edges indented with narrow slits, which divide the substance of the comb into long, fine, pointed teeth. Combs employed in the woollen manufacture, for disentangling the fibres of wool, which contain two or more rows of metal teeth, not formed by cutting the edges of a plate, but by inserting the teeth in a stock of wood or other material, and cards and carding-machines, which consist of many such rows of wire teeth fixed together, so as to form what may be styled a brush of metallic combs, are described under Woollen and Worsted Manufactures, P. C., pp. 551-554, Cotton Spinning, P. C., p. 95, and Cards, P. C. S., p. 289. Somewhat similar to the last are the curry-combs used in dressing horses, which consist of a number of iron plates notched on one edge to form saw-like teeth, and attached by the other edge to an iron back, in parallel lines, so as to form an instrument the action of which is between that of a scraper, a comb, and a brush.

In the mode of cutting and shaping the plates of which combs are formed there is little to call for remark, but in the act of comb-cutting or comb-parting, by which the teeth are cut of a uniform size, at equal and often very minute intervals, and, in many cases, of extreme thinness or fineness, much ingenuity has been called into exercise. The old method of forming the teeth was by means of a double saw, consisting of two separate fine saws, placed parallel with each other, and adjusted to such a distance from each other as to embrace a tooth of the required fineness between them. These two saws are so arranged that while one cuts into the comb to the full depth required, the other cuts only about half that depth, and by this contrivance the uniformity of the comb is secured, because, while the deeper saw is completing the first cut, the shallower one is forming the commencement of the second, and when, on the completion of the first cut, the deep saw is put into the second cut to complete it, the shallower one immediately commences a third. The cuts thus formed are subsequently enlarged and rendered smoother by means of a very thin wedge-shaped file, which also points the teeth. With such accuracy may these operations be performed, that delicate ivory combs, with from fifty to sixty teeth in an inch, are produced in this way. Though this method of comb-cutting is still practised, a superior and much quicker mode of performing the same operations by means of circular saws and revolving cutters for pointing the teeth has been long in use; a machine for this purpose, having a series of saws or cutters fixed upon one axis, with washers between them to regulate the distance of the cuts, and consequent size of the teeth, having been patented by Mr. Bundy as early as 1796.

By the above-described modes of comb-cutting all the material of the interstices between the teeth is lost or destroyed, but by the operation known as the *parting* of combs such loss or waste of material may be avoided in the manufacture of combs of tortoiseshell, horn, or any other tough material; two combs being, by this process, made out of one piece, the teeth of one being cut, by the pressure of chisel-like instruments, out of the interstices of the other. According to a paper in the forty-ninth volume of the 'Transactions' of the Society of Arts, descriptive of the improved machine contrived for this purpose by Mr. Rogers, this ingenious mode of forming combs was invented by an artisan named Ricketts, who was led to the invention by being engaged in the production of ornamented tortoiseshell combs in which the decorative parts were formed by the pressure of cutters. The name of Ricketts is not referred to in the articles on comb-making in Dr. Ure's 'Dictionary of Arts' and Hebert's 'Engineer's and Mechanic's Encyclopædia,' but both those works contain a notice, and the latter an engraving also, of a machine for performing this operation, which is described as the invention of Mr. Lyne. In this machine, the various motions of which are effected by the alternating action of a lever handle, the piece of tortoiseshell or horn which is to be converted into a pair of combs is secured upon a traversing carriage, which is capable of motion in a direction perpendicular to that of the teeth of the comb, by means of a screw turned by a ratchet-wheel, which is advanced one tooth by each movement of the lever, and which, by varying the size of the ratchet-teeth, may be made to move the carriage more or less according to the intended breadth of the teeth of the comb. This carriage is made hollow, to receive an iron heater, the heat of which softens the horn, and thereby renders it more easy to cut. Between each movement of the carriage the cutter, which is a chisel equal in breadth to the length of the intended teeth of the comb, is brought down with sufficient force to cut completely through the horn or tortoiseshell. As the teeth are not required to be perfectly parallel, but in a slight degree wedge-shaped, the successive cuts of the chisel must incline a little obliquely, first in one direction, and then in the other, for which provision is made by an arrangement for alternately changing the position of the cutter during its descent. A pair of very narrow chisels mounted at right angles with, and at the ends of, the long cutter, serve, by their alternate descent, to connect each pair of cuts at their converging extremities, so as to detach the ends of the teeth. In a subsequent improvement of the parting process two cutters were employed, set permanently at the required opposite degrees of obliquity, and having returns to liberate the ends of the teeth. In Mr. Rogers's engine, above referred to, which obtained a prize from the Society of Arts in 1833, all the required movements are obtained by very simple means, everything being effected by the continuous turning of a winch, which, by means of a crank, works a double cutter, the two chisels of which are capable of adjustment according to the size of the teeth, while the screw for moving the bed or carriage is turned by means of a cog-wheel upon its axis, working into another on the axis of the winch. The extent of motion between each operation of the cutter is regulated by varying the relative sizes of these cog-wheels; and the cessation of the motion of the carriage during the operation of the cutter is provided for by removing the cogs from a portion of the circumference of one of the wheels. For the mode of working two of the principal materials of combs, see Horn and Tortoiseshell, P. C. S.

COMBINATION LAWS. The laws known by this name were repealed in 1824. Till then any combination of any two or more masters, or of any two or more workmen, to lower or raise wages, or to increase or diminish the number of hours of work, or quantity of work, to be done, was punishable at common law as a misdemeanour: and there were also thirty-five statutes in existence, most of them applying to particular trades, prohibiting combinations of workmen against masters. The act passed in 1824 (5 Geo. IV. c. 95) repealed all the statute and common law against combinations of masters and of workmen, provided a summary mode of conviction, and a punishment not exceeding two months' imprisonment for violent interference with workmen or masters, and for combinations for violent interference; and contained a proviso with regard to combinations for violent interference, that no law in force with regard to them should be altered or affected by the act. But all the common law against combinations being repealed by the act, this proviso was considered as of no force: and the act also went beyond the intentions of the framers in legalizing combinations unattended with violence for the purpose of controlling masters in the mode of carrying on their trades and manufactures, as well as peaceable combinations to procure advance of wages or reduction of hours of work. The act was passed after an inquiry into the subject by a committee presided over by Mr. Hume, which reported to the house the following among other resolutions:—

'That the masters have often united and combined to lower the rates of their workmen's wages, as well as to resist a demand for an increase, and to regulate their hours of working, and sometimes to discharge their workmen who would not consent to the conditions offered to them; which have been followed by suspension of work, riotous proceedings, and acts of violence.

'That prosecutions have frequently been carried on under the statute and the common law against the workmen, and many of them have suffered different periods of imprisonment for combining and conspiring to raise their wages, or to resist their reduction, and to regulate their hours of working:

'That several instances have been stated to the committee of prosecutions against masters for combining to lower wages, and to regulate the hours of working; but no instance has been adduced of any master having been punished for that offence.

'That it is the opinion of this committee that masters and workmen should be free from such restrictions as regard the rate of wages and the hours of working, and be left at perfect liberty to make such agreements as they may mutually think proper.

'That therefore the statute laws which interfere in these particulars between masters and workmen should be repealed; and also that the common law, under which a peaceable meeting of masters or workmen may be prosecuted as a conspiracy, should be altered.'

Immediately after the passing of this act a number of widely organized and formidable combinations arose in various trades and manufactures for the purpose of controlling the masters as to the way in which they should conduct their business; and the extent to which the act had repealed the common law being doubtful, and the act having clearly gone beyond the resolutions on which it was grounded in legalizing combinations, Mr. Huskisson, then President of the Board of Trade, moved early in the session of 1825 for a committee to consider the effects of the act 5 Geo. IV. c. 95; and a committee was appointed with Mr. (afterwards Lord) Wallace, then Vice-President of the Board of Trade, for its chairman. This committee recommended the repeal of the act of the previous session, and the enactment of another: and in consequence of their recommendation the 6 Geo. IV. c. 129, was passed, which is the act now in force relative to combinations.

This act repealed the 5 Geo. IV. c. 95, and all the statutes which that act had repealed. It relieved from all prosecution and punishment persons meeting solely to consult upon rate of wages or hours of work, or entering into any agreement, verbal or written, on these points. And it provided a punishment of not more than three months' imprisonment, with or without hard labour, for any one using violence or threats to make a workman leave his hiring, or return work unfinished, or refuse to accept work, or belong to any club, or contribute to any common fund, or pay any fine for not belonging to a club, or contributing to a common fund, or refusing to conform to any rules made for advance of wages or lessening of the hours of work, or regulations of the mode of carrying on any business, and for any one using violence to make any master alter his mode of carrying on his business.

By the act 6 Geo. IV. c. 129, therefore, combinations of masters and workmen to settle as to rate of wages and hours of labour are made legal and freed from all punishment: but the common law remains as it was as to combinations for otherwise controlling masters.

By 9 Geo. IV. c. 31, assaults in pursuance of a combination to raise the rate of wages are made punishable by imprisonment and hard labour.

A committee of the House of Commons sat in 1838, presided over by Sir Henry Parnell, to consider the effect of combinations of workmen; but nothing followed from this committee.

COMBRETA'CEÆ. [TERMINALIA, P. C.]

COMBUSTION, a process in which both light and heat are emitted by chemical agency: thus, when a piece of charcoal is ignited and put into oxygen gas, combustion commences, and continues with increasing brilliancy until the charcoal disappears, or the oxygen has undergone a change which renders it incapable of further action as a supporter of combustion.

In the same way, if we ignite a slender piece of iron and immerse it in oxygen gas, much light and heat are given out by the combustion of the iron; the gas disappears, and the iron, by combining with it, has acquired a new form and properties, or, in other words, it is converted into oxide of iron.

These two cases will exhibit instances of the more important changes which accompany combustion: in the first a solid body, charcoal, by combining with oxygen, becomes gaseous, being converted into carbonic acid gas, and the oxygen, though it still retains its gaseous form, is found to be so entirely altered in properties, that it is no longer capable of supporting life or combustion, but is soluble in water, and precipitates carbonate of lime from lime-water.

In the second example, unlike the first, the oxygen does not retain its gaseous form, nor does the iron, like the charcoal, lose its solid form, being, as already stated, converted into oxide of iron, which is a solid body.

Distinction is then to be made between *combustion* and *ignition*. In the former, heat and light are elicited by chemical agency; but the substances by which it is produced undergo so complete a change of properties, that if we were to heat fresh charcoal in the carbonic acid gas resulting from the combustion of the first piece, no combustion would again occur: so also, if the oxide of iron obtained in the second case were heated in a fresh portion of oxygen gas, neither would suffer any change of properties, or give out any light or heat by chemical agency.

It is however well known that if certain bodies, such as a mass of oxide of iron or a stone, be ignited, it will continue to give out both light and heat for a longer or shorter period, according to the cooling power to which it is exposed. But in this case the *ignited* oxide of iron or stone gives out the light and heat which it had previously received from the contact of bodies in *combustion*.

It is then to be understood, that while *incombustible* bodies which have been ignited yield only the light and heat which they had previously received from bodies in *combustion*, combustible bodies evolve the light and heat which they generate by chemical agency.

In all common cases of combustion the heat which is generated by it is accompanied by flame, but not necessarily so. Some idea of the difference may be formed by observing the circumstances under which bituminous coal and anthracite burn; the former burns with flame, and the latter with scarcely any.

COMBUSTION, SPONTANEOUS HUMAN. This term is applied to a singular phenomenon which occasionally occurs in the human system. Many of the older medical writers spoke of a mysterious burning of the human body, which, as it seldom occurred, was frequently doubted. Cases however of a consuming or decomposition of various parts of the body during life, with the evolution of light, have been constantly put on record, and although often misrepresented by superstition and ignorance, the evidence of such a combustion of the human body is admitted as perfectly satisfactory by the best writers on medical jurisprudence of the present day.

One of the earliest well-authenticated cases put on record occurs in the Transactions of the Copenhagen Society. A woman of the lower classes, who had for three years used spirituous liquors to excess, and took little of any kind of food, sat down one evening on a chair to sleep, and was consumed during the night, so that next morning no part of her was found entire except the skull and the joints of her fingers; all the rest of the body was reduced to ashes. In the forty-third volume of the 'Philosophical Transactions' there is a case related which occurred in 1744. A woman of the name of Grace Pett, who was in the habit of getting up in the night to smoke by the kitchen fire, was found one morning by her daughter dead. The body was extended on the hearth with the legs on the deal floor, and it had the appearance of a log of wood consumed by a fire without apparent flame. The girl immediately ran and procured water to pour over the burning body, which produced a suffocating smoke and brought in the neighbours; but the woman was quite dead. The trunk was incinerated, and resembled a heap of coals covered with white ashes. The head, the arms, the legs, and the thighs had also participated in the burning. It is stated that she had that day drunk a large quantity of spirituous liquors. There was no fire in the grate, and the candle had burnt entirely out in the socket of the candlestick which was close to her. There were also found near the body the clothes of a child and a paper screen which had sustained no injury from the fire. Her dress consisted of a cotton gown.

Since the period at which this case was recorded many others have occurred to competent observers and been accurately described. Beck in his Medical Jurisprudence gives references to twenty-eight cases, which are probably not more than half that have been related in various places. Dr. Apjohn, in the article 'Spontaneous Human Combustion,' in the 'Cyclopædia of Practical Medicine,' relates four cases which have occurred in Ireland within the present century. All were females and addicted to ardent spirits.

The following conclusions may be deduced from the various cases which have been related:—

1. The subjects were nearly all females. Of seventeen cases collected by Kopps, sixteen were females. Eight cases mentioned by Lair are all of the same sex. They were far advanced in life.

2. Most of the individuals had for a long time been addicted to the use of ardent spirits, and they were either very fat or very lean.

3. The combustion occurred accidentally and often from a slight cause, such as a candle, a coal, or even a spark.

4. The combustion proceeded with great rapidity, usually

consuming the entire trunk, while the extremities, as the feet and hands, were occasionally left uninjured.

5. Water, instead of extinguishing the flames which proceeded from the parts on fire, sometimes gave them more activity.

6. The fire injured very slightly or not at all the combustible objects which were in contact with the human body at the moment when it was burning.

7. The combustion of these bodies left as a residuum fat fœtid ashes, with an unctuous, stinking, and very penetrating soot.

8. The combustions have occurred at all seasons, and in northern as well as southern countries.

These facts being admitted, the question arises as to what is the nature of the process by which this decomposition of the body has been effected? That it is not an ordinary combustion of the body from external agents is very evident. Dr. Beck says 'that large quantities of fuel are needed to convert the body to ashes. It is necessarily slow in its progress, and the heat required, being high, would extend itself to surrounding substances. The combustion also in ordinary cases would often be incomplete, and particularly so as to the bones. Again, if the body be not wholly unconsumed, there will be blisters, scars, &c. on various parts.' It must therefore arise from some change in the chemical composition of the body, which favours its combustion at a lower temperature than usually occurs at the surface of the earth. All union of carbon, hydrogen, sulphur, phosphorus, &c. with oxygen, is combustion. This is constantly going on in the lungs of all animals, and generating animal heat. The heat evolved in this process is not sufficient to produce light, but if the temperature was exalted only a few degrees above that of the human body, it would be possible for light to be emitted, and this actually takes place in the burning of highly inflammable compounds, such as æther. There can, we think, be little doubt of the possibility of such a chemical composition of the blood and solids of the body taking place, under the influence of a stimulating compound containing the combustible elements carbon and hydrogen, which would under certain circumstances produce a slow combustion by contact with the oxygen of the atmosphere. Other theories have been advanced, but are not so free from objection as the one we have advanced above. Pierre Amie Lair and others attribute it to the impregnation of the tissues of the body with alcohol, but Fontenelle immersed pieces of meat for a length of time in alcohol, and could not consume them by setting fire to them. Maffei, Le Cat, and Kopp suppose it to be an electrical phenomenon. Marc, in the article Spontaneous Combustion in the 'Dictionnaire des Sciences Naturelles,' supposes that it may arise from inflammable gases, such as carburetted and phosphuretted hydrogen, generated in the human body; and the probability of this mode of production Dr. Apjohn is inclined to adopt.

The consideration of this subject may be the object of medico-legal inquiry; and although within a recent period it has not been brought before the courts of law, the following case indicates its relations in medical jurisprudence. It is related by Le Cat. The wife of the Sieur Millet of Rheims was in the habit of indulging in the use of ardent spirits, and the economy of her household was managed by a handsome female servant. On the 20th of February, 1725, she was found consumed at a distance of a foot and a half from the hearth in her kitchen. A part of the head only, with a portion of the lower extremities and a few of the vertebræ, had escaped combustion. A foot and a half of the flooring under the body had been consumed; but a kneading-trough and a tub which stood close by sustained no injury. Millet, being interrogated by the judges, stated that his wife had retired to rest with him, but had left him during the night; supposing she was warming herself by the kitchen fire, he fell asleep, but was awakened about two in the morning by a strong odour; and having repaired to the kitchen, he found his wife in the state described. The judges, from the evidence, supposed he had conspired with the servant to kill his wife, and condemned him to death; but, having appealed to a higher court, the circumstances were again examined, and the judgment reversed, the case having been pronounced one of spontaneous combustion.

(Foderé, *Traité de Médecine Légale*; Beck, *Medical Jurisprudence*; Apjohn, *Cyclopædia of Practical Medicine*; Marc, *Dictionnaire des Sciences Médicales*.)

COMMIA, a genus of plants belonging to the natural order Euphorbiaceæ. It has diœcious flowers. The staminiferous flowers are formed of bracts united into an amentum, the stamens are numerous and united into a single column. The pistilliferous flowers are racemose, the calyx is 3-parted, the styles 3, the capsule 3-lobed.

C. cochinchinensis is a small tree with a resinous juice. It has alternate, entire, smooth leaves. The male flowers are amentaceous, the catkins consisting of imbricated 1-flowered scales, axillary and short; the female racemose, terminal, and small. This tree yields a gum which possesses emetic and purgative properties. It is recommended in cases of dropsy, but has not been introduced into European practice. It is a native of Cochin China.

(Lindley, *Flora Medica*.)

COMMISSARY, an officer who is delegated by a bishop to act in a particular part of the diocese, to exercise jurisdiction similar in kind to that exercised by the chancellor of the diocese in the consistory court of the diocese. A commissary has, generally speaking, the authority of official principal and vicar-general within his limits. An appeal lies from his decisions to the metropolitan. In some dioceses there is a commissary court for each archdeaconry. The commissarial courts were established for the convenience of the people in parts of the diocese remote from the consistory court. A commissary must be learned in the civil and ecclesiastical law, a master of arts or bachelor of law, not under the age of twenty-six, and he must subscribe the Thirty-nine articles (Canon 127).

In Scotland the same classes of questions which in other parts of Europe were arrogated to the ecclesiastical judicatories came under the authority of the bishops' courts while the episcopal polity continued, and subsequently devolved on special judges, who were called commissaries. The four commissaries of Edinburgh constituted the Supreme Commissary Court, which had jurisdiction in questions of divorce, and of declarations of the existence or non-existence of marriage. The district commissaries had the administrative authority of confirming executors to persons deceased, a function resembling the granting of letters of administration in England. By 4 Geo. IV. c. 97, the functions of the provincial commissaries were vested in the sheriffs of the respective counties, who, before the passing of that act, were usually appointed the commissaries of their districts. By 11 Geo. IV., 1 Wm. IV. c. 69, the jurisdiction of the commissaries of Edinburgh, as above, was vested in the Court of Session.

COMMISSION. [Agent, P. C.; Broker, P. C.; Factor, P. C.]

COMMISSIONERS, LORDS. [Assent, Royal, P. C.; Admiralty, P. C.]

COMMISSIONERS OF BANKRUPTS. [Bankrupt, P. C.]

COMMISSIONERS OF SEWERS. [Sewers, P. C.]

COMMITTEE OF A LUNATIC. [Lunacy, P. C.]

COMMON RECOVERY. [Recovery, P. C.]

COMOCLA'DIA (from κόμη, hair, and κλάδος, a branch), a genus of plants belonging to the natural order Anacardiaceæ. It has hermaphrodite or monœcious flowers; a 3-4 parted permanent calyx, 3-4 long petals; 3-4 short stamens; a single ovary with no style, and a single stigma, an ovate 1-celled, 1-seeded drupe; the seed somewhat pendulous from a curved funiculus originating at the base of the cavity; no albumen.

C. dentata, Tooth-leaved Maiden Plum, has pinnated shining leaves, green above, with a round rachis 6 inches long, 6-10 leaflets on each side, with an odd one oblong, acuminate, spiny-toothed, veiny, and somewhat downy at the back. This plant is a tree reaching a height of about thirty feet. It is a native of the woods of Cuba and St. Domingo, where it is called Guao. It has an erect not much branched stem. A milky juice exudes from it, which is glutinous, and becomes black by exposure to the air. It stains linen and the skin black, which cannot be washed out of the former, and only comes off from the latter by the exfoliation of the cuticle. It is believed, by the natives of Cuba, that it is death for persons to sleep under this tree, especially if they are fat or of a full habit of body. It is, undoubtedly, a poisonous tree, although nothing is recorded of its mode of action on the system.

C. integrifolia has stalked leaflets, lanceolate, quite entire, smooth. It is a tree twenty feet high, with small scentless deep red flowers. The berries are black and succulent, and may be eaten with impunity, but are not pleasant to the taste. The wood is hard, of a fine grain, and reddish colour. The tree gives out a watery juice, which is slightly glutinous, and grows black on exposure to the air. Like the juice from the last, it stains linen and the skin indelibly. It is a native of Jamaica.

(Don, *Gardener's Dictionary*; Lindley, *Flora Medica*.)

COMPLEMENTARY COLOURS. [Colours, Complementary, P. C. S.]

COMPOS, or NON COMPOS MENTIS. [Insanity, P. C.]

COMPOUNDING A FELONY. [Felony, P. C.]

COMPRESSIBILITY OF WATER. Like almost every other substance, water expands in volume by an increase of temperature, and contracts by a decrease; but it has this peculiar property, that at a temperature expressed by about 40 degrees of Fahrenheit's thermometer it attains a maximum of density. The quantity of water which, at 60 degrees, would occupy one cubic foot, at 40 degrees occupies only 0·9907 cubic foot; while at the temperatures both of 45° and 35° (its fluidity at the latter temperature being preserved by the avoidance of all agitation) the volume is 0·9991 cubic foot (Gilpin, Phil. Trans., 1792): the increase of volume at temperatures below 40° is ascribed to some tendency of the water to crystallize while it is still fluid.

The variations produced in the volume by variations of temperature, as well as the fact that water is a conductor of sound, and consequently that it possesses some elasticity, are to be considered as arguments that water may be capable of being compressed by mechanical means; but the quantities of compression which have been obtained by experiments made for the purpose are so small as to render it very difficult to determine its precise value.

In 1661 some members of the Accademia del Cimento at Florence made experiments of different kinds in order to ascertain whether or not water was compressible; and one of these consisted in filling a hollow globe of silver with water at the point of freezing: an effort was then made, by blows with a hammer, to diminish the volume of the globe by altering its form, when it was found that the water escaped through the pores of the metal. The like experiment was made by Muschenbroeck in 1731, with a globe of gold, which was attended with a like result; and, till the year 1762, it was considered that water was incapable of being reduced in volume by pressure. In that year Mr. Canton introduced water at a certain temperature into a glass tube, and having, by an application of heat, made the water fill the tube so as to expel the air, he sealed the tube hermetically: then, having reduced the temperature to its former value, he broke off the upper extremity of the tube in order that the atmosphere might press on the top of the column of liquid, when the height of the latter was found to be thereby diminished. The like experiment was tried with alcohol, oil, and mercury; and these fluids were found to suffer different diminutions of volume by the pressure.

It has been imagined that the apparent diminution of the volume of water was only the result of an expansion of the tube in consequence of the elasticity of the atmosphere, when the latter was allowed to enter it; but, if such expansion alone had produced the effect, it would have been the same, and would have caused equal depressions, in the columns of different kinds of fluid, whereas the depression of the water was about fifteen times as great as that of the mercury: there is little doubt therefore that the observed diminutions of height were results of the compressions of the fluids by the weight of the atmosphere.

The experiments of Canton show that, under a weight equal to that of an atmospherical column in its ordinary state (29½ inches of mercury), the compressions of the four following fluids, in millionth parts of their volumes, and at a temperature equal to 50°, are—

Alcohol	66
Rain-water	46
Sea-water	40
Mercury	3

COMPRESSION OF THE BRAIN. [Head, Injuries of, P. C.]

COMPT'ONIA, a genus of plants belonging to the natural order Myricaceæ, named after Henry Compton, Bishop of London, by whom the fine collection of plants attached to the episcopal palace at Fulham was formed. The male flowers have cylindrical loosely imbricated catkins, with deciduous 1-flowered bracts; 2 sepals; 6 stamens, adhering in pairs; the female flowers have ovate densely imbricated catkins, with 1-flowered bracts; 6 sepals, larger than the bracts; 2 capillary styles, and a 1-seeded nut. There is only one species, the *C. asplenifolia*, Sweet Fern. It is a small bush, three or four feet in height, yielding a powerful aromatic fragrance when rubbed between the fingers It has long linear pinnatifid leaves, brown and rather downy on the under side, shining on the upper. It is a native of the woods and mountains of the United States, where it is a favourite domestic remedy in the cure of diarrhœa. It possesses tonic and astringent properties. It is a handsome shrub, and will thrive in a peat soil or sandy loam, and may be propagated by layers or suckers. It was called *Liquidambar asplenifolium*, by Linnæus, but differs very much from that genus in its characters and properties.

(Lindley, *Flora Medica*; Loudon, *Encyclopædia of Plants*.)

COMPUTATION. We need not tell those who are acquainted with the existing treatises on arithmetic, that in no one instance do they pretend to give any mode of forming good habits of computation. The beginner, after receiving instructions as to what is to be done in the several great rules of arithmetic, is allowed to manage the details as he can.

The mere mechanical art of computation, apart from arithmetical reasoning or application to subjects of interest, is no very lofty exercise of the mind. A wonderful degree of proficiency in it can be attained by many who find connected reasoning almost an impossibility: and on the other hand, some of the first among mathematical discoverers have hardly arrived at more than the expertness of an ordinary schoolboy. It is one of those arts among many which are accessible to all who begin with a determination to conquer difficulties, and a power of arriving at methodical habits: no person who, after beginning in the right way, is obliged to confess a total failure, has any ground to suppose that he could master a common manual art: he may be a genius, but nothing could make him a weaver. That we may not frighten any one of the thousands who are miserable computers after going through years of school discipline, and whose minds are too well made to allow them to flatter themselves that they were above it, it is but fair to say that very few are allowed to begin in the right way. Every merely mechanical business must be learned by a sufficient repetition of the most purely elementary steps. A discipline of the mind may be taken up at the wrong place, and still be a discipline, though not so perfect as it might have been. But in what is merely art, nothing can compensate for the want of habit of operation duly learned at the proper time. Now computation is only an art: its elements are a small number of acts of memory: its details consist in a still smaller number of operations, each of which, by itself, is of the utmost simplicity.

Many readers will suppose us, in speaking of the elementary rules of arithmetic, to mean addition, subtraction, multiplication, and division, as given in the books: but we should as soon think of saying that the elementary operations of a journeyman tailor's business are the making of coats, waistcoats, and trowsers. The rules just named are the perfection of computation, not its commencement: he who can do them all with ease and accuracy is a calculator. The fundamental operations of which we speak are to those elaborate processes just what threading a needle and drawing a stitch are to the making of a coat. We can carry the comparison still further: and its justice is not accidental, but the necessary consequence of the resemblance of all mechanical operations. We do not say that a workman who is capable of joining two pieces of cloth together with strength and neatness is a finished tailor: he cannot therefore choose cloth, cut out work, imitate fashions; but he can follow directions, and he is the man who actually makes the coat. Nor do we mean that the person who can merely perform the four rules is a complete arithmetician: he cannot know how to apply those rules, he has not learned how to think of their uses. But, under directions, he can really manage the last and executive process of any mathematical inquiry. Until he is something better, he is but a tool in the hands of others, but no one thinks the less of tools because they cannot work of themselves.

Is this then, we shall be asked, all that you propose, namely, to describe addition, subtraction, multiplication, and division? We answer, yes, and on these simple grounds, that nothing more is wanted, and that in what we have to say upon them, we shall touch the reason why so many persons are incapable of and disgusted with arithmetical process. There are but few who find much difficulty in comprehending what is to be done in a question of arithmetic: but there are many who find that, however clearly they may see the way, there is a heavy and broken ascent between them and the answer. The figures will not come right, there is nothing but mistake after mistake: and though everything else is gained, the result is not. Few of those who are thus perplexed are aware that nothing is wanting but attention to the elementary processes with a better method than a beginner invents for himself: every one knows that books and teachers give no method at all.

The following system of exercises constitutes the whole of what is necessary. The degree of attention with which each is to be practised must depend upon the circumstances of the learner's case. Each one contains a difficulty which most persons will suppose they could avoid, some in one manner, some in another. Their several suppositions are true: and it is just as true that the trouble and risk with which an infant learns to walk upon its feet could be avoided: some could continue to crawl, others could contrive to walk on their knees: all would get on in a certain manner. Any person who is determined to succeed, and who has reason to know that his method has not answered as yet, should try our plan with the faith of a learner. But we can promise him no success unless he will make up his mind, from the outset, entirely and at once to abandon every habit which we condemn, and to adopt every mode which we prescribe: and this, though it should seem to him that what he has to take up is more difficult than what he is to leave off. He may take any time, and must not be discouraged by finding that the new operations are at first longer than the old ones. He must continually attempt more and more rapidity, remembering that quickness of operation will never come of itself by practising with deliberate caution. Slow and sure is better than quick and wrong, no doubt, if one or the other must be the end of it; but *quick and sure* must be the motto of an arithmetician. All very correct computers that we have seen have been rather rapid workers: we believe the reason to be that those who cannot acquire rapidity give it up in disgust.

1. Presuming that the learner can count one, two, three, &c., as fast as he can speak the words, he must then try if he can do the same backwards, as fifty, forty-nine, forty-eight, forty-seven, &c. He must then practise counting forward—by two at a time, as in 2, 4, 6, &c., 1, 3, 5, &c.—by three at a time, as in 1, 4, 7, &c., 2, 5, 8, &c., 3, 6, 9, &c.—by four at a time, as in 1, 5, 9, &c., 2, 6, 10, &c.—and so on up to 11 or 12 at a time. The same should be done backwards, as in the following by sevens, 90, 83, 76, 69, &c. In doing this he must not use any description, either vocal or mental: it must not be 22 and 6 are 28, 28 and 6 are 34, &c.; but 22, 28, 34, &c. These various processes should be carried to or from 100 at least.

2. Proceed to form with rapidity the number which must be added to a given number to make up the next number which ends with a given digit. Thus, one of the questions asked, at its fullest length, is 'Given 38 and 4, how much must be added to 38 to give the next number that ends with 4?' But all that must be repeated, orally or mentally, is '38 and six are forty-*four*.' Write down a row of numbers, as in

7 2 9 6 3 2 8 4 1

and practise thus:—72 and 7 are 79, 29 and 7 are 36, 96 and 7 are 103, 63 and 9 are 72, &c.; taking 72, 29, 96, &c. for the successive lesser numbers, and 9, 6, 3, &c. for the successive unit figures of the greater numbers.

3. Endeavour occasionally, in the exercise immediately preceding, and in those which follow, to fix the thoughts particularly upon the *tens* of the result. It will generally happen that the units are immediately to be written down and discarded, while the tens are to be retained in memory. Practise repeating a number, so as while repeating it to write down the units and think of the tens: thus, in 76, at the moment of writing down 6, think of 7.

4. Learn the multiplication table up to 12 times 12, but not with the usual practice of wording all the results, as in '7 times 8 make 56,' '4 times 5 are 20,' &c. The table must be so learnt that the two factors suggest the product instantaneously. Thus, 8 and 9 must give 72 the instant they come together in the mind; and so on. Take a row of numbers as before, and looking at the successive pairs, repeat the products. Thus, 2 9 8 7 4 3 5, &c. is to suggest 18, 72, 56, 28, 12, 15, &c. as fast as the words can be spoken. Those who have been accustomed to learn the multiplication table from the half of it, always putting either the greater factor first, or else the lesser, must now accustom themselves to the whole: 5 and 9, or 9 and 5, must suggest 45 with equal ease.

5. Augment the last exercise as follows:—Having three digits, learn to pass in thought immediately to the product of the first two augmented by the third; thus, 7, 9, and 8 must lead to 7 times 9 increased by 8, or 71. Take a row of figures, as before, say 2497163, &c. which must be made the means of suggesting immediately 17, 43, 64, 13, 9, &c. The usual repetition, 'twice 4 are 8 and 9 are 17,' &c. must not be tolerated for one moment.

6. Acquire the power of combining the fifth and second exercises as follows:—Having four digits, learn to add the third to the product of the first and second, and to pass on to the next number which has the fourth in its unit's place. Thus, with 7, 8, 5, and 0, think of 61 (7 times 8 and 5) as in the last exercise, and as in the second, get '61 and 9 are 70.' Repeat only as much as is in the last phrase, dealing with the first three numbers by the habit acquired in the last exercise. Thus, with the row of numbers 19728663, &c. should be rapidly suggested—16 and 6 are 22, 65 and 3 are 68, 22 and 4 are 26, 22 and 4 are 26, 54 and 9 are 63, &c.

7. Having four numbers, deal with the first three as in the fifth exercise, and then repeating the result, add the fourth. Thus, from 2, 7, 5, 8, get 19 and 8 are 27. Thus, the row of figures 7984361, &c. must give—71 and 4 are 75, 76 and 3 are 79, 35 and 6 are 41, 18 and 1 are 19.

8. Having a digit and a number of two places, learn to arrive speedily and with few words at the number of times which the second contains the first (when not more than 9), and at the remainder. Thus, '7 in 53, 7 times and 4,' '8 in 29, 3 times and 5,' &c.

A person who really desires to become a good computer *must* arrive at the power of performing these exercises easily, quickly, and accurately. It is possible to dispense with them, and it is possible to dispense with rules and numerals altogether and to use pebbles. But we are very confident that when these exercises are once made very rapid and safe, the computer has gone through nine parts out of ten of his training: he can walk, and will soon learn to find his way. The common error lies in imagining that learning to find the way is learning to walk.

We now take the four rules, insisting on the details of the mode of performing each of them, and presuming the usual process to be known.

Numeration.—Learn to distinguish tens, hundreds, &c. not by the places in which their digits come, but by the numbers of places which come after those places. Instead of connecting thousands in the mind with the *fourth* place, connect them with *three places cut off.* Thus 176493 has 1764 hundreds, 176 thousands, &c.

Addition.—Add as in exercise 1; thus, if the figures were to be 7 2 3 4, &c., it should not be 7 and 2 are 9 and 3 are 12 and 4 are 16, &c., but 7, 9, 12, 16, &c. Dwell upon the tens to be carried, in writing down the units. In the following question, every word that should be repeated, orally or mentally, is written down, and each figure that is to be written down is marked with an accent; each ten that is to be dwelt on for a moment is in italics:—

27649	8, 17, 22, 30, 36, *forty*-five′
9276	10, 19, 20, 27, *thirty*-one′
308	11, 18, 24, 27, 29, *thirty*-five′
44615	3, 5, 9, 18, *twenty*-five′
2799	3, 7, nine′.
10868	
95515	

Let the method of verification be simply taking the columns in the opposite order, or downwards, as 9, 15, 23, 28, 37, *forty*-five′, &c.

Subtraction.—Let the several subtractions be made by mental recovery of additions as in exercise 2 : not '7 from 16 leaves 9,' but '7 and 9,' not repeating 16, which is unnecessary, inasmuch as when 9 is found, 16 is done with, and the carriage of one is all that is to be remembered. The following detail has every word of the process:—

274631807	8 and 9′; 5 and 5′; 10 and 8′; 9 and 2′;
95318948	2 and 1′; 3 and 3′; 5 and 9′; 10 and 7′;
	1 and 1′.
179312859	

According to even recent books the computer should say, '8 from 7 I cannot, but 8 from 17 and there remains 9, set down 9 and carry one,' &c. It would be shorter than this to say, '8 from the next higher number that ends with 7 leaves 9.' Our plan is the abbreviation of '8 and 9 make up the next number that ends with 7' repeating only the first three words.

Multiplication.—Apply the exercises 4 and 5 to the usual process. Here, as before, the detail given has every word which need be repeated. The figures to be written down are accented; all others are carried.

```
   7296 | 54′, 86′, 26′, 6′5′; 30′, 48′, 14′, 3′6′; 48′, 76′,
    859 |   23′, 5′8′; 4′; 6′; 8, 16, 22′; 8, 12, 17′; 4, 10,
 ------ |   16′; 9, 12′; 6′.
  65664 |
 36480  |
58368   |
------- |
6267264 |
```

The usual process of *casting out the nines*, as it is called, though not an absolute verification, is a useful one. Without entering upon its demonstration, we describe it.

Casting out the nines, means adding together the digits of a number and throwing out 9 as fast as it arises. Thus in 26647895 we have—2 and 6 are 8 and 6 are 14, throw out 9 and 5 remains; take in the next figure 4, giving 9, throw out 9 and 0 remains; then 7 and 8 are 15, throw out 9 and 6 remains; pass over the 9 and take in 5 which gives 11, on which 2 remains. All that is necessary to be repeated is, 2, 8, 14, 5, 9, 7, 15, 6, 11, 2. Cast the nines out of both factors, multiply the results, and cast out nines; the answer should give the same figure as the reputed product gives when the nines are cast out. Thus 7296 and 859 give 6 and 4, the product of which is 24, giving 6: and the reputed product 6267264 also gives 6. This is a high presumption that the result is correct: the error, if any, lies in this, that the figures of 6267264 which are too great are exactly compensated by others which are too small. Now it is very unlikely that this exact compensation of errors should exist; and in this unlikelihood consists the strong presumption of verification which the rule of casting out the nines affords.

It may be observed that this rule applies to all operations, thus:—Do with the result of casting out the nines the same as was done with the numbers from which the nines were cast out; the answer, with its nines cast out, should give the same result as arises from casting out the nines of the reputed answer. Thus in the previous example of addition, the nines cast out from the several numbers to be added give 1, 6, 2, 2, 0, 5, the sum of which, with nines cast out, is 7, the same as from the reputed answer 95515. In subtraction, it may be necessary to *take in* a nine before subtracting.

Division.—This rule is considerably shortened, and (in our opinion, though we think many would differ from us) increased in safety, by performing each subtraction without setting down the multiplication. As a preliminary, suppose it required to subtract 7 times 29398 from 410843. Beginning with 7 × 8 instead of putting it down as 56, look at 3 and pass from 56 to 63, writing down the 7 and carrying the 6 tens just used. Take these 6 tens and 7 times 9, giving 69, and make them up to 74, putting down the 5, and carrying 7. All that need be repeated is as follows, dwelling on the tens carried:—

```
From 410843      | 56 and 7′ make 63;  69 and 5′ make 74;
Take  29398 × 7  |   28 and 0′ make 28; 65 and 5′ make 70;
     -------     |   21 and 0′ make 21;  2 and 2′ make 4.
      205057     |
```

Suppose 3293614829 is to be divided by 47698. Instead of the usual plan, write the divisor on the left, or the quotient on the right: at any rate, the divisor and quotient should be near one another.

```
  Divisor 47698)3293614829
Quotient 69051   431734
                  245282
                   67929
                   20231 remainder.
```

The work is as follows:—The first quotient figure being 6, subtract 6 times 47698 from 329361, thus: 48 and 3′ are 51, 59 and 7′ are 66, 42 and 1′ are 43, 46 and 3′ are 49, 28 and 4′ are 32. The 4 being brought down, and 9 ascertained to be the next quotient figure, we have 72 and 2′ are 74, 88 and 5′ are 93, 63 and 4′ are 67, 69 and 2′ are 71, 43 and 0 (unnecessary) are 43. Then 8 and 2 are brought down, 0 and 5 written as quotient figures, and 40 and 2′ are 42, 49 and 9′ are 58, 35 and 7′ are 42, 39 and 6′ are 45, 24 and 0 are 24. The last quotient figure is 1, and 8 and 1 are 9, 9 and 3′ are 12; 7 and 2′ are 9, 7 and 0′ are 7, 4 and 2′ are 6.

Casting out the nines, the products obtained from the divisor and quotient, increased by the result of the remainder, ought, after casting out nines, to agree with the dividend. Here the divisor gives 7, the quotient 3, and the remainder 8: 7 times 3 and 8 is 29, giving 2; the dividend also gives 2.

We have put down every step of the work in all the rules. The very basis of this method is the acquisition of such expertness in the previous exercises as will enable the computer to dispense with a large quantity of the ordinary halting-places. We need not enter upon the rules for the extraction of the square and cube root [SQUARE, P. C.], or of the solution of equations [INVOLUTION AND EVOLUTION, P. C.], at length; but we shall annex an example of each, leaving the reader to apply the seventh exercise in its proper place. In the contracted part of Horner's method, we add to the method of the last article cited, a provision for making the first figure on the right of the vertical line of contraction as correct as the process will allow it to be. This last process (Horner's method) is the best exercise of computation. It involves all rules in a form of considerable detail and dispersion.

First, we put down the process for the extraction of the square root of 157.

```
              • •
              157(12·5299640861416677884953 7
22          57
245         1300
2502          7500
25049         249600
250589          2415900
2505986          16059900
25059924          102398400
2505992808          21587040000
25059928166          153909753600
250599281721          355018460400
2505992817224        10441917867900
2505992817228          417946599004
 ••••••••••••••        167347317281
                        16987748248
                         1951791345
                          197596373
                           22176876
                            2128934
                             124140
                              23900
                               1347
                                 94
                                 19
                                  1
```

Now let it be required to find the positive root of $x^3+x^2-12x-12=0$.

```
1   1            —12              12(3·4641016151377545871
    4              0              12000
    7           2100               1936000
  100           2516                126664000
  104           294800                3142656000
  108           301556                  49953279000000
  1120          30834800                19025101177699
  1126          30880336              .  468183547708
  1132          3092588800               158901517715
  11380         3092702721                 4260501864
  11384         30928166430000             1167681541
  11388         30928177822301              239835444
  113920        30928189214603               22338022
  113921        30928196049985                1688280
  113922        30928202885367                 141870
  11392300      3092820299929                   18157
  11392301      3092820311321                    2693
  11392302      309282031702                      219
  11392303      309282032272                        3
                 ••••••••••                         0
```

In both these examples the result is carried to about three times as many figures as are usually wanted. But this is what should be done in computing for exercise. No one does his very highest with ease or with certainty; and a person who can safely and rapidly knock off the seven or eight figures which are generally requisite must be one to whom a much larger amount of correctness is, or has been, familiar.

It is necessary to insist particularly upon acquiring the habit of rapid computation by attempts at rapidity. Taking any exercises which verify one another, as a multiplication and a division, or a raising of a square and extraction of the square root, the learner who has acquired a little familiarity with the rules should try them at the top of his speed. If the verification be attained; if the division, for instance, reproduce the multiplier for a quotient, without remainder, it is thousands to one that the whole process is correct. But if there should be a failure, as may, and almost certainly will at first, happen several times running, there is no occasion to examine closely into the reason of the failure. The whole question should be thrown aside, and another should be taken. In this course it will soon appear that the attempts become more and more nearly correct, until at last failure is the exception, and not the rule. There must be no fear of error, whether there be cause for it or not. The young calculator should proceed as boldly as if he were infallible; for he may depend upon it, that it is not inaccuracy which is to be avoided by precaution, but accuracy which is to be obtained by habit.

With regard to minor points, every one must decide for himself whether actual vocal repetition of the words and numerals necessary to the process does or does not tend to accurate working. Some persons cannot compute without repeating to themselves; but it is worth while to give silence a fair trial. It would also be of assistance to some persons to invent a habit of signifying the multiplier, which is in actual use, by some arbitrary position of the left hand. Thus, 1, 2, 3, and 4 might be signified by placing the corresponding number of fingers of the left hand on the paper, 5 by placing the thumb only, and 6, 7, 8, and 9 by the thumb, with a corresponding number of fingers.

In all those parts of computation which relate peculiarly to fractions, common or decimal, we know of no guide but reason. The ultimate process, the actual step for the time being, must be either addition, subtraction, multiplication, or division; and accuracy may be acquired mechanically. However desirable it may be that the learner should demonstrate these processes, his power of performing them does not depend upon his being able to do so. It is otherwise with regard to the new and distinct processes introduced in questions which require fractions; and which are in fact, not themselves processes, but directions for selection of processes.

The general run of commercial calculations hardly needs any distinct preliminary exercise. There is one great improvement of which ordinary methods are susceptible, namely, the expression of the parts of a pound decimally, instead of by shillings, pence, and farthings. Until a decimal coinage is obtained [STANDARD, P. C.], any person with a moderate knowledge of decimal fractions may procure for himself most of its advantages, by the rules which are partially given in INTEREST, P. C., and which we here make complete. The demonstration will be easy enough to those who consider the fraction which one farthing is of a pound, ·00104166666...., or ·00104⅙.

To write down any fraction of a pound decimally, proceed as follows:—

Fill up the *first place* of decimals with 1 for every pair of shillings; and the *second and third places* with 50 for the odd shilling, if any, and 1 for every farthing in the pence and farthings, with an additional 1 if these amount to sixpence. Thus, as far as three places of decimals, 8*s*. is ·4*l*., and 9*s*. is ·450*l*.; 9*s*. 3*d*. is ·462*l*., 9*s*. 5½*d*. is ·472*l*., 9*s*. 6*d*. is ·475*l*., 9*s*. 8¾*d*. is ·486*l*.

Fill up the *fourth and fifth places* with 4 for every farthing above the last sixpence, and an additional 1 for every three halfpence. Thus, as far as five places of decimals, 9*s*. 3*d*. is ·46250*l*., 9*s*. 5½*d*. is ·47291*l*., 9*s*. 8¾*d*. is ·48645*l*., 9*s*. 10¼*d*. is ·49270*l*.

Fill up *all the remaining places* with the decimal fraction derived from the number of farthings above the last three halfpence for a numerator, and 6 for a denominator. Thus, 9*s*. 3*d*. is completely expressed in ·4625*l*., 9*s*. 5½*d*. is ·472916666....*l*., 9*s*. 8¾*d*. is ·4864583333....*l*., 9*s*. 10¼*d*. is ·4927083333....*l*., 10*s*. 0¾*d*. is ·503125*l*., 3*s*. 3½*d*. is ·164583333....*l*.

For the most part three places are sufficient; and it is rarely that more than five are wanted. The inverse rule, namely, that for reading off a fraction of a pound into shillings, pence, and farthings, is done from the first three places, within a farthing, by allowing a pair of shillings for each unit in the first place, another shilling for 50 (if there be so much) in the second and third places, and a farthing for each 1 that is left in the second and third places, deducting 1 if 25 or more be left. Thus ·12345*l*. is 2*s*. 5¾*d*., ·29933*l*. is 5*s*. 12*d*.* or 6*s*., ·267*l*. is 5*s*. 4¼*d*.

These rules look repulsive at first. None but those who have practised them until the transformation is easily made, can have any idea of the amount of labour which they save. They are in fact as good as a decimal coinage to those who have mastered them. Those who doubt of it may try the following question in the usual way, and compare it with the decimal mode.

When the government, for ease of calculation, proposed seven pence in the pound instead of 3 per cent., as an income tax, how much tax, to a farthing, did they give up on 100 millions of income? On one pound 3 per cent. is ·03, and seven pence is ·0291666666...., which falls short of the former by ·0008333333... : and this, taken 100 million of times, is 83333·333*l*., or 83333*l*. 6*s*. 8*d*.

Some development of the reasons for the plan which forms the main part of this article will be found in the 'Companion to the Almanac' for 1844.

CONCA, SEBASTIANO (Cavaliere), a celebrated Italian oil and fresco painter of the eighteenth century, was born at Gaeta, in the kingdom of Naples, in 1676. He was for sixteen years the pupil of Solimena at Naples, but attracted to Rome in 1706 by the great reputation of the Roman masters, he and his brother Giovanni determined to settle there, being convinced of the superiority of the Roman school. Conca, with an unparalleled resolution, laid aside the brush in his fortieth year, and for five years exerted himself assiduously and exclusively with the portcrayon, copying the best antient and modern works in Rome, with a view to improving his style of design. The reward however was not worth the price, for his works, though improved, were still mannered; habit had too strong a possession of him: he returned at length to painting, by the advice of Le Gros the sculptor.

Conca was one of the imitators of Pietro da Cortona, and possessed to a great degree the facilities of that master: he was ready, rapid, and superficial. His works are numerous in Rome and in the Roman States: there is one at Siena which is considered his masterpiece, the Probatica, or the Sacred Pool of Siloam, in the hospital of Santa Maria della Scala. Several of Conca's works have been engraved by Frey and others, and he etched a few plates himself. He died at Naples in 1764. There is an eulogium upon him by De Risso in his 'Memorie delle Belle Arti' Giovanni Conca acted chiefly as his brother's assistant.

(Lanzi, *Storia Pittorica*, &c.)

CONCEALMENT OF BIRTH. [INFANTICIDE, P. C.]

CONCERTI'NA, a musical instrument recently invented by Professor Wheatstone, the principle of which is explained under the word ACCORDION, P. C. S. The Concertina, in its simple form, claims priority of the Accordion in point of date, though the former, in its highly improved state, and as now generally in use, was more lately introduced.

This instrument is composed of a bellows, with two hexagonal faces or ends, and on these are placed the various stops, or studs, by the action of which air is admitted to the laminæ (or tongues, or steel bars) producing the sounds; and hereon are also fixed the thumb-straps and finger-rests. The finger-stops are in four rows, the two middle ones confined to the notes of the natural scale, the two external rows to the flats and sharps. Each sharp and flat is placed by the side of its corresponding natural note, and the instrument has, in addition to a complete chromatic scale, two other notes in each octave, whereby the chords in different keys are rendered more perfect than on the organ or piano-forte, and by which also the fingering of the various scales is rendered equally easy.

The Concertina, when the bellows is extended, is twelve inches in length, and the sides are about six inches wide. Its compass is three octaves and three notes, commencing at G, the fourth space in the base, and thence ascending. Some instruments, however, are made with a higher, some a lower, scale. That which we here describe is called the Double-Action Concertina, because two springs, or tongues, are given to each note, in order that the same sound may be produced, whether the bellows be pressed in or drawn out. The Single-Action Concertina has but one spring, or tongue, for each note, yielding a sound only when the bellows is moved inwards; that is, pressed. But it is provided with a self-acting valve, in order that the bellows may collapse instantaneously, which closes while the latter is pressed, and opens to admit air when it is expanded. A still further improvement of this instrument is said to be ready to be produced, which will give a complete treble and base.

There are also tenor and base Concertinas: the compass of the first from C, the second space is the base, to C the second additional line above the treble: of the last, from the second additional line below the base, to the third space in the treble.

CONCUSSION OF BRAIN. [HEAD, INJURIES OF THE, P. C.]

---

* When 49 is left in the second and third places, this mode gives the same as when 50 is left. The direct rule gives the exact truth or a little less, the inverse rule gives the exact truth or a little more; about one farthing more in the case here before us.

CONDENSER, a vessel employed to facilitate the liquefaction of aqueous or spirituous vapours, by exposing them to the cooling effect of a current of water, which may be either injected immediately upon or among the vapour, or, where it is required to keep the condensing water and the product of condensation distinct, separated from the vapour by a thin partition of metal. In the latter case copper is the metal most generally employed, on account of the rapidity with which it conducts heat, and the facility with which it may be fashioned into thin sheets adapted for the purpose.

The condensers employed for suddenly diminishing the volume of steam after it has impelled the piston of a condensing steam-engine are noticed under Steam-Engine, P. C., p. 474, &c., and Steam-Vessel, P. C., pp. 507, 508. The condenser forms a very important part of any steam-engine which works by condensation as well as pressure, but is especially important in a marine steam-engine. 'It is here,' observes Mr. Scott Russell, in the admirable treatise on Steam Navigation contributed by him to the new edition of the 'Encyclopædia Britannica,' 'that the whole process carried on in the boiler in so great bulk, and at so much expense, is instantly reversed, and all its laborious effects at once, as it were, annihilated.' The instantaneousness of condensation forms, in this case, its most important characteristic, as the condenser must be capable of condensing the steam faster than it can be produced by the boiler and passed through the cylinder. Were it not possessed of this power of rapid condensation, the power of the engine would, as Russell observes, cease, 'the elastic force of the steam above the atmosphere would alone act, the steam being only condensed as the piston carried it out of the cylinder;' and, as he further remarks, the engine would then only act as a high-pressure engine. 'It is,' he proceeds, 'by forming a perfect vacuum in the cylinder on the moment when the steam is about to enter on the opposite side, that the full power of the steam can alone be obtained in useful effect. A perfect condenser must therefore have much greater capability than that of merely condensing the steam as fast as the boiler is capable of evacuating it, or the engine of passing it through.' While, however, so much depends upon the power of the condenser, it appears that there is a point beyond which attempts to render the vacuum in the condenser more perfect fail to produce a corresponding increase of condensing power. Referring to Russell's treatise for his explanation of this matter, we can only quote the important practical remark that, 'If the barometer stand at 29½ inches, the standard of this country, the vacuum in the condenser is *too good* if it raise the barometer more than 28 inches of mercury.'

For the condensation of spirituous vapours it is always necessary to prevent actual contact between the condensing water and the vapour upon which it acts. Such condensers are alluded to under Distillation, P. C., p. 27, and a fuller account of several contrivances for the purpose is given in Dr. Ure's 'Dictionary of Arts,' under the title 'Refrigeration of Worts.' In the article 'Cooling of Fluids,' in the same work, is a minute account of a process patented by M. Derosne for cooling by means of a worm-pipe bound round with linen or cotton-cloth, upon which a continual shower of *hot* water is suffered to fall from a colander, the refrigerating effect being produced by the consequent evaporation of the water, which draws a current of cold air up the centre of the coil of pipe. Of this singular scheme, so completely opposed to all other plans of condensation or refrigeration, Dr. Ure observes that 'no man at all versant in the scientific doctrines, or the practical application of caloric, will ever seek to meddle with his (the patentee's) monopoly.'

Contrivances for the condensation of air, by pressure, are described under Air-Gun, P. C., p. 238, and Air-Pump, P. C., p. 239.

CONDENSER OF ELECTRICITY. Any apparatus by which the electric fluid can be accumulated may be so called, and thus every electric or galvanic battery is to be considered as a condenser; but the term is applied chiefly to such instruments as are employed to collect and render sensible very small quantities of the fluid.

The principle upon which a condenser of electricity acts may be thus stated. When the electricity of any body is decomposed by being brought near another body which has received from an object in contact with it more than its natural quantity of either kind (vitreous or resinous), the fluid of that kind is repelled from the first body, and that of the opposite kind then disposes the second body to receive a new supply of the former kind from the object with which it is connected. For example, if a thin circular plate of metal, having attached to its circumference a glass handle, by which it may be insulated when held in the hand, be made to receive a small quantity of fluid (suppose it to be vitreous) from the conductor of an electrical machine with which it may be put in connection by a wire; and then a similar piece of metal, connected with the earth by being held in the hand or supported on a pillar of metal, be brought directly under it and so near as almost to touch it, the nearest surfaces of both having been covered with a thin coat of resinous varnish; the electricity of the latter plate will be decomposed, the vitreous portion (in the case supposed) flowing to the earth and the resinous portion being attracted, by the fluid in the plate which is connected with the conductor, to the upper surface of the other plate. This resinous fluid now attracts more of the vitreous fluid from the conductor to the under surface of the plate in connection with it, and the latter fluid further decomposes the free electricity in the former plate, thus causing in it a new repulsion of the vitreous fluid, and a new attraction of the resinous fluid to its upper surface. The like process continues till an equilibrium is produced between the vitreous fluid supplied by the conductor and the resinous fluid which is drawn from the earth.

If the plate which is connected with the conductor be now removed from thence by means of the glass handle, the fluid in it, having no means of escape, will, on the plate being presented to an electrometer, make its condensed state manifest by producing a greater effect than if the plate, while attached to the conductor, had been unaccompanied by the other plate.

Many different kinds of condensers of electricity have been constructed, and those of Volta and Cavallo have been described in the notices of the lives of those electricians [Volta, P. C., and Cavallo, P. C. S.]; but, except for some particular purposes, Coulomb's Electrical Torsion Balance [Electrometer, P. C.] may be advantageously used when it is required to determine the intensity of the fluid in any body.

CONDITION OF A BOND. [Bond, P. C.]

CONDUCTORS OF HEAT. When a bar, or column, of any solid material is in contact, at one extremity, with a body already heated, the caloric in the latter seems to combine with the nearest particles of the former; and the particles next beyond these, by their affinity for heat, attract to themselves a portion of that element: these give a portion of the heat which they have received to the next, and so on; the quantities thus received in successive laminæ of equal thickness being nearly in a decreasing geometrical progression.

The conducting powers of different solid bodies have been noticed in Abstraction and Absorption of Heat, P. C. S. With respect to liquids, the experiments which have been made to determine whether or not they are conductors of heat consist in introducing into a cylindrical vessel half filled with the fluid whose conducting power was to be examined, a quantity of heated fluid of less specific gravity, all due precautions being used to prevent the particles of the two fluids from intermixing; and it was constantly found that thermometers placed at different depths in the former indicated a gradual descent of caloric from the upper to the lower surface. By such experiments Professor Thomson, Dr. Dalton, and others, have found that, with equal volumes of the fluids, the conducting power of linseed oil is rather greater than that of water, and the conducting power of mercury about twice as great.

The conducting power of gases, if such power exist, must be extremely small. Little confidence can however be placed in the results of the experiments made to ascertain the fact, from the impossibility of discovering how much of the effect produced may be due to radiation, or to the currents in the gases under examination. Sir David Leslie inferred from his experiments that the conducting power increases as the gases are more dense; and he estimated that, in atmospheric air, it varies with the fifth root of the density.

CONFECTIONS, called also *Conserves*, or *Condita*, are formed of fresh, generally succulent, vegetable substances, in a few instances with prepared chalk, as in the aromatic confection, preserved by means of sugar or honey. These were formerly much more numerous, and were examples of the polypharmacy prevalent among our ancestors: the number might be still beneficially reduced. The quantity of sugar required to prevent them from spoiling is so great as to disagree with delicate stomachs. In several instances the ingredients are ordered to be kept apart, or if associated, in a dry state, the water or syrup is to be added when the preparation is intended to be used; as in the cases of the aromatic, opiate, and almond confection. This is especially necessary in regard to the last; for if bitter almonds should be accidentally introduced, the presence of water might produce deleterious combinations.

When astringent substances such as roses are to be pounded, this process must be conducted in marble, not iron, mortars. The quantity of sugar is better to be excessive than deficient; and more is required in wet seasons than in dry. The conserves should be put into several small pots, rather than one large pot, which should be glazed with salt, as in Bristol ware, not lead. They should then be well closed, and kept in a dry cool place. Patent jars, of a very useful kind, are now manufactured for this purpose.

CONFERVA. [Water-Plants, P. C.]

CONFERVITES, species of fossil plants, probably of the Confervaceous family, occurring in the chalk of Bornholm and the south of England, in the green-sand of Maidstone, and chalk-marl of Hamsey. (Mantell.)

CONFLICT OF LAWS. [Laws, Conflict of, P. C. S.]

CONGLETON, RIGHT HONOURABLE HENRY BROOKE PARNELL, LORD, was born 3rd July, 1776, and was the second son of the Right Honourable Sir John Parnell, Chancellor of the Irish Exchequer; his mother was Letitia Charlotte, second daughter and co-heir of the Right Honourable Sir Arthur Brooke, of Colebrooke, in the county of Fermanagh, Bart. He was educated at Eton and Cambridge; and after leaving the university he spent some time abroad. It is stated in some accounts, that upon his return home 'he began his political career in the Irish parliament under the eye of his father.' His elder brother having been born a cripple, and incapable of articulating, the estates had, in 1789, been settled by act of parliament upon Henry, and he came into possession of them upon the death of his father in 1801. The baronetcy, an Irish one, fell to him upon the death of his brother in 1812.

On the 17th of February, 1801, Mr. Parnell married Lady Caroline Elizabeth Dawson, eldest daughter of John, first Earl of Portarlington, and granddaughter of the Earl of Bute, George the Third's prime minister; and at the general election in 1802 he was returned to Parliament for the borough of Portarlington, of which his father-in-law was the political patron. But a few weeks after the opening of the session he resigned his seat, by accepting the office of Escheator of Munster, to make way for Mr. (afterwards Sir) Thomas Tyrwhitt; and he remained out of parliament till March, 1806, when he was again returned as one of the members for Queen's County. This seat were commanded by the conjoint influence of his own property, of that of Lord Portarlington, and of that of Lord De Vesci, who was also his near relation, being the son of his mother's sister. Wakefield, in his 'Account of Ireland,' published in 1812, states (vol. ii. p. 308) that Lord Portarlington then commanded about 400 votes, Lord De Vesci 250, and the Parnell influence 350. Sir Henry sat in every succeeding parliament as one of the members for Queen's County, till the general election in 1832, when he declined a contest with the Repeal of the Union party, and Mr. Lalor was elected in his place. He had however previously stood three contested elections with the Tory party: in 1818 and in 1820, when he was brought in second on the poll, Mr. Wellesley Pole (the late Lord Maryborough) being first; and in 1831, when he was brought in first, Sir C. H. Coote being second. In April, 1833, he was returned for Dundee; and he was elected again for the same place in 1835 and in 1837, on the second occasion, however, not without opposition. In August, 1841, he was removed to the Upper House, by being created Baron Congleton, of Congleton, in the county of Chester. The family was originally from that county. It was the same to which the poet Parnell belonged, in whose life Dr. Johnson says, 'Thomas Parnell was the son of a Commonwealthman of the same name, who at the Restoration left Congleton, in Cheshire, where the family had been established for several centuries, and, settling in Ireland, purchased an estate, which, with his lands in Cheshire, descended to the poet.' It was a nephew of the poet who was made a baronet in 1766.

Sir Henry Parnell's political course was throughout that of an adherent to the most liberal section of the Whig, as distinguished from the Radical, party. In 1835, in appealing to the electors of Dundee, he summed up the leading principles of his creed and conduct as embracing triennial parliaments and the ballot, with an extension of the suffrage if it should be found necessary; the speedy abolition of the corn laws, through the intervention of a gradually diminishing fixed duty; general freedom of trade; the abolition of flogging and impressment; and the substitution of a property tax (we do not know whether, under this phrase, he included an income tax) for six or seven millions of the then existing taxes. He was also at all times a great advocate for economy and the reduction of taxation.

Upon the accession of the Whig ministry, in 1806, he was made a Lord of the Treasury in Ireland. He made the motion on the Civil List which dissolved the ministry of the Duke of Wellington in the end of 1830; and on the accession of his friends to power, which followed, he was made Secretary at War. In 1832 however a difference with his colleagues, on some financial points, led to his resignation; and he remained out of office till the formation of Lord Melbourne's administration, in 1835, when he was made paymaster of the forces and treasurer of the ordnance and the navy, both which offices he retained till the breaking up of the ministry to which he belonged in August, 1841. He had also served as chairman of the finance committee appointed by the House of Commons in 1828. In 1833 he was made a member of the government commission appointed to inquire into the excise; and he was also chairman of the Holyhead Road commission. In each of these investigations he took a leading part.

Besides corrected reports of five speeches which he delivered in the House of Commons—on the Irish currency, in 1809; on Irish tithes, in 1810; on the Bullion report, in 1811; on the state of Ireland, in 1824; and on unlawful societies in Ireland, in 1825—Sir Henry Parnell published the following treatises and pamphlets:—'Observations on the Currency of Ireland, and upon the Course of Exchange between London and Dublin,' 1804; 'The Principles of Currency and Exchange, illustrated by Observations on the State of Ireland,' 1805; 'An Historical Apology for the Irish Catholics,' 1807; 'A History of the Penal Laws against the Irish Catholics, from the Treaty of Limerick to the Union,' 1808; 'Treatise on the Corn Trade and Agriculture,' 1809; 'Observations on the Irish Butter Acts,' 1825; 'Observations on Paper Money, Banking, and Overtrading, 1827; 'On Financial Reform,' 1830 (his principal work, several times reprinted); and 'A Treatise on Roads,' 1833, reprinted 1838. (See P. C. xx. 36.)

Lord Congleton had been for some months in a state of health which made it necessary that he should be carefully watched; but on the morning of the 8th of June, 1842, having been left for a few minutes alone, he put an end to his life. Besides three daughters, he left two sons, the elder of whom however, the present Lord Congleton, having joined the community calling themselves the Plymouth Brethren, or Primitive Christians, has not taken his seat in the House of Lords.

(Memoir in *Gentleman's Magazine* for August, 1842; Peerages, Baronetcies, and Sir H. Parnell's publications.)

CONGLOMERATES. This term is most usually applied by geologists to designate rocks more or less distinctly enclosing displaced fragments of mineral masses which had been consolidated at some previous epoch, and subsequently broken up, removed from their original site, and placed in circumstances such as to permit of their being *re-aggregated*, and more or less cemented together by intervening smaller particles. Thus the old red conglomerate on the borders of the Grampians is full of *fragments* of the still more antient schistose and gneissic strata, worn by attrition in water, and reunited into a solid rock by interposed red sands.

In some volcanic regions the materials thrown out by eruptions are re-aggregated into conglomerate, by the operations of water.

CONO'CERAS, a genus of Cephalopoda, fossil on Lake Huron. Bronn founds the characters of it on the form of the septa, which are convex towards the base of the cone.

CONSCIENCE, a term derived from the Latin 'conscientia,' which, as well as the word 'conscious,' contains perhaps nearly the same fundamental notion as the English word conscience.

Some remarks are made on the term Conscience in the article Moral Sense, P. C.

Bishop Butler in the preface to his sermons remarks, that 'Man has several (instincts and principles of action) which brutes have not; particularly reflection or conscience, an approbation of some principles or actions, and disapprobation of others.' Conscience, as thus explained, might compre hend approbation and disapprobation of the principles or actions of others, as well as the principles or actions of the reflecting agent. But from other parts of his preface it seems that he limits it to a man's approbation or disapprobation of his own principles or actions; which is the ordinary meaning of the word conscience, and that which is chiefly intended here.

Nobody disputes that man has a moral judgment, or at least a capacity for having one; for it is possible that a man may have lived under such circumstances that this moral judgment has hardly ever been called into activity, just as many faculties both corporeal and mental may, for want of being exercised, never show themselves, and he who possesses them may not be conscious that he does possess them.

Language is the chief exponent of the human mind; and the language of all nations, that we know anything of, has some term by which it expresses the fact of a man reflecting on his own acts and thoughts, and also some word or words by which they express that a man forms a judgment upon them, that he is satisfied or dissatisfied with them, that the reflection gives him pain or pleasure. But a man may either reflect on an act, which is universally called good, and be pleased with the reflection; or he may reflect on an act, which the judgment of a large part of mankind may condemn, and be pleased with that reflection also. For instance, a man may reflect with pleasure on an act of vengeance. It cannot be denied that the reflection on bad acts does sometimes give pleasure; but it is not certain that this pleasure is unmixed with some pain: it is not the reflection which follows immediately on some acts that finally determines the self-judgment of the agent: this judgment may not be completely formed until other and new circumstances have called the reflection into greater activity.

Bishop Butler observes, 'the very constitution of our nature requires, that we bring our whole conduct before this superior faculty (reflection or conscience); and make it the business of our lives, as it is absolutely the whole business of a moral agent, to conform ourselves to it. This is the true meaning of that antient precept, *reverence* thyself.' Butler, it appears, considers that conscience is a faculty, and a superior faculty, one which exercises authority over other faculties; and he says in another place, 'Man is thus by his very nature a law to himself.'

If we admit that a man does reflect on his actions and his thoughts, and that he does approve or disapprove of them, it does not seem material to determine, whether it is by virtue of some particular faculty, or whether it is effected in some other way, either capable of explanation or incapable. The important fact of his exercising such judgment remains undisputed.

It seems probable that a man's judgment of the conduct of others, and his approbation or disapprobation of such conduct, which he expresses by the words right and wrong, good and bad, is founded on his own reflex judgments. It seems to be a fact in our constitution that a man can not directly inflict pain on another, at least when he has no provocation, without some feeling of self-disapprobation. The less directly the pain is inflicted, the less self-disapprobation he will feel, simply because the act of giving pain is less apparent to the agent. A man's general judgment of other men is and must be founded on his self-experience, on his reflection on himself and his own acts; and he who views any act of his own with disapprobation will view the like acts of others in the same way. He who judges of the acts of others by their tendency to be generally injurious to society, never forgets himself in forming this judgment; and in proportion as his mind is more or less enlarged and cultivated, he forms his judgment of the acts of others more or less with reference to mankind in general. The most stupid and ignorant of men can comprehend the danger to themselves, if certain acts were not forbidden and punished.

It cannot be denied that the general measure by which all mankind form their judgment of any given act, is its tendency to promote the general happiness, or the contrary; though they are not always aware that their judgment is founded on such considerations. A single act, unimportant in itself, is judged, not by its consequences only, but the consequences which would flow from such acts being general. And this is a right way of judging of things. Acts are also judged with reference to the intention of the doer, because it is necessary to ascertain whether the act is from design or from accident. Thus it is here admitted that the general judgments of mankind upon acts and dispositions are formed by a reference, either direct and known to themselves, or secret and often hardly perceived, to the tendency of such acts and dispositions to affect the general happiness. No man contends that the conduct of men in general is immediately directed by a previous consideration of the general tendency of their actions before they do them: men act from impulse, from habit, and according to imitation, and the mass of men are guided by these three things mainly. But though no man did direct his conduct in any degree by the rule of public utility, which however is certainly not true, others form a judgment of his conduct by that rule: it is that rule and no other, combined with an estimate of his motives and dispositions, which determines whether his acts shall be called good or bad. But after a man has considered the acts and dispositions of another, and has determined that they are injurious to human happiness, why does he pronounce a judgment of disapprobation and not of approbation? and why do men, when they are agreed that the tendency of certain acts is injurious to the happiness of mankind, also agree to condemn them? If there is one man so disposed as to look with approbation on acts of cruelty, fraud, and oppression, there are thousands on the other side who look on them with abhorrence. Their disapprobation cannot be called accidental, or capricious, for it is one judgment; and when a very large number of persons coincide in one judgment, that which is the foundation of their judgment must be one. Whether the foundation is true or false is immaterial: a general agreement or conclusion must rest on one and the same foundation. Why then does a man condemn a particular act after he has satisfied himself that it tends to injure human happiness? Is it because he also would condemn his own judgment, if he did not condemn the act? If so, his reflex judgment, his conscience, is his ultimate rule. Is it simply because he sees that his approbation of what is injurious to society would itself be injurious to society, and that he is solely moved to declare his disapprobation by that consideration? It is sometimes assumed, and it seems that there are people who think, that conscience, or whatever is meant by any equivalent term, tells a man at once what is right and what is wrong. [MORAL SENSE, p. 301.] This is however a confused way of stating the thing. Conscience, or reflex judgment, may produce an opinion of an action as right or wrong, and so one man's conscience may differ from another man's as to the same action. If there is right and wrong, both judgments cannot be right. Who must settle which is right? Clearly the majority of those who are for the one or the other opinion; and it happens that a very great majority of mankind do agree in their judgment of what is right and wrong: and this agreement is the sole foundation of morals. It is a common expression that people may honestly differ in opinion as to some acts; which means no more than this, that they do not agree as to the ultimate influence of such act on the happiness of society, but that each believes that he has formed his opinion according to the best of his judgment, and that each believes that he expresses the conclusion that he has come to. When we say that each believes he has expressed the conclusion that he has come to, we mean that each has examined the matter. We do not mean that the examination of one is as complete as the examination of the other; but we mean that each has examined as well as he can, and that each thinks so, and declares his judgment accordingly. There is therefore something which comes after the judgment that is formed of the 'influence of actions, and the dispositions from which they emanate, upon human happiness,' and determines whether we shall declare that judgment, or declare something which is not that judgment: and this something we here call Conscience.

CONSCIENCE, COURTS OF. [REQUESTS, COURTS OF, P. C.]

CONSIDERATION. This is a Latin word, 'consideratio,' which, as well as the verb 'considero,' was used by Cicero and others to express 'careful observation,' or 'reflection,' or 'deliberation before action.' It has nothing to do with looking at the stars, as the Latin grammarian Festus states, but it implies something which is nearer to the business of common life than star-gazing: it implies the sitting down of a man in a place alone or with others. The word 'consideration' means 'deliberation' in the English language of common life.

But consideration has also a legal and technical meaning, which seems to flow naturally from its primary and vulgar meaning. A consideration is something which enters into all contracts, and is a part of all transfers of property, except they are made by will or testament. The following are examples of *expressed* considerations, from which examples the technical meaning of consideration may be collected:—If a man agrees to sell his land to another for 100*l.*, the 100*l.* is the consideration for which he agrees to part with his land; or if a man promises to give 1000*l.* to another man if he will marry his daughter, the man is entitled to the 1000*l.* if he does marry the daughter. There is an *implied* consideration in many cases where none is expressed. A man may undertake to do a piece of work for another without any express bargain that he shall be paid; but if he does the work according to his agreement, the other man may be compelled to pay him. The implied consideration here is the implied promise to pay if the work is done.

The word consideration applies either to agreements about something which is to be done, which in England are generally called contracts, or to something that is done, some transfer of property, which is generally done by the act which is called a deed.

Contracts cannot be enforced if there is no consideration. A man may promise to give another 1000*l.*, but the promise cannot be enforced unless there is a consideration, which has been defined to be a reason which moves the contracting party to enter into the contract. This is not a very good definition, but it will do; the meaning is, there must be a motive which the law considers a sufficient motive. A consideration must of course be a thing lawful.

Considerations are sometimes divided into valuable considerations and good considerations. Marriage, as in the instance just given, that is, a marriage intended, and afterwards carried into effect, is a valuable consideration; money and any other thing which is of the nature of property, and has a money value, are valuable considerations. Therefore, if a man parts with his estate for a valuable consideration, the transaction is valid, and he who gets the estate has, so far as the consideration is concerned, a good title. A good consideration is the consideration of natural affection between blood relations, and a man may give his estate to another for such a consideration. But this kind of consideration is not sufficient to maintain the validity of a conveyance of property against the claim of a subsequent purchaser for valuable consideration. Thus if a man after his marriage settles an estate upon his wife and children in consideration of his natural affection, and then sells the estate for money, the purchaser will have the estate, and not the wife and children. (Hill *v.* Bishop of Exeter, 2 Taunt. 69.) Such a settlement after marriage is called voluntary or gratuitous. A settlement of property made in consideration of a future marriage, which afterwards takes place, is a settlement for valuable consideration. The actual settlement may be made after marriage, if it is made pursuant to a written agreement entered into before marriage.

In the statute 13 Eliz. c. 5, the object of which is to prevent persons from cheating their creditors by disposing of their real or personal property, it is declared that the provisions of the act do not extend to estates or interests made or conveyed 'upon good consideration and *bonâ fide*,' and the good consideration here means money, or money's worth, or a marriage which is then intended and afterwards takes effect. Good consideration here is therefore equivalent to what has been above defined to be a valuable consideration.

The acts 27 Eliz. c. 4, and 30 Eliz. c. 18, § 3, make void, as against subsequent purchasers, all conveyances, &c. of real property which are made for the purposes of defrauding such purchasers, unless 'upon or for good consideration and *bonâ fide*.' This statute has received a singular interpretation, for it has been decided that it makes void a previous conveyance, though not made to defraud any one, if the consideration is not such as the statute intends; and accordingly, as in the case just stated, if a man settles his land after marriage on his wife and children, and then sells it, the prior settlement is void as a fraudulent conveyance.

A voluntary conveyance then by a man who is at the time insolvent, is not valid against his creditors; but if a man is not insolvent at the time, a voluntary conveyance, that is, one where there is no valuable consideration, is valid against future creditors (13 Eliz. c. 5). A conveyance for valuable consideration, such as marriage, is a valid conveyance, even if a man be insolvent at the time. An insolvent man may therefore cheat his creditors by settling his property on a woman with a view to marriage, and then marrying her; but in certain cases, such settlements are not valid against creditors when made by a person who is subject to the bankrupt laws. A voluntary conveyance is not valid against a future purchaser for good consideration: it is a fraudulent transaction according to the construction of the 27th of Eliz., and as such is declared void against the purchaser. If the purchaser knew that there was such a voluntary prior conveyance, that makes no difference; his purchase is valid against such conveyance.

It appears from these instances that the legal notion of consideration is this:—the fact of there being a good consideration is evidence that there is no fraud, and the absence of it is a presumption of fraud. The doctrine of consideration is intended to protect either the giver or grantor, or other persons whom he may wish to defraud by disposing of his property.

Every deed therefore or instrument by which property is conveyed ought to show some consideration for which the person conveys the property to another; for though a deed is valid between the parties to it, when no consideration is expressed, it may be invalid with respect to other persons who are not parties to it. There is no absolute amount of consideration which can be legally required, but a very small amount of consideration might in some cases raise a presumption of fraud, and indeed even if the amount of consideration should be the full value of the thing conveyed, it may be necessary in some cases to inquire whether the consideration expressed was actually paid.

In the case of a contract or agreement to give or settle property, the necessity for a consideration is obvious, both for the protection of the giver, and of others to whom he is indebted, or whom it is his moral duty to provide for. No contract to give can be enforced unless there is a sufficient legal consideration. An agreement to settle property on a lawful child may be such consideration; the case of an illegitimate child is not such a consideration. An illegitimate child is viewed as standing to his supposed father exactly in the situation of a stranger.

Many curious legal questions have arisen on the doctrine of consideration, such for instance as the case of one man promising to pay the debt of another man. The general principle is, as already stated, that there must be some advantage to the person promising, either certain or prospective, which shall be a reasonable and sufficient inducement for him to promise. If a man were to give his physician a bond which should bind his executors to pay the physician a certain sum after his death, a case which has happened, the validity of the bond might be disputed if the circumstances under which it was given were such as to raise a suspicion of fraud; for instance, if no person was privy to the transaction except the man and his physician, and if the sum should be very large, and the services of the physician altogether disproportionate to the amount.

CONSTABLE, JOHN, was born at East Bergholt, in Suffolk, in 1776. He was the second son of Golding and Ann Constable, and was originally intended for the church, but as he showed an aversion or disinclination to study, his father gave up this design and endeavoured to make a miller of him, in which business Constable was actually engaged for about a year. His time was, however, chiefly spent in contemplating and studying the beauties of natural scenery: he displayed much originality of observation in his attempts at portraying its beauties, and his mind became gradually engrossed in sketching and the study of landscape. His taste for art had early displayed itself; when at school at Dedham he was in the habit of neglecting his lessons for his pencil.

The result was his adoption of landscape painting as a profession, and in this he was instructed by R. R. Reinagle, R.A., and he received much encouragement from Sir George Beaumont. In 1795 he visited London, but returned to his native place; in 1799 he again visited London with a view to try his fortune, and in 1800 he was admitted as a student into the Royal Academy. For many years he was a steady exhibitor in the Royal Academy, but his works attracted little attention, owing probably to the unpretending nature, and extreme simplicity of his style. He professed to, and probably did, despise all *styles* and conventionalities; he used to say, 'There is room enough for a natural painter; the great vice of the day is *bravura*—an attempt to do something beyond the truth.' He was right; and in no great number of years his merits were acknowledged by the public.

In 1820 he took a house at Hampstead, where he chiefly resided; he had also a house in Charlotte-street, Fitzroy-square, where he kept a gallery of his works, for though admired, many of his paintings remained on the artist's hands. At length in 1829 Constable received the tardy acknowledgment of the Royal Academy; he was elected an academician on the 10th of February of that year, and when he received notice of the honour which had been done him, he observed—'It has been delayed until I am desolate and cannot impart it,' in allusion to the death of his wife, which had occurred only a few weeks before his election: he was then in his fifty-third year. He was taken ill on the night of the 30th of March 1837, and died in less than an hour afterwards.

Constable has painted many excellent pictures, and all his works improve much in colour by age; the 'Corn-field' in the National Gallery is a very good specimen of his style, and is indeed one of his best works. 'The Chain Pier at Brighton,' 'Hampstead Heath,' and 'The Glebe Farm' are also among his best productions. His style is original and peculiar, and his scenes are generally extremely simple, for his attention was more engrossed by certain minutiæ and transient effects in nature, than by a love for the picturesque, or what may be termed scenery. In one respect he carried this attention to minutiæ to an extreme, namely, the effect of the morning dew. He may have fallen into this error by his habit of early sketching, but an exact and judicious observer of nature, studying in all seasons and in all hours, could not fail to observe that this effect is extremely transient, and is but one, and not the most beautiful, of the ever varying effects of nature. Constable appears to have been very early influenced by his own views of things, for when a young man, being asked by Sir George Beaumont what style he proposed to adopt, he answered, 'None but God Almighty's style, Sir George.'

This effect of dew, of which he was so fond, is a distinctive characteristic of his works, and has caused them to be styled mouldy by some critics, who in the earlier part of his career exercised their functions with little charity towards the painter. Now, however, whether from the improvement which time has effected in his colouring, or from familiarity with his style, his admirers far outnumber his detractors, and his pictures are increasing in commercial value.

Constable's character both as a man and an artist is well described in the following account of him by his friend and fellow academician, Mr. Uwins, in a paper read at the Phrenological Society in 1843. 'He seemed to think that he came into the world to convince mankind that nature is beautiful. Instead of seeking for the materials of poetic landscape in foreign countries amidst temples and classic groves, or in our own amongst castles, lakes, and mountains,—he taught that the simple cottage, the village green, the church, the meadow covered with cattle, the canal with its barges, its locks and weedy banks, contained all the materials and called up all the associations necessary for picture. He doted upon his native fields. "I love," said he, "every stile, and stump, and lane in the village: as long as I am able to hold a brush I shall never cease to paint them." So great a lover of simple truth could not tolerate the commonplaces of art or literature.' The freshness and novelty of his pictures, he continues, both surprised and delighted the French painters, at the time they were exhibited at the Louvre. 'They seemed more like the works of nature than art. The dew of the morning was found upon the leaves and the grass.'

'Originality in every art will always meet with opposition from those whose ideas are bounded by the commonplaces of the day. It was Constable's glory that he did not escape. The damnatory judgment of the critics confirmed him in his own views, and gave fresh animation to his exertions. "A great connoisseur," he says, in one of his letters, "called on me the other day, and told me he did not like my picture. This convinces me there must be something good in it." But while disgusted with the cant of ordinary criticism, he delighted to hear honest John Bannister say he felt the wind blowing in his face as he looked at his pictures, and Fuseli declare that they made him call for his umbrella. "I care not," he would say with Sterne, "for the dogmas of the schools: let me get at the feelings and the heart in any way I can."' The above extract clearly points out the style of Constable, the peculiarities of his execution and of his character, though the process of reasoning is not very evident which leads him to conclude that there must be something good in a picture because a connoisseur dislikes it, or to lead him to feel delight because looking at his pictures makes one man feel the wind, and another fancy it is going to rain. A gallery of pictures which required its visitors to put on their great coats and hold up their umbrellas would be as unpleasant as peculiar.

A very elegant Life of Constable, by his friend Leslie, was published by Mr. Carpenter, with twenty-two engravings from his works, by David Lucas—'Memoirs of the Life of John Constable, Esquire, R.A., composed chiefly of his Letters. By C. R. Leslie, Esquire, R.A.' 4to., Lond. 1842.

CONSTITUTIONS AND CANONS ECCLESIASTICAL. King James I., in the first year of his reign in England, by his writ directed to the Archbishop of Canterbury, summoned and called the 'bishops, deans of cathedral churches, archdeacons, chapters and colleges, and the other clergy of every diocese within the province of Canterbury,' to meet in the Cathedral Church of St. Paul in London, to 'treat, consent, and conclude upon certain difficult and urgent affairs mentioned in the said writ.' The persons so summoned met in Convocation, and 'agreed upon certain canons, orders, ordinances, and constitutions, to the end and purpose' by the king 'limited and prescribed unto them;' to which the king, out of his 'princely inclination and royal care for the maintenance of the present estate and government of the Church of England by the laws of this realm now settled and established,' gave his royal assent by letters-patent, according to the form of the statute of the twenty-fifth year of King Henry VIII. The king, by his prerogative royal and supreme authority in causes ecclesiastical, commanded these said canons, orders, and constitutions to be diligently observed, executed, and kept by his loving subjects of the kingdom, both within the provinces of Canterbury and York, in all points wherein they do or may concern every or any of them; and the king also commanded that every minister, by whatever name or title soever he be called, shall in the parish church or chapel where he hath charge read all the said canons, orders, ordinances, and constitutions once every year, upon some Sundays or holydays, in the afternoon before divine service.

The canons and constitutions may be divided into fourteen heads, which treat as follow:—1, Of the Church of England. 2, Of divine service, and administration of the sacraments. 3, Ministers, their ordination, function, and charge. 4, Schoolmasters. 5, Things appertaining to churches. 6, Churchwardens, or quest-men, and side-men, or assistants. 7, Parish clerks. 8, Ecclesiastical Courts belonging to the archbishop's jurisdiction. 9, Ecclesiastical Courts belonging to the jurisdiction of bishops and archdeacons, and the proceedings in them. 10, Judges ecclesiastical and their surrogates. 11, Proctors. 12, Registrars. 13, Apparitors. 14, Authority of synods. The number of constitutions is one hundred and forty-one. The authority of these canons is binding on the clergy, but not on the laity, except so far as is stated under the head Canon, P. C. The authority of Canon 77 may be doubted; it is this: 'No man shall teach, either in public school or private house, but such as shall be allowed by the bishop of the diocese, or ordinary of the place, under his hand and seal; been found meet as well for his learning and dexterity in teaching, as for sober and honest conversation, and also for right understanding of God's true religion; and also except he shall first subscribe to the first and third articles afore mentioned simply, and to the first ten clauses of the second article.' The 78th Canon provides that 'curates desirous to teach shall be licensed before others:' and 79 declares 'the duty of schoolmasters.' The Constitutions and Canons Ecclesiastical have been printed by the Society for Promoting Christian Knowledge, London, 1841, together with the Thirty-Nine Articles of the Church of England.

CONTINGENT REMAINDER. [Remainder, P. C. and P. C. S.]

CONTRACTION, in Surgery, an abnormal and permanent alteration in the relative position and forms of parts, arising from various causes. Under the heads of Anchylosis, P. C., and Distortion, P. C., some of the more remarkable results of contractions have been pointed out. In this article we shall describe the nature of club-foot and wry-neck, and point out the recent mode of treating these contractions by surgical operation, which has been remarkably successful.

Club-foot, *Talipes*, is the term which has been applied to all kinds of distortion of the foot. Four species have been described—*talipes varus*, distortion of the foot inwards; *talipes valgus*, eversion of the foot; *talipes equinus*, forced extension; and *talipes calcaneus* or *talus*, extreme flexion of the foot upon the leg. Till within a recent period it was a generally received opinion that all forms of club-foot consisted in a malformation of the bones of the tarsus, more particularly the arstragalus, and this malformation was traced to a diseased condition of the bones. It is a curious fact however that Hippocrates attributed club-foot to the unnatural contraction of one set of ligaments and the elongation of another. Whether this be the original cause of the distortion may be doubted, but there can be no doubt as to its being a result, and that the only malformation which exists in the parts is removed by relieving the contraction of the ligaments. It is however to Delpech in modern times that we are indebted for a sound view of the nature of club-foot, and more particularly for suggesting, though himself unsuccessful, the modern operation for its relief. Two cases of club-foot, which had been produced after the bones had attained their full development, led him to regard the irregular action of the muscles as the cause. To this conclusion also Stromeyer of Berlin was led, by an inquiry in which he engaged, on the occurrence of paralysis in the muscles of inspiration. The following are the various sources of distortion dependent upon irregular action of the muscles, according to Dr. Stromeyer.

1. Structural changes in the muscles, inflammation and wounds, with loss of substance.

2. Debility and inactivity of antagonists, produced either by wounds of tendons or the bellies of antagonist muscles, or by paralysis of the nerves of antagonist muscles.

3. Diminution of voluntary power in the entire limb through which the flexors or extensors preponderate over the extensors or flexors by the constant organic contraction of the muscles.

4. Painful affections of the part, restraining or prohibiting motion, such as that from inflammation of a joint.

5. Increased energy in the muscle, morbid contraction or motion in the muscular fibres, tonic spasm.

The various modes of treatment of club-foot formerly pursued indicated the want of a definite knowledge of its nature. They were mostly mechanical, and seldom effected the object they had in view. The mode of treatment now more generally pursued is the use of mechanical means after the performance of a surgical operation. The operation consists in dividing the tendons of the contracted muscle, which admits of the restoration of the malformed parts to their normal position, and the space between the divided ends of the tendon is filled up with new matter, and the function of the muscle is normally performed. This operation, simple as it is, was never performed till the year 1784, when Lorenz, a surgeon at Frankfort, divided the tendo-achillis for the cure of a case of club-foot, under the direction of Thilenius. This operation was afterwards unsuccessfully resorted to by Sartorius and Michaelis. In 1816 Delpech again attempted it, and upon more philosophical principles than his predecessors, but he also failed. This did not prevent Stromeyer from repeating the operation in 1831, which was perfectly successful. In 1833 and 1836 he published two memoirs, containing six successful cases. It was speedily performed again by several surgeons in England and on the Continent, and the value and utility of the operation are now universally admitted. The principal rule to be observed in the operation is not to cut through more parts than is necessary, and to divide the tendon of the contracted muscle. The division of the tendo-achillis is however only calculated to relieve talipes equinus, and the slighter cases of varus. But in the severer forms of varus, the tendons of the tibialis posticus, flexor longus pollicis, and sometimes of the tibialis posticus, require division. In valgus the tendons of the peronei as well as the tendo-achillis require division. The principal part of the treatment takes place after the operation, and consists of applying various mechanical means for the restoration of the part to their normal position. This treatment is generally commenced from two to four days after the operation. A great variety of apparatus have been designed for the purpose, but each case requires a peculiar adaptation of the means for effecting the reduction of the parts.

Club-hand does not occur so frequently as club-foot, but the distortion is of precisely the same nature, and requires for its removal the application of the same measures.

Wry-neck (*Caput obstipum*, *Torti-collis*) is a disease of the same nature as the preceding, and most frequently arises from the unequal contraction of the muscles of the neck, originating in some one of the causes previously mentioned. The consequence is that the head is permanently inclined towards one of the shoulders. Sometimes this disease arises from disease in the vertebræ or from the contraction of cicatrices after severe wounds and burns of the neck. In the former case the wry-neck can seldom be removed, but in the latter the cicatrix may sometimes be advantageously divided, and the wound allowed to heal again with the head in its natural position. Where it depends on contraction of the muscles the same operation may be had recourse to as is used for the relief of club-foot and club-hand. It is a curious fact that the operation for dividing the muscles in wry-neck had been recommended and practised long before it was found to be generally applicable to the treatment of contractions. When it is determined to treat wry-neck by mechanical means without operation, the best apparatus is that of Jörg. It consists of a pair of leather stays, and of a band or fillet which goes round the head. To the stays is attached a pulley, over which runs a band to the back of the ear, in the direction of the muscles of the neck, and which can be tightened by means of a screw. It thus acts on the head as the muscles would do if they were in action.

Dr. Little of London has recently published a work on the application of the Stromeyerian operation to contractions depending on what is called partial ankylosis. These ankyloses depend upon some organic or functional lesion of tendon or muscle, arising from one of the following causes:—1, From sloughing or adhesion. 2, From spasmodic contraction. 3, From organic contraction through paralysis of antagonist muscles. 4, From contraction owing to long continued rest of the limb. When this kind of ankylosis has not existed for a great length of time, or occurs in young persons, a division of the contracted muscle, and careful extension of the limb afterwards, is very often followed by a complete restoration of the function of the ankylosed joint.

The same causes which produce the above-named diseases give rise to the irregular action of the eye called squinting, and the operation of Stromeyer has been found perfectly successful in this deformity. [SQUINTING, P. C.]

(Little, *On Ankylosis*; Little, *On Club-Foot*; Cooper's *Surgical Dictionary*; Cooper, *First Lines of Surgery*; Articles 'Ankylosis' and 'Club-Foot,' *Cyclopædia of Surgery*.)

CONULA'RIA, a fossil genus of Mollusca, generally ranked with Cephalopoda, but which appears to us allied to the Pteropod genus Cymbulia. [THECOSOMATA, P. C.]

CO'NULUS, a generic name for Echinida, to which also the term Galerites is applied.

CONVALLARITES, a genus of Liliaceous? plants, fossil in the red-sandstone of Sulzbad. (Brongniart.)

CONVENTION TREATIES. These are treaties entered into between different states, under which they each bind themselves to observe certain stipulations contained in the treaty. In 1843 two acts were passed (6 & 7 Vict. c. 75 and c. 76) for giving effect to conventions between her Majesty and the King of the French and the United States of North America for the apprehension of certain offenders.

The act relating to France (c. 75) legalises the convention entered into with the government of that country for the giving up of offenders who may escape from France into England. On requisition duly made by the French ambassador, a warrant will be issued for the apprehension of fugitives accused of having committed the crimes of murder (as defined by the French code), attempt at murder, forgery, or fraudulent bankruptcy; and any justice before whom they may be brought is authorised to commit them to gaol until delivered up pursuant to the ambassador's requisition. Copies of the depositions on which the original warrant was issued, duly certified as true copies, are to be received as evidence. But no justice is to issue a warrant for the apprehension of any French fugitive unless the party applying is the bearer of a warrant or document, issued by a judge or competent authority in France, authenticated in such a manner as would justify the arrest of the supposed offender in France upon the same charge. The secretary of state will order the person committed to be delivered up to the person or persons authorised to receive him. If the prisoner committed shall not be conveyed out of her Majesty's dominions within two months from the time of his committal, any of her Majesty's judges, on application made to them, and after notice of such application has been sent to the secretary of state (or to the acting governor in a colony), may order such person to be discharged, unless good cause shall be shown to the contrary. The act is to extend to all her Majesty's present or future possessions, and to continue in force during the continuance of the convention.

The act relating to America (c. 76) is similar in its nature and purposes to the one relating to France; but the crimes specified include, in addition, piracy, arson, and robbery, and do not include fraudulent bankruptcy.

In 1844 a case occurred of a fraudulent French bankrupt who had escaped to England, and the French government demanded that he should be given up under the Convention

Treaty. He was arrested and taken to prison; but before the surrender could take place he applied for a writ of habeas corpus, on the ground that fraudulent bankruptcy was an offence unknown to the law of England, and that therefore it was contrary to law to arrest him or keep him in custody on such a charge. The warrant of commitment did not specify that the prisoner should be given up on requisition duly made according to the act, but the words were, 'until he shall be delivered by due course of law.' In consequence of the defective application of the Convention Treaty in this particular case the prisoner was discharged.

At the close of 1843, seven persons accused of murder, robbery, and piracy fled for security from Florida, in the United States, to Nassau, one of the Bahama Islands. They were followed by a marshal of the United States, who was authorised by his government to demand that the fugitives should be given up under the Convention Act. The governor, Mr. George Cockburn, issued his warrant accordingly to the chief justice of the colony, authorising and directing him to take measures for the fulfilment of the act. In anticipation of the application of the marshal, the chief justice had a warrant prepared for apprehending the fugitives, expecting that the evidence tendered would be such as could be judicially received. The only evidence that was offered consisted of indictments, without the evidence upon which they were framed. The act requires that copies of the depositions upon which the original warrant was granted, certified, &c., must be adduced in order to render the provisions of the act available. The chief justice, with his associate judges, were under the necessity of refusing the warrant applied for, chiefly on the following grounds:—'An indictment per se can never be received as evidence: it is not enough for us to know that the American jury thought the parties guilty; we ought to know the grounds upon which they thought them guilty. What may constitute the crime of murder in Florida may be very far from doing so according to the British laws; or even to the laws of the Northern States of America. By issuing a warrant, then, to apprehend the parties in virtue of these indictments, we might be doing so on evidence which would not justify their apprehension by the British law, and should thereby be proceeding in direct violation of the act.' (*Parl. Paper*, No. 64, Sess. 1844.)

CONVERSION. [Trover, P. C.]

CONY'ZA, a genus of plants belonging to the natural order Compositæ, to the suborder Tubulifloræ, the tribe Eupatoriaceæ, the subtribe Baccharideæ, the division Conyzeæ, and the subdivision Enconyzeæ. It has an herbaceous imbricate involucre, the flowers of the ray tubular, 3-toothed, pistilliferous, those of the disk tubular, 5-toothed, hermaphrodite, the anthers caudate, the achenium beakless, the pappus pilose, the receptacle naked. The species are herbs and shrubs, and are found in Europe, Asia, Africa, and America.

C. squamosa, Flea-bane, Ploughman's Spikenard, has the scales of the involucre all linear, the leaves ovate-lanceolate, downy, denticulate, the lower leaves narrowed into a footstalk, the florets of the ray subligulate, the fruit terete. This is a common plant on calcareous soils in Great Britain and throughout Europe. It possesses a volatile oil with a peculiar scent, and is used for the purpose of driving away fleas and gnats It seems to have had this reputation from an early period, as its names in most languages have reference to this quality. Its Latin name is *pulicaria;* French, Herbes aux puces; English, Flea-bane. This species has been referred by De Candolle, in his 'Prodromus,' who is followed by Babington, in his 'Manual,' to the genus *Inla*, under the name of *I Conyza.*

C. anthelmintica has ovate or oval-oblong leaves acuminate at both ends, coarsely serrated and downy; the heads corymbose, each containing 40-50 florets; the scales of the involucre lanceolate, linear, acute, the outer somewhat spreading, leafy, and obovate-linear. It is a common plant among rubbish and in dry uncultivated ground in the East Indies. It is the *Vernonia anthelmintica* of Willdenow. The fruit is used by the doctors of India as a powerful remedy for worms.

C. genistelloides has very small leaves reduced to sharpish somewhat ternate scales; 1-2 heads in interrupted spikes, the involucre turbinate, with the scales all acuminate. This plant is a native of Peru and Brazil. It is the *Baccharis genistelloides* of Persoon, the *Molina reticulata* of Lessing. It contains a bitter extractive matter and an aromatic oil, and is not unlike in its medicinal characters the common wormwood. It is employed in the Brazils in intermittent fevers, and may be used in all those cases where the Artemisia is indicated. It is particularly beneficial in the chronic diseases of horses, which are very fond of this plant. It may be employed in the form of an extract or decoction.

C. marylandica has sessile, broad-lanceolate, acute, serrated leaves; the corymbs terminal and fastigiate. It is a native of North America, and secretes a powerful volatile oil, which gives out the odour of camphor. This property is also possessed by *C. camphorata.*

(Loudon, *Encyclopædia of Plants;* Koch, *Flora Germanica;* Lindley, *Flora Medica.*)

COOLER. The Spanish word *Alcarraza*, which is referred to Cooler, P. C., signifies an earthenware vessel or pitcher, porous and unglazed, in which water is cooled by evaporation. [Evaporation, P. C. S.]

COOLEY, THOMAS, an Irish architect, born in 1740, erected what is not only one of the most elegant public buildings in Dublin, but of its kind anywhere, the Royal Exchange in that city. This structure was begun by him in 1769, and although of but moderate size is in a style at once noble and ornate; on the exterior, a Corinthian order is continued in columns and pilasters, between which there is only a single range of upper windows, the lower part of the intercolumns being filled in with solid rusticated wall, a circumstance that contributes materially to character; nor is the interior less remarkable for both elegance and commodiousness of plan, it being a rotunda inscribed within a square,—the circular part formed by a peristyle of twelve columns of the composite order, and covered by a dome. Had Cooley done nothing else, this work alone would entitle him to very high rank among his contemporaries for originality and refined taste in design. He also erected the prison called Newgate (1773), in the same city, and commenced the noble pile of the 'Four Courts,' which was begun by him in 1776, but he did not live to complete it, little more than the west wing being erected at the time of his death in 1784; after which the edifice was carried on by Gandon [Gandon, P. C. S.], with some variations from the original design.

COOPER, SAMUEL, a very distinguished English miniature painter of the seventeenth century, was born in London in 1609, and was brought up together with his brother Alexander by his uncle John Hoskins, likewise a miniature painter, and much distinguished in the reign of Charles I. Samuel Cooper soon displayed such ability as to alarm his uncle, who perceived that the works of his nephew were preferred to his own, and he accordingly took him into partnership with him, which partnership however he almost immediately dissolved again, finding the marked preference which was invariably displayed for Cooper to be intolerable. Cooper was without a rival in the time of the Commonwealth, and during the reign of Charles II. He painted the portrait of Cromwell which has been engraved by Vertue, but the head only was finished. The original is still in existence, but it has changed hands various times, and is at present, we believe, in one of the Royal collections. Walpole speaks in the highest terms of its merits; he says that if it could be enlarged to the size of one of Vandyck's portraits, the latter would lose by the comparison: he says, 'it would be an amusing trial to balance Cooper's Oliver and Vandyck's Lord Strafford.' Another of Cooper's masterpieces was a head of a person named Swingfield, which he took with him to the court of France, where it procured him the highest patronage: he remained some years in France and Holland. He was also much patronised by the court of Charles II., whose miniature he painted, as well as that of his queen: he painted also the Duchess of Cleveland, the Duke of York, Monk duke of Albemarle, Archbishop Sheldon, the Chancellor Shaftesbury, and many others. Walpole possessed a drawing by Cooper of Pope's father lying dead in his bed; Cooper's wife was the sister of Pope's mother. Cooper died in London, in 1672, in his sixty-third year, and was buried in old St. Pancras church, where a beautiful marble monument was raised to his memory, on which was inscribed a long and highly commendatory epitaph, in Latin, commencing—'Samuel Cooper, Esquire, of England the Apelles, of his age and of art the ornament,' &c. He was an excellent musician, being an admirable performer on the lute, and he was also well versed in several foreign languages. His widow was pensioned by the crown. Cooper's excellence did not extend beyond the head, but so far he was without a rival. He was particularly successful in painting hair. The following entry in one of the pocket-books of Charles, the husband of Mary Beale, shows that for a head he enjoyed the highest reputation among his contemporaries—'Sunday, May 5th, 1672, Mr. Samue. Cooper, the most famous limner of the world for a face, dyed.'

The writer of the 'Essay towards an English school,' (London, 1706,) says that Cooper acquired this great excellence by copying the pictures of Vandyck and imitating his style. 'Our nation,' he says, 'may be allowed to boast of him, having far exceeded all that went before him in England in that way (miniature), and even equalled the most famous Italians, insomuch that he was commonly styled the Vandyck in little, equalling that master in his beautiful colouring, and agreeable airs of the face, together with that strength, relievo, and noble spirit; that soft and tender liveliness of the flesh which is inimitable.' One of the chief excellences of his works is their freedom of execution, and their vigorous style, for though executed in water-colours they have the power and effect of oil paintings. Walpole makes a comparison between the works of Cooper and Oliver; he says—'Oliver's works are touched and retouched with such careful fidelity that you cannot help perceiving they are nature in the abstract; Cooper's are so bold that they seem perfect nature only of a less standard. Magnify the former, they are still diminutively conceived: if a glass could expand Cooper's pictures to the size of Vandyck's, they would appear to have been painted for that proportion.'

(*An Essay towards an English School of Painters*; Walpole, *Anecdotes of Painting in England.*)

COOPER, SIR ASTLEY, was born at the village of Brooke, in Norfolk, where his father, Dr. Cooper, was curate. His mother was a popular authoress in her day, and published several novels and other literary productions. The object of these publications was to elevate and dignify the position of woman in society.

Astley was born on the 23rd of August, 1768, and was the fourth son. As a boy he was remarkable for his liveliness and good humour, and numerous anecdotes of his boyish adventures are remembered in his family, and have been recorded with great minuteness by his nephew Mr. Bransby Cooper, in a recent memoir of his uncle. As a boy he was not remarkable for application to study, but the following incident determined his choice of surgery as a profession:—A youth had fallen down in front of a cart, one wheel of which passed over his thigh, lacerating it and wounding the femoral artery. No surgeon was near, and the boy in danger of dying from loss of blood, when young Astley Cooper bound his handkerchief sufficiently tight over the upper part of the thigh to prevent circulation in the artery, and thus stopped the bleeding till a surgeon arrived.

When in his thirteenth year his father was presented with the living of Great Yarmouth, in Norfolk, to which place he immediately removed. In August, 1784, young Cooper left home for London. His uncle William Cooper, who was then a surgeon at Guy's Hospital, not being able to receive him into his house, he was placed with Mr. Cline, who was at that time surgeon to St. Thomas's Hospital, and one of the most distinguished surgeons of his day. To his connection with Mr. Cline, and the influence of his example, Sir Astley attributed much of his success in after life.

In London he began to devote himself with earnestness to his new pursuit. He early perceived the importance of correct anatomical knowledge to the study of surgery, and made such advances by an habitual attendance in the dissecting-room, as to lead others to consult him in their difficulties. He also at this time attended the lectures of John Hunter, and was one of the few who comprehended the real value of this great man's theories and experiments. In 1787 he visited Edinburgh, and on his return was made demonstrator of anatomy at St. Thomas's Hospital. This speedily led (A.D. 1791) to his being permitted to take part of the lectures on anatomy and surgery which were then delivered, together with Mr. Cline. He was married in the same year, and after the close of the winter session paid a visit to Paris in 1792. He was here on the breaking out of the Revolution on the 10th of August; and, although at that time he sympathised with the revolutionists, he was compelled, on account of Mrs. Cooper's fears and delicate health, to return to England. In the next course of lectures which he gave he lectured on surgery alone, and this was one of the first courses in London given on that subject independent of anatomy. It was perfectly successful. He was also this year appointed professor of anatomy at Surgeons' Hall, and was re-appointed in 1794 and 1795.

The earliest of Sir Astley Cooper's literary productions appeared in a volume of papers entitled 'Medical Records and Researches,' which was published in 1798. In these essays, the caution in collecting facts, and fearlessness in coming to conclusions when his facts were sufficient, which characterised him through life, are evident. Up to this time, although his reputation was increasing, his income was small. From the time he first commenced, he says, 'My receipt for the first year was 5*l*. 5*s*.; the second, 26*l*.; the third, 64*l*.; the fourth, 96*l*.; the fifth, 100*l*.; the sixth, 200*l*.; the seventh, 400*l*.; the eighth, 610*l*.' On the death of his uncle he was appointed to the office of surgeon at Guy's Hospital, but not without some difficulty.

Cooper was intimate with Horne Tooke and Thelwall, and others who held the same political opinions. However, just before the vacancy for the surgeoncy at Guy's Hospital, in an interview with his friend Coleman, Cooper assured him that he felt a 'disagreeable sensation' about his throat which he regarded as a prelude to his fate, should he persist in his political conduct, and he resolved on changing his politics. This explanation being deemed satisfactory by the managers of Guy's Hospital, he was appointed surgeon in 1800. In this and the following year he read two papers before the Royal Society, 'On the effects which take place from the destruction of the membrana tympani, with an account of an operation for the removal of a particular species of deafness.' Although the operation here proposed was apparently successful, its benefits seemed to be only transient, and it is not had recourse to at the present day. For these papers the author had awarded him the Copleian medal of the Royal Society for 1802. In 1805 he was elected a fellow of the Royal Society. In the same year he took an active part in the formation of the Medico-Chirurgical Society, which originated in some disagreement which took place in the London Medical Society—which still maintains its existence. After some trouble the members of the Medico-Chirurgical Society obtained a royal charter, and it now takes the first position amongst the medical debating societies of London. In the first volume of the 'Transactions' of this Society is recorded a case of carotid aneurism, in which the artery was tied by Mr. Cooper. Although the case terminated unfavourably, the merit is due to him of having first attempted this operation, which has been successful in the hands of many subsequent operators.

In 1804 he brought out the first part, and in 1807 the second part, of his great work on Hernia. At the time he first undertook inquiry into this subject, not only was the anatomy of the disease ill understood, but the operation for its relief was frequently unsuccessful. This work was published in atlas folio, and got up in an unnecessarily expensive style. Most of the illustrations were of the size of life. When the whole was sold, he was a loser of one thousand pounds by the work. It however added greatly to his increasing reputation, and in a few years after this (1813) his annual income from his profession amounted to twenty-one thousand pounds. This income is probably the largest ever received by a medical practitioner.

During the constant occupation which an enormous practice, besides his hospital duties and lectures gave him, he found time to pursue his favourite science of anatomy. He had a private dissecting-room over his stables, and here he employed dissectors, artists, and modellers, being present himself every morning by six o'clock to superintend and direct them for the day.

In 1813 he was appointed professor of comparative anatomy to the College of Surgeons, a post which he occupied rather because there was no one else to fill it, than that he felt himself qualified for the task. During this year he removed from the City to the West End, not only with the view of cultivating his interest with those about court, but also for the purpose of avoiding the enormous practice of the City.

In 1817 he performed one of his most remarkable operations, that of tying the aorta. Although not successful, it is undoubtedly the boldest attempt in the annals of surgery. If any circumstances would have justified it, they were those in which Cooper operated. It has been attempted since without success.

In 1818, in conjunction with his former pupil and colleague, Mr. Travers, he commenced publishing a series of surgical essays. Two parts of this work appeared, treating of important practical subjects in surgery, but the plan of continuing it was abandoned by the authors. In 1820 Cooper was called in to attend on George IV., although he held no official position at court. Shortly after this he removed a steatomatous tumour from the head of the king. In the course of six months after this the king offered him a baronetcy, which was accepted on the condition that, as he had no son, the title should descend to his adopted son and nephew Astley Cooper, who now bears the title.

In 1822 he was elected one of the Court of Examiners of the College of Surgeons, and the same year brought out his great work on Dislocations and Fractures. This work was characterised by the same diligence of research, and it was got up in the same style as his work on Hernia, and, like that work, threw great light on many obscure points on the anatomy of the subjects it treated of, as well as suggested improved methods of treatment.

In 1827 Sir Astley Cooper was elected President of the College of Surgeons, an honour which he again received in 1836. In 1827 he lost his wife, and the grief which this occasioned, added to previous indications of ill-health, determined him to resign practice and retire to his estate at Gadesbridge. Here he lived only a short time, and returned the following year to his practice in London. He had however previously resigned his lectureship at St. Thomas's, which he did not resume. In 1828 he was married a second time, and in the same year was appointed serjeant surgeon to the King. In 1830 he was elected a Vice-President of the Royal Society.

In 1829 he published the first part of a work on the Anatomy and Diseases of the Breast. This was accompanied by admirable illustrations, and was a worthy companion to his previous works. The whole of this work was completed in 1840. In 1832 appeared a work of the same magnitude, on the Anatomy of the Thymus Gland, which was an important addition to the knowledge of a very obscure organ of the human body. He was in the same year elected a member of the Royal Institute of France, and shortly after a corresponding member of the Royal Academy of Sciences. In 1834, on the occasion of the installation of the Duke of Wellington at Oxford, he received from that University the honorary degree of Doctor of Civil Laws. He visited Edinburgh in 1837, where new honours awaited him; he was made an LL.D. of the University, the freedom of the city was voted to him, and a public dinner was given him by the College of Surgeons.

In the year 1840, attacks of giddiness, to which he had been subject, increased, and he had much difficulty of breathing. These symptoms increased, and he died on the 12th of February, 1841, in the seventy-third year of his age. He was interred by his own desire beneath the chapel of Guy's Hospital. A colossal statue by Bailey has been erected to his memory in St. Paul's Cathedral. In his will he left one hundred pounds a year to be given every third year to the best essay on some surgical subject.

Sir Astley Cooper is a striking instance of what unceasing industry can accomplish. As a teacher, his kindness, and the easy manner with which he communicated his knowledge, placed him far above most of his contemporaries. His unwearied assiduity in the dissecting-room enabled him to produce those great works which are amongst the most important contributions to modern surgery, and must ever give him an important position in surgical literature. His influence on the surgery of the day was great. 'Before his time,' says Dr. Forbes, 'operations were too often frightful alternatives or hazardous compromises; and they were not seldom considered rather as the resource of despair than as a means of remedy: he always made them follow as it were in a natural course of treatment; he gave them a scientific character; and he moreover succeeded in a great degree in divesting them of their terrors, by performing them unostentatiously, simply, confidently, and cheerfully, and thereby inspiring the patient with hope of relief, where previously, resignation under misfortune had too often been all that could be expected from the sufferer.'

(*The Life of Sir Astley Cooper, Bart.*, by Bransby B. Cooper; *British and Foreign Medical Quarterly*, vols. x. xvi.)

COPARCENERS. [Parceners, P. C.]

CO'PHINUS, a fossil genus whose affinities are uncertain. (Murch. 'Sil. Syst.' pl. 26, f. 12.)

COPPER, MANUFACTURE OF. In the article Copper, P. C., p. 501, a description is given of the processes of smelting and refining copper, of granulating the metal when intended for the manufacture of brass, and of rolling it into sheets, in which form it is very extensively applied for various important purposes. We may here briefly notice some of the subsequent processes in the manufacture of copper goods, and point out the various articles in which particulars are given of the manufacture of those alloys in which copper forms an important constituent.

The principal peculiarity in the manufacture of copper arises from the facility with which it may be fashioned by the hammer. The processes of casting and rolling, both of which are extensively practised in the manufacture of copper goods, so closely resemble the like operations upon other metals, that they do not require further notice; but the operations of the coppersmith are very distinct from any other branch of metallic manufactures. These are well illustrated by Mr. Dodd, in his little work on British Manufactures in Metals (Knight's 'Weekly Volume,' No. xxxviii.), by an account of the process of making a sugar-pan, like that represented under Sugar, P. C., p. 232, which consists of a circular domed vessel, with several apertures for valves, gauges, &c., and a spiral coil of copper pipe within the lower part. The top and bottom of this vessel, which are of similar shape, both being convex externally, are formed of one piece each, in the manner thus described:—'The copper is in the first place cast into a form resembling that of a double convex lens, or spectacle-glass, thickest in the middle, and diminishing gradually towards the edges. This lens is then subjected to the powerful blows of a tilt-hammer, directed more continuously near the centre than near the edges.' 'A little consideration will show,' observes our authority, 'that this hammering, while it reduces the thickness of the copper, must make it curl up at the edges, or assume a dished or hollow form: we find that this is the case even when a flat piece of metal is hammered at its centre, and still more does this result ensue when an increased substance is given to the centre.' 'The thickness of the centre,' he states, 'is so adjusted as to afford metal enough for the curvature of the vessel, and the hammering is continued till the thickness of the whole is brought nearly uniform. This is a very important process, since the fitness of the vessel for the operations of the sugar-refinery depends on the soundness and perfection of the metal. Sometimes a piece of copper, dished or hollowed in this way, and worth forty guineas if sound, is rendered useless by a flaw in the metal.'

The above description will indicate the mode in which many curved articles of copper receive their shape. Another process no less peculiar to the manufacture of copper is the hammering, technically called *planishing*, by which the metal is rendered dense and firm, and its toughness is increased; a process of so deafening a nature as to impart a singular character to a coppersmith's establishment. This operation, to revert to the language of the little work just quoted, 'has something of the picturesque effect presented by an anchor-smithery; for six or eight men, standing in a circle round the piece of copper, and each wielding a heavy hammer, strike the metal in succession, every part of the surface receiving probably as many as ten or twelve blows.' Any one who examines a large copper vessel will perceive, both in the hammer-marks and in the density and close grain of the surface, evidences of the planishing process.

By these two processes of hammering, the first to beat the copper into the required shape, and the second to condense and harden the surface when the shaping is completed, many articles which it might seem difficult to form without numerous joints are fashioned, often from masses of cast metal formed originally in a very different shape, or very much smaller and thicker than the finished articles are intended to be. In many cases, however, the hardness occasioned by the hammering impedes the shaping process, and must be repeatedly removed by annealing or softening by heat, to renew the malleability and extensibility of the metal. The principal component parts of a large copper vessel being thus formed, the next point which claims notice is the mode of joining them together. *Riveting* is a mode of fastening much employed for this purpose. In this process the edges of the adjoining plates are made to overlap, and holes are punched through the overlapping plates by a punching-engine, which cuts out a small circular piece equal in size to the rivet. The rivets, which may be compared to short, thick, blunt nails, are then inserted, and the smaller ends, which project through the holes, are spread out by the hammer so as to form what may be styled a second head. The edges of the sheets or plates of copper are finally *caulked*, or hammered until they close so perfectly as to form a joint impervious to water, air, or steam. Smaller copper vessels are united by soldering or brazing. [Soldering, P. C., p. 201.] Holland, in his treatise on 'Manufactures in Metal,' in Lardner's 'Cabinet Cyclopædia,' a work which enters much into the details of the working of metals, refers to a copper tea-kettle as presenting a familiar but ingenious specimen of the coppersmith's art, both with reference to soldering and hammering.

'Taken, indeed,' he observes, 'in all its parts, it exhibits the result of almost every operation of his workshop.' To make this article a piece of sheet copper is taken, rather longer than the intended circumference of the kettle, and some inches wider than its depth. The surface of this piece of copper, for about an inch at each end, is then brightened by filing, and one end is cut into to the depth of about an inch, and at intervals of about an inch, with a pair of shears. Every alternate portion of the cut edge is then turned a little back, so that when the plate is bent round into a cylindrical shape, the uncut end may be laid between the alternate tongues or portions of the cut edge, and embraced, as it were, by them. A little borax and solder is then applied to the joint, which is, after soldering, hammered upon a steel mandril or stake, until the seam becomes smooth, and is beaten down to the thickness of the adjoining portions of the plate. A perfect cylinder being thus formed, the next operation is to turn it inwards in a sloping direction for a space of about two inches, to form the top of the kettle, or that portion which extends from the shoulder at the top of the cylindrical side of the vessel to the edge of the opening to which the cover is fitted. This is done by hammering upon an anvil of suitable shape. About an inch of the lower end is then turned inward in the same way, and cut with the shears into tongues, which are bent back alternately in the same manner as those at the end of the plate had been. A piece of sheet copper cut to fit the end of the cylinder, so as to form the bottom of the kettle, is then inserted and united to the cylinder by the same process as that described for the first joint. The vessel is then *pickled* in diluted sulphuric acid, after which it is planished to brightness, the marks of the hammer being rendered imperceptible by the intervention of a piece of old moreen, or other woollen stuff, between the surface of the copper and the stake or anvil on which it is laid. 'The lid of the kettle,' Holland states, 'is dished by stamping it in a die; the handle is cast; and the spout, after being soldered up and rounded a little on a mandril, is finally shaped upon lead with which it has been filled, and afterwards soldered or riveted into its place.' 'Copper tea-urns and saucepans,' he adds, 'are formed by soldering and hammering in a similar manner, the former being in general finished with a beautiful colour, produced by the application of sulphate of copper or Roman vitriol, previous to the planishing or burnishing.'

Holland describes five different modes of forming copper piping out of sheet metal, in the first of which the edges of the sheet, which is curved round a mandril, are made to meet without overlapping, and united by hard solder; in the second they overlap, and are united by soft solder; in the third they overlap, and are secured by rivets; in the fourth the edges are folded together, one being bent outwards and the other brought over it and turned into the acute angle formed between the outside of the tube and the turned back edge, the whole being subsequently made close and firm by hammering; while in the fifth, which he styles the patent strip overlap, both edges of the pipe are turned back and covered with a strip of sheet metal, the two edges of which are turned in like the outer edge of the joint last described. The bending of such pipes into curved forms, as for the spiral coil in the sugar-pan described above, is a curious operation. Any attempt to bend such a tube while empty would be certain to impair its shape, and would probably occasion its fracture. To obviate this difficulty the pipe is, before bending, filled with lead, or some soft metallic alloy which will melt at a temperature which will not injure the tube. Being thus filled, the pipe may be treated as a solid bar of metal, and safely bent into any required form by suitable machinery; and when the desired curvature is gained, sufficient heat is applied to cause the contained metal to melt and flow out of the pipe.

The use of copper sheathing for ships, an application which occasions a very large demand for this metal, is alluded to under Ship-Building, P. C., pp. 395, 396, and the articles Brass, P. C., p. 353; Bronze, P. C., p. 466; and Bell-Casting, P. C. S., p. 188, treat of some of the most important manufactures of the alloys of copper. Of some of the minor articles of manufacture, in the composition of which copper forms a chief constituent, an account is given under Button, P. C., p. 70; Pin, P. C., p. 161; and Cock, P. C. S., p. 384. Of the metal button manufacture, which comprises many curious and interesting processes, a much fuller account is given in Mr. Dodd's work above quoted.

COPTIS (from κόπτω, 'to cut'), a genus of plants belonging to the natural order Ranunculaceæ. It has 5-6-sepals, coloured, petaloid, deciduous; the petals small, cucullate; the stamens 20-25; the capsules 6-10, on long stalks, somewhat stellate, membranous, ovate, oblong, tipped with the style; 4-6-seeded.

C. trifolia, Gold Thread, has ternate leaves, obovate, blunt, toothed, hardly 3-lobed leaflets; the scape 1-flowered. It is a native of Iceland, Norway, Greenland, Siberia, and Kamtchatka, in swampy woods, and also of the cedar-swamps of North America, from Canada to Virginia. It is a small plant with white flowers and a yellow fibrous rhizoma which runs in all directions. The French in Canada call it Tissavo-yaune jaune. A decoction of the leaves and stalks is used by the Indians for giving a yellow colour to cloth and skins. The rhizomata are bitter, and when administered as a medicine act in the same manner as quassia, gentian, and other bitters, but are not astringent.

C. asplenifolia has biternate leaves, the leaflets rather pinnatifid, very acutely serrated, the scape 2-flowered. It is a native of Japan and the north-west coast of America.

Both species are pretty plants, and will thrive in a peat soil. A moist situation agrees with them, or they may be planted in pots among alpine plants. They may be propagated by seeds, or by dividing the roots.

(Don, *Gardener's Dictionary*; Lindley, *Flora Medica*.)

COPYHOLDS. The following remarks on copyholds are rendered necessary by the statutes which have been enacted since that article was written. By the 1st section of the 1 Vict. c. 26, the last statute which relates to Wills and Testaments, the 55 Geo. III. c. 192, and the 12th section of the Statute of Frauds, are repealed; and by the 3rd section of this act of Victoria the power of disposition by will is extended to customary freeholds and tenant right estates, and all estates of a customary or copyhold tenure, without the necessity of any surrender or admittance, and notwithstanding the want of a custom to devise a surrender to the use of a will; and to all estates *pur auter vie*, whether of customary freehold, tenant right, customary, or copyhold tenure. The 4th section provides that where any real estate of the nature of customary freehold, or tenant right, or customary or copyhold, might by the custom of the manor of which the same is holden, have been surrendered to the use of a will, and the testator shall not have surrendered the same, no person claiming to be entitled under his will shall be entitled to be admitted, except upon payment of all such stamp duties, fees, and sums of money as would have been due in respect of the surrender of such estate, or the presentment, registering, and enrolment of such surrender to the use of his will. And also, that where the testator, being entitled to admission to any real estate, and upon such admission to surrender the same to the use of his will, shall not have been admitted thereto, no person claiming to be entitled to such real estate in consequence of such will shall be entitled to admission, except on payment of all such stamp duties, fees, fine, and sums of money as would have been due in respect of the admittance of the testator to such real estate, the surrender to the use of his will, the presentment, registering, or enrolment of such surrender; all such stamp-duties, fees, fine, or sums of money, to be paid in addition to the stamp-duties, fees, fine, or sums of money due on the admittance of the person so claiming to be entitled to such real estate.

By the 5th section, when any real estate of the nature of customary freehold, or tenant right, or customary, or copyhold, is disposed of by will, the lord of the manor, or reputed manor, of which such real estate is holden, or his steward, or the deputy of such steward, is to cause the will by which such disposition is made, or an extract thereof, to be entered on the Court Rolls; and when any trusts are declared by the will, it is not to be necessary to enter the declaration of such trusts, but it is to be sufficient to state in the entry on the Court Rolls that such real estate is subject to the trusts declared by the will; and when such real estate could not have been disposed of by will, except by virtue of the act, the same fine, heriot dues, duties, and services are to be paid and rendered by the devisee as would have been due from the customary heir in case of the descent of such real estate And the lord is, as against the devisee, to have the same remedy for recovering and enforcing such fine, heriot dues, duties, and services as he is entitled to against the customary heir in case of a descent.

By the 6th section, if no disposition by will be made of any estate *pur auter vie* of a freehold nature, the same is to be chargeable in the hands of the heir, if it come to him by reason of special occupancy, as assets by descent, as in the case of freehold land in fee simple; and in case there be no special occupant of any estate *pur auter vie*, whether freehold or customary freehold, tenant right, customary or copyhold, or of any other tenure, and whether a corporeal or incorporeal hereditament, it is to go to the executor or administrator of the party that had the estate by virtue of the grant; and if the estate come to the executor or administrator, either by reason of a special occupancy or by virtue of the act, it is to be assets in his hands, and to go and be applied and distributed in the same manner as the personal estate of the testator or intestate. By the 26th section a general device of the testator's lands is to include copyholds, unless a contrary intention appear by the will; which is an alteration of the old rule whereby copyholds did not pass under a general device of 'lands, tenements, and hereditaments,' or other general words descriptive of real estate, unless the copyholds had been surrendered to the use of the will, or the testator had no freehold lands upon which it could operate. And besides the above-mentioned changes relating peculiarly to copyholds, all the other enactments of the act, including that which prescribes the formalities to be observed in making a will, are applicable to estates of copyhold or customary tenure.

By the 11th section of the 1 & 2 Vict. c. 110, copyholds are made subject to execution by judgment creditors in the same manner as freeholds.

Still greater changes in the nature of estates of copyhold and customary tenure are gradually taking place under the provisions of the stat. 4 & 5 Vict. c. 35, the principal objects of which are—1, The commutation of certain manorial rights in respect of lands of copyhold and customary tenure; 2, The facilitating the enfranchisement of such lands; and 3, The improvement of such tenure.

1. The enactments with respect to the commutation of manorial rights are partly compulsory and partly permissive. All rents, reliefs, and services (except service at the lord's court), fines, heriots, or money payments in lieu thereof, the lord's rights in timber, and in mines and minerals, may be made the subject of compulsory commutation upon an agreement being entered into between the lord and the tenants of any manor at a meeting called in the way prescribed by the act. As soon as this agreement receives the signatures of the lord or tenants whose interests are not less than three-fourths in value of such manor and lands, and of three-fourths in number of the tenants, it becomes (on receiving the confirmation of the commissioners appointed under the act) compulsory on the lord and all the tenants of such manor. Powers are likewise given to any lord, and any one or more of the tenants, to effect by agreement between themselves a commutation, wholly voluntary, of the above-mentioned rights or any other rights of the lord, such as escheats, waifs, fairs, markets, &c. The lord's rights may be commuted either for an annual rent-charge and a small fixed fine not exceeding 5*s.* on death or alienation, or for the payment of a fine on death or alienation or any other contingency, or at any fixed period or periods to be agreed upon between the parties: such annual rent-charge or such fine, as the case may be, if exceeding the sum of 20*s.*, to be variable according to the price of corn, upon the principle of tithe rent-charges. After the completion of the commutation, the lands are to continue to be held by copy of Court Roll, and to pass by surrender and admittance or other customary mode of conveyance, but the customs of Borough-English, or Gavelkind (except in Kent), or any other customary mode of descent or custom relating to dower, free-bench, or curtesy to which the lands may have been subject, are to cease, and they are to be thenceforth subject to the general law of descent, dower, and curtesy relating to lands of freehold tenure.

2. For the purpose of facilitating the enfranchisement of copyhold lands, the act enables lords of manors, whatever may be the extent of their interests, with the consent of the commissioners under the act, to enfranchise all or any of the lands holden of their manors, in consideration of any sum or sums of money payable forthwith or at a future time, according to agreement: and tenants, whatever be the extent of their interests, are in like manner enabled, with the consent of the commissioners, to accept of enfranchisement on the terms agreed upon. After the completion of any such enfranchisement, the lands included in it are to become of freehold tenure, subject to the consideration agreed upon for the enfranchisement, but without prejudice to the tenant's right of common and existing limitations affecting the land.

3. The act contains a clause applicable to cases where commutation or enfranchisement has been effected, and there has been a reservation of the lord's right in mines and minerals, enabling the tenants to grant to the lord such rights of entry and way, and such other easements, as may be necessary to the enjoyment of the reserved rights.

It also, after stating the doubts entertained as to the power of the courts of equity to decree a partition of lands of copyhold or customary tenure, confers that power to be exercised according to the practice of the court in freehold cases. Formerly a customary court could not be legally constituted unless two or more tenants were present to form the homage; all acts of court were by usage required to be matters of presentment by the homage; and in a great majority of manors grants could not be made nor admissions taken except at courts held within the manors. A remedy is provided for these inconveniences by clauses giving power to hold customary courts though there should be no tenant of the manor holding by copy, or though no such tenant, or not more than one such tenant, should be present; enabling lords and stewards to make grants and take admissions out of court and out of the manor: and requiring the lord forthwith, upon payment of the usual fees, to enter on the rolls all such surrenders, deeds, wills, grants, and admissions as would formerly have required the formality of a court to authorise their entry or to give them legal effect; and also declaring that no presentment of a surrender, will, or other instrument shall be essential to the validity of any such admission. But the operation of these provisions is restrained by a clause providing that wastes and commons are not to be granted or inclosed without the consent of the homage at a court duly constituted.

The act also contains a provision extending the powers of the lords and tenants of certain manors to dispose of and divide antient tenements held of the manor, subject to a due apportionment of the antient rent where a tenement is sold in parcels.

There are likewise numerous provisions in the act for defining boundaries, settling disputes, providing for cases of disability, payment of expenses, &c., similar to those in the Tithe Commutation Act, 6 & 7 Wm. IV. c. 71.

The act applies partially to the Duchy of Lancaster, but not otherwise to Crown lands, and not at all to the Duchy of Cornwall.

In the 'Third Report of the Copyhold Commissioners,' dated June 22, 1844, it is stated that 'enfranchisement of church property is now proceeding to a considerable extent, and there is every reason to suppose that in manors held by ecclesiastical persons the disposition to avail themselves of the act will become general.' The commissioners also stated that enfranchisements had also increased in other manors, but not in the same proportion, and that the act had encouraged building, especially in the neighbourhood of London. They suggested as an improvement that, without being in any way compulsory on the lord, enfranchisements might be made binding on the other tenants if two-thirds of the tenants in number and value agreed. At present it may happen that the lord is willing to enfranchise, and he can make arrangements with the principal tenants, but if there is a difficulty in agreeing with the smaller tenants, enfranchisement is hindered, as the lord might be left with the dregs of the manor

COPYING-MACHINES. The great value of a convenient and certain means of copying any piece of writing with perfect accuracy, and with less labour than is involved in the process of transcribing, has led to numerous inventions which may be classed under the general name of copying-machines, some of which are extensively used in mercantile establishments for producing duplicates of letters, invoices, and other MS. papers.

The most simple and obvious mode of effecting this object is by transferring, by means of a rolling or screw press, a portion of the ink with which a letter is written to the surface of a sheet of blank paper, prepared to receive it by damping. The transfer thus obtained is of course the reverse of the original letter, and, unless it be taken on paper so thin and transparent that it may be read through it, it must be read backwards. Watt's copying-press, referred to under WATT, P. C., p. 141, was a contrivance for obtaining transfers of this kind upon thin unsized paper, wetted, and then placed between two woollen cloths, which absorbed all unnecessary moisture. Elegant screw-presses of iron are manufactured for this purpose, of various designs, some having the power applied solely by means of a screw, turned by a transverse bar or lever, or by a cross or wheel-shaped handle, while others have also a contrivance for increasing the pressure beyond what can be conveniently applied by the simple turning of the screw. The nature of such contrivances may be conceived from those described under Screw-Press, P. C., p. 111. One of the best and simplest copying-presses is that invented by Mr. Ritchie, of Edinburgh, a cut of which is given by Hebert (*Engineer's and Mechanic's Encyclopædia*, vol. i., p. 400), in which the platten is depressed by a screw, turned by a short transverse handle, until a moderate pressure is given; after which, by the movement of a second lever-handle acting upon an eccentric cam, which bears upon a piece of steel attached to the head of the screw, the screw and platten are further depressed through a very small space, but with immense force. Barlow (*Treatise on Manufactures and Machinery*, in the 'Encyclopædia Metropolitana,' section 401) describes a very simple and compact copying-machine invented by Mr. Brunel, in which the pressure is given by means of levers. In some cases, letters intended for transferring by the copying-press are written with an ink made for the purpose; and when common ink is used it may be thickened by adding a little sugar to it. In some cases the transfers are taken from the pages of a MS. book prepared for the purpose, a sheet of dry oiled paper being placed over the damp sheet to prevent the transmission of the moisture. It is almost needless to observe that transfers may be taken from several written sheets at one operation of the press.

Hebert gives the following description of a simple, and, he says, effectual copying-machine:—'Take a roller of beech, or any hard wood, about eighteen inches long and one inch in diameter, and having cut a longitudinal slit therein nearly the whole length, insert in it and fasten very neatly with glue a slip of strong cloth, about fourteen inches wide and eighteen inches long; the remaining part of the roller will serve as a handle, and may be cut with several faces to obtain a firmer hold. To use this copying-press, lay the sheet of paper on which the letter is written upon the strip of cloth; on that place the thin copying-paper, and upon these lay a thick baize or horse-hair pad; then roll the whole round the roller, and grasping that part where the cloth is with the left hand, turn the roller round with the right, gradually increasing the grasp with the left; the pressure becomes very great, and quite sufficient to transfer the letter to the copying-paper.'

Holland (*Manufactures in Metal*, [illegible] Lardner's 'Cabinet Cyclopædia,' vol. ii. p. 243) mentions a plan suggested by Dr. Franklin, which, although he styles it ineligible in practice, is worth recording as conveying an idea which might be usefully applied. He proposed to write the original letter with a gummy ink, and then to strew it over with flour-emery, which would be retained by the ink, though it would not adhere to any other part of the surface of the paper. The writing was then to be laid, face downwards, upon a smooth pewter plate, and subjected to the action of a powerful rolling-press, which, he conceived, would cause the emery to make an impression of the writing upon the surface of the metal, which might be charged with printing ink, and printed from like an engraved plate.

Mechanical contrivances for enabling a person to write with two pens or pencils at once, on different sheets of paper, on the principle of the Pantograph, P. C., p. 192, have been tried as copying-machines, but they are too complicated for ordinary use. All such machines, and perhaps we might say even the copying-press, are far surpassed in convenience by the *manifold writer*, an apparatus patented in 1806, by a person named Wedgwood. In this apparatus a sheet of paper blackened on both sides with printers' ink, and dried for five or six weeks between sheets of blotting-paper, or covered with some other black composition which will come off when pressed hard, but will not move with a slight degree of pressure or friction, is laid between two sheets of thin writing-paper, and the whole is placed upon a smooth copper or pewter plate. The letter is then written firmly on the upper sheet of paper with an agate style or point, the pressure of which causes the blackened paper to produce two impressions of the writing, one, which is read through the paper, upon the under side of the sheet directly acted upon by the style, and the other upon the upper side of the lower sheet. More than two impressions of the writing may be obtained by using two or more sheets of blackened paper, interposed between several sheets of thin white paper. This apparatus is conveniently fitted up in a small portfolio, and occupies no more room than an ordinary writing-case.

COPYRIGHT. The following additions are rendered necessary by the acts that have been passed since the article Copyright, P. C., was written:—

The act 5 & 6 Vict. c. 45 (Lord Mahon's Act), entitled 'An act to amend the law of copyright,' and having for its preamble, 'Whereas it is expedient to amend the law relating to copyright, and to afford greater encouragement to the production of literary works of lasting benefit to the world,' is the act which now regulates literary property. It repeals the 8 Anne, c. 19; 41 Geo. III. c. 107; 54 Geo. III. c. 156 (P. C., viii. p. 2); and enacts that in every book published in the life-time of the author, after the passing of the act (1st of July, 1842), the author and his assigns shall have copyright for the term of the author's life, and for seven years after his death, or if these seven years expire before the end of forty-two years from the time of publication, then for such period of forty-two years; while for books previously published, in which copyright still subsisted at the time of the passing of the act, the copyright should be continued for the full term provided in the cases of books thereafter published, except in cases where the copyright should belong wholly or in part to a person other than the author, 'who shall have acquired it for other consideration than that of natural love and affection.' In these excepted cases however the author, or his personal representative, and the proprietor or proprietors of copyright may agree, before the expiration of the subsisting term of copyright, to accept the benefits of the act: and on a minute of such agreement being entered in a book of registry directed to be kept at Stationers' Hall, the copyright will be continued, as in other cases, for the author's life and seven years after his death, or for forty-two years from the time of publication, and will be the property of the person or persons specified in the minute. The copyright of a book published after the author's death is to endure for forty-two years from the time of publication, and to belong to the proprietor of the manuscript from which it is first published, and his assigns. With regard to encyclopædias, reviews, magazines, periodical works, or works published in a series of books or parts, or any book in which the publisher or projector shall have employed persons to write, on the terms that the copyright shall belong to himself, the copyright shall be in the publisher or projector, after he has paid for it, in the same manner and for the same term as is given to authors of books, except only in the case of essays, articles, or portions forming part of, and first published in, reviews, magazines, or other periodical works of a like nature, the right of publishing which separately shall revert to the authors at the end of twenty-eight years after publication, for the remainder of the term given by this act; and during these twenty-eight years the publisher or projector shall not have the right to publish any such essay, article, or portion separately, without the consent of the author or his assigns.

The act provides, at the same time, against the suppression of books of importance to the public, by empowering the judicial committee of the Privy Council, on complaint made to them that the proprietor of the copyright in any book, after the death of its author, refuses to republish or allow the republication of the same, to license the complainant to publish the book, in such manner and subject to such conditions as the Privy Council may think fit.

The remedies provided by this act for infringement of copyright are, an action for damages (in which the defendant is required, on pleading, to give notice to the plaintiff of the objections to the plaintiff's title on which he means to rely), and a power given to the officers of customs and excise to seize and destroy all foreign reprints of books in which copyright exists, with a penalty on the importer (if he be not the proprietor of the copyright) of 10*l*., and double the value of every copy of any book imported, on conviction before two justices of the peace; 5*l*. of the penalty to go to the officer of customs or excise who shall procure the conviction, and the remainder to the proprietor of the copyright.

The act provides that a book of registry be kept at Stationers' Hall, where entries may be made of proprietorships of copyright, assignments thereof, licences of the judicial committee, and agreements as to copyrights subsisting at the time of the passing of the act, on payment in each case of a fee of 5*s*. The entry of proprietorship of copyright in this book does not affect copyright; but no action can be brought for infringement of copyright, nor any other legal proceedings taken, unless the proprietorship of copyright has been entered.

The entry of an assignment in the registry book is to all intents and purposes an effectual assignment. § 13, Certified and stamped copies of entries in the registry book are to be evidence in all courts of justice, and are to be taken as *prima facie* proof of copyright. The making of a false entry in the registry book, or the production in evidence of any paper falsely purporting to be the copy of an entry therein, is made a misdemeanor. Persons thinking themselves aggrieved by any entry in the registry book, may apply to a court of law in term time, or a judge in vacation, for an order to vary or expunge such entry; and such court or judge may make an order for varying, expunging, or confirming such entry, with or without costs.

With respect to dramatic literary property and the 3 Wm. IV. c. 15 (P. C. viii. p. 2), the 5 & 6 Vict. c. 45, has extended the term of the sole liberty of representing dramatic pieces to the period provided by that act for the copyright of books, and gives the same protection to the authors of musical pieces and their assigns. The remedies provided by the 3 Wm. IV. c. 15, in the case of dramatic pieces are confirmed by the 5 & 6 Vict. c. 45, and extended to musical pieces. The 5 & 6 Vict. c. 45, also enacts that no assignment of the copyright of any book consisting of a dramatic piece or musical composition shall convey the right of representing or performing such dramatic piece or musical composition, unless an entry, expressing the intention that such right should pass by the assignment, be made in the registry book at Stationers' Hall.

The protection given to authors by the statute of copyright is coupled with the condition of presenting five copies of every book to certain public libraries. A copy of every work, and of every second or subsequent edition which contains any additions or alterations, bound, sewed, or stitched together, and on the best paper on which the same shall be printed, is to be delivered at the British Museum within one month after its first publication, if it is published within the bills of mortality, or within three months if published in any other part of the United Kingdom, or within twelve months if published in any other part of the British dominions; and a copy of every work, or second or subsequent edition, containing additions and alterations, on the paper of which the largest number of copies shall be printed for sale, in the like condition as the copies prepared for sale by the publisher, is to be delivered, if demanded, within twelve months after publication, within one month after demand made, at Stationers' Hall, for the Bodleian Library at Oxford, the Public Library at Cambridge, the Library of the Faculty of Advocates at Edinburgh, the Library of Trinity College, Dublin, under penalty of forfeiting the value of the copy of each book or edition not delivered, and a sum not exceeding 5*l.*, to be recovered by the Librarian, or other officer properly authorised, of the library to which the book should have been delivered, on conviction before two justices of the peace for the county or place where the publisher resides, or by action of debt in any Court of Record in the United Kingdom. Formerly, under the 54 Geo. III. c. 156, an author was obliged to give eleven copies of his work to public libraries (P. C. viii. p. 2).

The strict powers given by the 5 & 6 Vict. c. 45, have been vigorously exercised by the Custom-house authorities, and found very effectual to prevent the importation into this country of the French, Belgian, German, and American reprints of popular English works; but English authors still suffer by the circulation of these reprints abroad; and a practice so destructive of the fair profits of mental labour can only be effectually redressed by prevailing on foreign countries to extend the benefits of their own laws against literary piracy to aliens as well as native authors. Two statutes have been passed in the present reign to enable her Majesty to extend to foreigners the benefits of our laws of copyright. The first of these, 1 & 2 Vict. c. 59, was repealed by 7 Vict. c. 12, the statute which is now in force, and which was substituted in consequence of the alterations in our law of copyright. This act, entitled 'An Act to amend the law relating to International Copyright,' empowers her Majesty by order in council to enable authors of works first published in foreign countries to have copyright in the British dominions for books, prints, articles of sculpture, and the sole liberty of representing dramatic and musical pieces, for periods not exceeding those allowed by the various copyright acts for the respective classes of works when first published in this country, on conditions of registration and delivering of one copy at Stationers' Hall; but no such order in council is to have any effect unless it is stated therein, as ground for issuing the same, that reciprocal protection for British authors has been secured in the foreign country to which the order in council refers. The power given by this act has not yet been exercised in the case of any single foreign country.

The chief statutes affecting the copyright in the arts of designing, engraving, and etching prints, are the 8 Geo. II. c. 13, the 7 Geo. III. c. 38, and the 17 Geo. III. c 57 (P. C. viii. p. 3). The 6 & 7 Will. IV. extends the provisions of the previous acts to Ireland.

With regard to designs for manufactured articles, the 27 Geo. III. c. 38, continued by 29 Geo. III. c. 19, and confirmed and made perpetual by 34 Geo. III. c. 23, gave the sole right of using a new pattern in the printing of linens, cottons, calicoes, and muslins for three months; and the 2 Vict. c. 13, extended this privilege to designs for printing other woven fabrics besides calicoes. The 2 Vict. c. 17 regulated copyright of designs in all articles except lace, and the articles to which the above-mentioned acts apply. But all these statutes were repealed by the 5 & 6 Vict. c. 100 (Mr. Emerson Tennent's Act), which considerably extended the periods of copyright in designs.

This act distributes articles to which designs may be applied into twelve classes:—

1. Articles of manufacture composed wholly or chiefly of any metal or mixed metals.
2. Articles of manufacture composed wholly or chiefly of wood.
3. Articles of manufacture composed wholly or chiefly of glass.
4. Articles of manufacture composed wholly or chiefly of earthenware.
5. Paper-hangings.
6. Carpets.
7. Shawls, where the design is applied solely by printing, or by any other process by which colours are or may hereafter be produced upon tissue or textile fabrics.
8. Shawls not comprised in class 7.
9. Yarn, thread, or warp, the design being applied by printing, or by any other process by which colours are or may hereafter be produced.
10. Woven fabrics, composed of linen, cotton, wool, silk, or hair, or of any two or more of such materials, if the design be applied by printing, or by any other process by which colours are or may hereafter be produced upon tissue or textile fabrics; except the articles included in class 11.
11. Woven fabrics composed of linen, cotton, wool, silk, or hair, or of any two or more of such materials, if the design be applied by printing, or by any other process by which colours are or may hereafter be produced upon tissue or textile fabrics, such woven fabrics being or coming within the description technically called furnitures, and the repeat of the design whereof shall be more than twelve inches by eight inches.
12. Woven fabrics not comprised in any preceding class.
13. Lace, and any article of manufacture or substance not comprised in any preceding class.

The act gives to the proprietor of a design not previously published the sole right of applying it to ornamenting articles of the first, second, third, fourth, fifth, sixth, eighth, and eleventh classes, for three years; to articles of the seventh, ninth, and tenth, for nine months; and to articles of the twelfth and thirteenth classes for twelve months; whether such design be applicable for the pattern, or for the shape and configuration, or for the ornament of the articles, or for any two or more such purposes, and by whatever means the design may be applicable, whether by printing, or by painting, or by embroidery, or by weaving, or by sewing, or by modelling, or by casting, or by embossing, or by engraving, or by staining, or by any other means whatsoever, manual, mechanical, or chemical, separate, or combined. The benefits of copyright of designs are made to depend on registration before publication. Piracy is punished by a penalty of not less than 5*l.* nor more than 30*l.*, to be paid to the proprietor of the design, and to be recovered by an action of debt or for damages, or by summary proceeding before two justices.

The law of patents in many respects resembles that of copyright. [PATENT, P. C.]

The act 'for preventing the publication of lectures without consent' (5 and 6 Wm. IV. c. 65) gives to authors of lectures the sole right and liberty of printing and publishing the same, and imposes a penalty on other persons, including printers and publishers of newspapers, who shall print, or publish, or sell them without the author's leave. The act does not extend to lectures of the delivering of which notice in writing shall not have been given to two justices, living within five miles of the place, two days at least before their delivery, or to any lecture delivered in any university, or public school or college, or any public foundation, or by individuals in virtue of any gift, endowment, or foundation. The act does not extend to sermons.

CORAL FISHERY. Coral (for a zoological account of which see Polypiaria, P. C., pp. 366-373, and the other articles there referred to,) is a marine production so nearly resembling some plants in appearance, that it has been supposed to belong to the vegetable kingdom, although it is now known to consist of the cells or habitations of minute animals, so built upon one another as to produce a branched tree-like structure, often very beautiful in form and colour, and exceedingly hard. Being much sought after, especially by the natives of India, for ornamental purposes, coral forms, in those places in which it is found of good quality, an important article of commerce. Coral was known to the antients under the name *corallium*, or *κοράλλιον*, and, as is shown by Pliny's description, they erroneously supposed it to be soft while in the sea, and to harden by contact with the air, or by touching with the hand. (Holland's translation of Pliny's *Natural History*, book xxxii. vol. ii. p. 429.) It is found abundantly in various parts of the Mediterranean Sea, in the Red Sea, the Persian Gulf, and several other places, in which the coral fishery forms the laborious and dangerous occupation of a large class of men. A full account of the coral fishery in the Straits of Messina is given in the fourth volume of Spallanzani's 'Travels in the Two Sicilies' (English Translation, 1798, pp. 306-329), from which it appears that the rocks which yield coral are situated in the middle of the strait, and that the parts from which it is taken vary from about 350 to 650 feet below the surface of the water. The coral here grows to about the height or length of twelve inches, and requires eight or ten years to come to perfection. The fishing-ground is therefore divided into several portions, from each of which the coral is removed only once in ten years. When taken at shorter intervals the coral is of smaller size, but it does not appear that it materially increases in length if left longer, although its stems become somewhat thicker. The free access of the rays of the sun through the water appears to be essential to the perfection of the coral, which, we are told, always grows nearly perpendicular to the surface of the rock to which it is attached, whatever the position of the rock itself may be. It is of various colours, from black or brilliant red to a dull white, and varies exceedingly in value, some selling for as much as eight or ten guineas per ounce, while other sorts are not worth a shilling per pound. The mode of conducting the fishery in various places is much the same. In that described by Spallanzani, the instrument used consists of two heavy beams of wood, secured together at right angles in the form of a cross, and loaded at their intersection with stones or other weights sufficient to sink them. A quantity of loosely twisted hemp, intermixed with coarse netting, is attached to the under side of the beams, at the ends of the cross, to the middle of which is secured one end of a strong rope by which the apparatus is let down from a boat, and guided to the spots where the coral is supposed to be most abundant. The branching form of the coral causes it to become entangled in the hemp and network attached to the cross, by which means it is broken off from the rock, and drawn up with the apparatus to the surface of the water. Owing to the great depth at which the fishery is carried on, the submarine movement and drawing up of the cross is a laborious operation, sometimes requiring the united efforts of half a dozen boats; and the men employed are exposed to considerable danger in case of the rope breaking. In Rees's 'Cyclopædia,' art. 'Coral,' where copious extracts are given from Spallanzani, there is also a notice of the machines used by the coral-fishers of Marseille, in the fishing-grounds of what is called the 'bastion of France,' one of which, called in the Provençal language the *salabre*, is intended for situations in which the bottom of the sea is rough and uneven. With a few trifling variations however, all the instruments of which we find any account consisted of weighted beams supplied with network, or some substitute for it, to entangle and break off the coral. In some cases a diver descends to guide the ends of the cross into caverns which they would not otherwise enter; and an iron hoop fixed to the beam is occasionally used to break coral from the roof or sides of caverns, a net being attached beneath it to secure what is thus broken off.

CORAL RAG, the most calcareous, or at least most coralliferous, part of the Oxford oolite formation. It is a variable and singular rock, most rich in Madrephylliœa and Echinodermata, in the vicinity of Calne.

CORALLORHI'ZA, a genus belonging to the natural order Orchideæ, and to the tribe Malaxideæ. It has a converging perianth; the lips with two prominent longitudinal ridges at the base, 3-lobed, the lateral lobes small, the middle lobe large, slightly emarginate; the spur short or obsolete; the stigma triangular; the rostellum obsolete, but with a large globose appendage; the anthers terminal, 2-celled, opening transversely; the column elongated; the germen slightly stalked, straight.

C. innata has the spur obsolete or wanting. It has thick fleshy roots with much branched fibres. The flowers are seated on a spike, and are of a yellowish colour. It is found in Great Britain in mountainous woods, but is a rare plant. There are several American species. They are exceedingly difficult of cultivation.

(Babington, *Manual*.)

CORBET, RICHARD, was the son of a wealthy gardener at Ewell in Surrey, whose professional skill and personal amiability are commemorated in verses of Ben Jonson. He was born in 1582, and received his education at Westminster school and at Christ church, Oxford, of which he became dean. After taking orders, he attained high popularity in the pulpit, being, in Anthony Wood's phrase, 'a quaint preacher.' His talents, his social qualities, and his firm adherence to the High Church party, gained for him, through the patronage of Buckingham, the place of chaplain to James I.; and he was afterwards elevated in succession to the bishopric of Oxford and to that of Norwich, each of which he held about three years. He died in possession of the latter see, in 1635. Although strongly adverse to the Puritans, and employed by Laud in several of his proceedings against them, he did much to mitigate the harsh commands of his superior, both by forbearance in the execution of them, and by the gentleness which he showed when compelled to act. His proved ability, his tolerance and desire for moderate procedure in ecclesiastical affairs, and the cheerful kindliness of his disposition, made Bishop Corbet beloved, and even respected, in spite of his exuberant eccentricities. These indeed were such as even the coarseness and freedom of manners prevalent in that age could hardly make reconcileable with the clerical character. Although we were to disbelieve some of those anecdotes of unbecoming joviality collected by Aubrey, there would remain evidence of extreme lightmindedness. His only published writings are his poems. These were first collected in 1647, 12mo. under the title of 'Poetica Stromata;' they were reprinted in 1648 and 1672; and they were edited in 1807, 12mo., with a life of the author, by Octavius Gilchrist. They are, almost without exception, of a cast more or less ludicrous; and several of them are satires on the Puritans. They possess very much merit in their class. The 'Journey to France,' and 'Farewell to the Fairies,' have been inserted in several collections of English poetry; but there are others in the series which, for their humorous merriment and pointed terseness, would not have been unworthy of the same distinction.

CORE'NZIO, BELLISA'RIO (Cavaliere), a Greek, and a celebrated painter, distinguished for his ability and notorious for his invidious tyranny over the painters of Naples in his time, whether Neapolitans or strangers. He was five years the pupil of Tintoretto at Venice, and settled in Naples about 1590. Here he obtained a complete ascendancy, which he accomplished partly by his ability, partly by dissimulation, and partly by violence. Some painters, who were of too high a rank to be subject to him, abstained from opposition to him through fear, and others whom he could neither awe nor control he associated with him, and these were but two, Ribera and Carracciolo. Corenzio, Ribera, and Carracciolo, therefore formed a triumvirate, whose object was to control all the great undertakings in painting in Naples, and to allot his portion to each. And if threats, or more active persecution failed to intimidate or suppress any new rival, Neapolitan or stranger, they are said to have had recourse to poison, and it is generally supposed that Domenichino was their victim. Guido Reni did not give them occasion to carry their opposition to that extremity in his case, he yielded to their threats and persecutions, glad to leave the province of such an infamous cabal. Annibal Carracci, Cesari, and other celebrated painters suffered similar treatment. They seem however to have been as inveterate against Neapolitans themselves as strangers, when their jealousy was roused: Corenzio is said to have poisoned with his own hand his most able scholar Luigi Rodrigo.

Corenzio, though not to be compared with Tintoretto, possessed nearly equal boldness of manner and facility of execution, and he was also little inferior to him in invention. He was an able colourist in oil, but he took little pleasure in that style; his ambition was to paint great works in fresco, and he executed many at Naples. In the number of his frescoes he has been equalled by few masters, and by still fewer in their extent; he could execute in a single day as much work as would occupy four painters of ordinary efficiency in the same time. One of his best and greatest works, the Feeding of the Five Thousand, in the refectory of the Benedictines, occupied him only forty days. He died in 1643, at an advanced age: he was repairing one of his frescoes, when he fell from the scaffolding and was killed.

(Dominici, *Vite dei Pittori*, &c.; Lanzi, *Storia Pittorica*, &c.)

CORIANDRUM SATI'VUM, *Medical Properties of.* This umbelliferous annual plant is a native of the South of Europe, Tartary, &c., and much is imported from the Levant, though a considerable portion is cultivated in Suffolk and Essex, for the use of confectioners in this country. The officinal part is the fruit, improperly called the seed. This is round, white, not unlike a grain of white pepper, and was used as a means of comparison for the manna with which the Israelites were fed in the wilderness. (See *Exodus* xvi. 31, and *Numbers* xi. 7.) The fresh fruit has a disagreeable odour, which disappears on drying, leaving a pleasant and peculiar one. The taste is warm and aromatic. The potency depends upon the quantity of volatile oil. Ten pounds of fruit yield six drachms of volatile oil. This oil, which is of a yellowish colour, is not in the Pharmacopœia, but it may be used in the same way as the other distilled waters or oils, as a carminative. Coriander was thought better to disguise the odour and taste of senna than other aromatics, but in the infusion ginger is now substituted for it. Making the infusion with cold water is preferable to either, and avoids the tendency to griping. Coriander is retained as an ingredient of the Confectio Sennae.

It is necessary to guard against confounding coriander with the seed of the Daphne Mezereon, called Semen Coccognidii, as the latter is very poisonous.

CORINNA (Κόριννα), a Greek lyric poetess, was a daughter of Archelodorus or Achelodorus and Procratia, and born at Tanagra in Bœotia. As she resided during some period of her life at Thebes, she is sometimes called a Theban. She bore the surname Myia (μυῖα, a fly), and is often spoken of under this name alone. She lived about B.C. 500, as we must infer from the persons with whom she was connected, and was a woman of unusual beauty. She is said to have been a disciple of the poetess Myrtis, and to have herself instructed Pindar in his youth; but afterwards to have contended with him in poetical contests, and to have gained five victories over him. She appears at any rate to have exercised a very great influence upon the developement of Pindar's youthful genius, and to have recognised his extraordinary powers; for she is said to have blamed Myrtis for venturing to enter into competition with him. Her poems were collected and divided (probably by the grammarians) into five books, and in addition to this collection we have mention of epigrams and lyric nomes. But not one entire poem of her's has come down to us, and only a very few fragments are extant, which scarcely enable us to form an idea of their merit. Her great reputation however is attested by the statues which were erected to her in several towns of Greece, and by the prominent place which the Alexandrine critics assigned to her among the lyric poetesses. She wrote in the Æolic dialect, which however was interspersed with many Bœotian peculiarities. Her poems moreover appear to have been principally intended for Bœotians; for they abounded in allusions to Bœotian localities. From the fragments extant we must infer that the subjects of some of her poems were traditions about mythical heroes, and as in addition to this we are told that she wrote ἔπη, we might suppose that she also composed epic poetry, but we know from Hephaestion (p. 22, ed. Gaisford), that these ἔπη were contained in the fifth book of her poems, and that they were choral odes or hymns in the heroic or epic verse. The fragments of Corinna's poems are collected in F. Ch. Wolf's 'Foeminarum IX. Illustrium Fragmenta et Elogia,' Hamburg, 1734, p. 42, &c.; in A. Schneider's 'Poetarum Græcorum Fragmenta,' Giessen, 1802, 8vo.; and best in Th. Bergk's 'Poetae Lyrici Graeci,' p. 811, &c.

(Comp. F. G. Welcker in Creuzer's *Meletemata*, vol. ii. p. 1, &c.; Bode, *Geschichte der Hellenischen Dichtkunst*, vol. ii. part 2, p. 115, &c.)

Suidas, in his article Corinna, mentions two other lyric poetesses of the name of Corinna, the one of Thespiae or Corinth, and the other, Corinna the younger of Thebes, who was surnamed Myia. But these two are otherwise unknown, and it is generally supposed that Suidas is blundering in his usual way, and has made three persons out of one.

CORIOLA'NO, the name of three celebrated engravers, chiefly in wood, in chiaroscuro. The earliest, CRISTOFORO, appears to have been a German and a native of Nürnberg, whose name, Doppelmayr supposes, was Lederer, but having settled in Italy he translated it into Coriolano. He cut, besides many other works, the very clever portraits of the second edition of Vasari, which was published at Florence in 1568. He died, according to Doppelmayr, in Venice, in 1600.

GIAMBATTISTA CORIOLANO, the next in point of time, was born at Bologna, and is supposed to have been the son of Cristoforo, but from the dates upon his works, 1619—1625, that of grandson is a more probable relationship: he died in 1649. He was the pupil of G. L. Valesio, and was painter, and engraver on copper and on wood; but he painted very little, and his cuts in wood are very few: his works consist chiefly of engravings and etchings on copper, of which Bartsch describes 223, among which are several after the Carracci and other celebrated Bolognese painters.

The most celebrated of this name was the Cavaliere BARTOLOMEO CORIOLANO, who is likewise said to have been the son of Cristoforo, but the statement in this case is still more doubtful than in that of Giambattista, for the earliest date on his works is that of 1627, twenty-seven years after the death of his reputed father, who must have been of a considerable age when he died, as he was employed by Vasari in 1568.

Bartolomeo was made Cavaliere di Loreto by Pope Urban VIII., for some prints after Guido, which he presented to his holiness: from this event he always wrote Eques after his name upon his prints.

He was one of the best of the Italian wood-engravers, and he has executed some very effective prints in chiaroscuro, after Guido and the Carracci; some with three and some with two blocks. The Fall of the Giants, after Guido, 1638, is one of his principal works; it is in four sheets, which together measure 32 inches high by 23 broad. The latest date to which his signature is found is 1647. His daughter, Teresa Maria, painted and engraved some few works.

(Doppelmayr, *Historische Nachricht*, &c.; Gandellini, *Notizie Istoriche degl' Intagliatori*, &c.; Bartsch, *Peintre Graveur*; Brulliot, *Dictionnaire des Monogrammes*, &c.)

CORMONTAINGNE (* * *) was a French engineer of the eighteenth century, who distinguished himself both by the services which he performed in the field, and by the improvements which he made in the art of fortification. He must have been born about the year 1692, for he died October 20, 1752, and he is said to have been then nearly sixty years of age; but it is remarkable that the circumstances of his early life, and even his baptismal name, have not been preserved.

The first notice which we have of him is that he was present at the siege of Fribourg in 1713, and probably he then acted as an engineer, for three years afterwards he addressed a Memoir on Fortification to M. le Pelletier de Souzi, who at that time held the rank of Intendant Général des Fortifications de France. In 1734 he was appointed by the Comte, afterwards the Maréchal Duc de Bellisle, to direct the siege of Traerbach; and when the division which performed that service rejoined the main army he accompanied it: the siege of Philisbourg being then undertaken Cormontaingne was employed to superintend the operations; and it is said that his successful attacks on two of the works were the immediate cause that the place was surrendered.

In the year 1744 he conducted, in Flanders, the sieges of Menin, Ypres, La Knoque, and Furnes; and, in Germany, that of Fribourg: at this last siege, though the casualties among the engineers were very great, the operations were conducted under the directions of Cormontaingne with the utmost regularity; and it is stated, as an example of the precision with which he formed his plans, that all the operations on the ground were exactly conformable to the written instructions which he drew up and to the sketches which accompanied them.

Subsequently to that time he was employed in inspecting the fortifications of the kingdom, from the Rhone to Calais; and, on this occasion, besides a general tract on the manner of fortifying the frontiers of a state, he wrote particular memoirs on the places of Franche Compté, Alsace, and the country between the Moselle and Calais. He was afterwards employed in superintending the constructions of new works at Strasbourg, Metz, Bitche, and Thionville: at the last of these places he resided, with the rank of Maréchal de Camp, and here his useful life terminated.

Cormontaingne wrote several memoirs relating to fortification and other branches of the military art; and that which is on the subject of the attack of fortresses, is said to have been composed, during the siege at which he served, from notes written in the trenches and on the breaches, even under the fire of the enemy. None of his writings were published during his life, except one which, without his knowledge, was printed at the Hague in 1741, under the title of 'Architecture Militaire;' and, after his death, all his papers were deposited in the Bureau de la Guerre, where they remained above thirty years. Extracts from them were, however, published, and these served as text books for the lectures given at the Ecole du Génie, which was established at Mézières in 1750. The manuscripts were at length obtained by M. Fourcroy from the government-offices, and were published at Paris by M. Bayart, capitaine du génie, in three volumes 8vo. The first is entitled 'Mémorial pour l'Attaque des Places (1806);' the second, 'Mémorial pour la Défense des Places (1806);' and the third, 'Mémorial pour les Fortifications permanentes et passagères (1809).' An edition of the first of these works had been published by Bousmard at Berlin in 1803.

Cormontaingne did not profess to invent a system of fortification; but, by certain variations in the constructions, and by additional works, he obviated many defects which are conceived to exist in the systems of Vauban: a brief notice of his improvements, with a plan of a 'Front' according to his method, is given in Fortification, P.C., pp. 376, 377.

It is observed that Cormontaingne's 'Mémorials' are less discourses than diagrams, and that his drawings are more correct than his style, which has few pretensions to elegance. He was endowed with great activity of body and mind, and had an ardent desire to penetrate into every subject relating to his profession.

(Bousmard's account of Cormontaingne in the Preface to the *Mémorial pour l'Attaque des Places; Biographie Universelle*).

CORN-LAWS. [Corn-Trade, P. C.; Wheat, P. C.]

CORN-RENT is a money-rent varying in amount according to the fluctuations of the price of corn. In some countries rent is paid in the produce of the land itself; but in no part of the United Kingdom does this primitive custom exist. Some landlords in Ireland, indeed, for the accommodation of their tenants, agree to accept corn in payment of their rent, at the price of the nearest market, and ship it to England for sale; but the rent is calculated in money. (See Appendix F to *First Report of Poor Laws* (Ireland) *Commissioners*, 1836, p. 221.)

A corn-rent is founded upon the principle that a farm being assumed to grow, upon an average, a certain quantity of produce, the value of such proportion of that produce as may be agreed upon shall be paid to the landlord as rent. But as the prices of all produce are liable to considerable variation, and as the profits arising from the land must generally be mainly dependent upon the prices for which the produce is sold, it is supposed to be equitable to the farmer that the money value of that portion of the produce which he pays as rent should be calculated so as to vary with prices, instead of being determined by any arbitrary or unvarying standard. And it is undeniable that with long leases a corn-rent is a security against the growth of any serious disproportion between the rent originally agreed upon and the actual value of the produce of the land. If the farmer, under the security of a long lease, lay out capital upon the land and thus increase the quantity of produce, he derives the entire benefit arising from increased production, as the quantity to be paid as rent has already been agreed upon; and he is secured against loss caused by a fall in prices, as the amount of his rent is governed by prices.

For the purpose of assessing a corn-rent the average price of wheat alone, or of wheat and other grain, is taken—sometimes for the last year, and sometimes for a certain number of years. If the price for one year only be taken, the results to the farmer may be thus stated:—When prices are low from a limited demand for produce, his rent is reduced; and when they are low from increased production, his rent is still reduced, although he has more produce than usual to sell. When prices are high from an increased demand, he has more rent to pay, but the remunerative prices enable him to pay it easily; but when an advance of prices is caused by scarcity, his rent is raised, while the high prices may be counterbalanced by the diminished quantity of produce which he has to sell. Thus in three cases out of four a corn-rent is favourable to the farmer; and even in the fourth case he is secured from loss by its favourable operation in other years. In some leases also a further advantage is given to him by fixing a maximum price: and thus if prices should happen to rise beyond that point, he derives the whole profit accruing from the difference. Under this system of annual averages, so advantageous to the farmer, there is a certain degree of unfairness to the landlord, which is sometimes corrected by assessing rent upon the average price of different kinds of produce for a certain number of years; by which means a just proportion is maintained between the money-rent and the average annual value realized from the land. It is upon this principle that the tithe rent-charges are calculated, from the average price of grain for seven years [Tithes, P. C.]; and corn-rents are sometimes regulated by the scale of average prices published annually for the purposes of the Tithe Commutation Act. In Wiltshire some farms are let in this manner, but their number is inconsiderable. The rent of grazing and dairy farms cannot be regulated by the ordinary system of corn-averages; but in some of the dairy-farms of Cheshire the rent is determined by the average price of wheat and of cheese. In many parts of the south of Scotland corn-rents are paid according to the *fiar* prices of corn, as determined in each county by a jury summoned by the sheriff for that purpose.

The principle of a corn-rent is by no means of recent origin; for by an act 18 Elizabeth, § 6, it was required that in all future leases granted by the colleges in the universities of Oxford and Cambridge, and by the colleges of Winchester and Eton, one-third part, at least, of the old rent shall be reserved and paid in good wheat at 6*s.* 8*d.* the quarter or under, and good malt at 5*s.* the quarter or under: or shall be paid in ready money after the rate of the best wheat and malt sold at the nearest market. (*Journal of the Royal Agricultural Society*, vol. v. p. 84, 177; see also Index to *Report on Agricultural Distress*, 1836.)

CORN-TRADE, ANCIENT. The production of corn, one of the chief necessaries of life, and its commercial exchange, have been a subject of the first importance in all ages. It is proposed here to state briefly the general nature of the trade in corn among two of the states of antiquity to whom we are mainly indebted for our knowledge of the economical condition of antient times. There are few important political questions at the present day to which we cannot find something similar in former times; and the blunders of antient legislation may still be instructive to modern statesmen.

Athenian Corn-Trade.—The small and comparatively barren territory of Attica did not produce sufficient corn for the consumption of the inhabitants. Corn was brought into the Piraeus, the port of Athens, from the countries bordering on the Black Sea, Syria, Egypt, and other parts of Africa, and from Sicily. Demosthenes asserted (B.C. 355) that the Athenians imported more grain than any other people (*Against Leptines*, c. 9). But the trade in corn between Greece and the Black Sea was of some magnitude at a much earlier date. In B.C. 480, Xerxes, while at Abydos, on his way to the invasion of Greece, saw the corn-ships that were sailing from the Black Sea and through the Dardanelles and carrying corn to Peloponnesus and Ægina. (Herodotus, vii. 147.) Some parts of the country on the coast of the Black Sea now export grain, and probably have exported grain ever since the time of Xerxes.

The importation of grain into Attica was a matter that was protected and regulated by the state; and instances are mentioned of armed ships convoying the corn-vessels from the Black Sea to the Piraeus. The exportation of corn from Attica was forbidden; and only one-third of the foreign corn that was imported into the Piraeus could be re-exported to other countries: this law as to importation was enforced by the overseers of the harbour. The law interfered with the trade in corn in other ways also, with the intention apparently of keeping prices low: but with what success it is easy to conjecture. Engrossing or the buying-up of corn was a serious offence: a man could not purchase more than fifty loads (called *φορμοί*). The amount of these loads cannot be exactly ascertained, nor is it material: the principle is clearly shown by the limitation. The penalty for violating this law was death. Boeckh (*Public Economy of Athens*, Eng. transl.) states the law thus: 'In order to prevent the accumulation and hoarding of corn, engrossing was very much restricted; it was not permitted to buy at one time more than fifty such loads as a man could carry.' According to this a man might buy fifty loads as often as he pleased at different times. But the meaning of the passage of Lysias is that a man must not buy up corn so as to have on hand more than fifty loads at a time. This interpretation is consistent with the Greek, and the other is not; and it is not open to the same kind of objection that Boeckh's interpretation is.

The absurdity of the Athenian legislation on the trade in corn appears from a speech of Lysias against the corn-dealers (*Κατὰ τῶν Σιτοπωλῶν*). The corn-dealers were generally aliens, and their business made them objects of popular detestation: it was alleged that they bought up corn, and refused to sell it when it was wanted, and thus compelled the buyers to pay them their own price. Yet it is stated by Lysias that the law was, that a dealer must sell his corn only one obolus dearer (the medimnus?) than he bought it. Thus the law attempted to fix the maximum profit of the dealers. But they evaded the law, according to the same authority, by selling it a drachma (six oboli) higher on the same day: the meaning of the orator here is not quite clear. The orator states that the hope of great gain made the dealers run the risk of the extreme penalty of the law. He urges the court which was then sitting for the trial of some of the corn-dealers whom he was prosecuting, to enforce the penalty against them, and so make them mend their manners; and he represents both the consumers and the importers of corn as suffering from the combinations of the dealers. A more signal instance of absurdity and commercial ignorance is not extant than this oration.

To carry the laws as to the sale of corn into effect, the Athenians had Corn Wardens (*σιτοφύλακες*) who kept an account of the corn that was imported, inspected flour and bread, and saw that they were sold of the weight and at the price fixed by law.

Various enactments were made with a view of securing a supply of corn; such as that no money should be lent on a vessel which did not bring back to Athens a return cargo of goods, among which corn was mentioned; and that no person living in Attica should import corn to any place except the port of Athens. The interests of individuals, and ultimately the real interests of the community, were thus set in opposition to the supposed interests of the state, and evasions of the laws are often spoken of. Individuals attempted what they will always do, to sell their grain at the dearest market. (Xenophon, *Œconom.*, c. 20.)

There were public corn-warehouses at Athens, in which corn was lodged that had been purchased at the expense of the state, and sometimes, as it appears, by private contributions. There were officers appointed to purchase the corn (corn-buyers, *σιτῶναι*), and persons to give or measure it out (*ἀποδέκται*). Corn so purchased was probably sold to the people at a low price, and sometimes also there were gratuitous distributions of it, as at Rome; and occasionally, as at Rome also, presents of grain were received from foreign princes or rich persons, and distributed among the people gratis.

This subject has been investigated by Boeckh, *Public Economy of Athens*, translated by G. C. Lewis, 2nd edition, revised, 1842; and these remarks are mainly founded on what is said there. The subject is curious, but unfortunately we must collect our information mainly from detached passages of the Athenian orators, who deal largely in falsehood and exaggeration, and it is not possible to arrive at certainty on some points.

Roman Corn-Trade.—What we know of the antient corn-trade of Italy mainly relates to the city of Rome. From an early period it belonged to the administration to see that the city was duly supplied with grain. The immediate neighbourhood of Rome did not supply the wants of the city, and grain was imported into Rome from the country of the Volsci and from Cumae soon after the establishment of the consular government. (Livy, ii. 9.) An importation of corn from Sicily is mentioned by Livy (ii. 41) under the year B.C. 486. As the Romans extended their empire, and provincial governments were formed, such as those of Sicily and Sardinia, supplies of grain were got from foreign parts. After the conquest of Sicily, the proprietors were allowed to keep their lands on condition of paying a tenth of the produce to the Romans, according to the system which had been established by King Hiero. Sardinia, after the conquest, paid the same. (Livy, xxxvi. 2). The mode of proceeding, as to the tenths in Sicily, was this:—The cultivator gave notice of what quantity of land he intended to sow, and an entry was made of it. The Roman State took the tenth of the produce in kind, which the cultivator was bound to convey to some port in Sicily, where it was embarked for Rome. All the wheat produced by the tenths was entered in the public books, and it was all conveyed to Rome or to the armies which were serving in parts remote from Rome; this at least appears to have been the general rule.

Sometimes two-tenths of the produce were claimed by the Roman State (Livy, xxxvi. 2; xxxvii. 2), but in this case the second tenth was paid for out of the Roman Aerarium. Presents of grain from foreign states and princes were sometimes made to the Romans. (Plutarch, *C. Gracchus*, c. 2.) Thus it appears that the State undertook to provide the chief supply of grain for the city: the grain was sometimes sold, and sometimes distributed gratis among the poor, a practice which became common under the late Republic. Besides these distributions of corn at the public expense, the wealthy Romans who sought popularity sometimes made like distributions of corn among the poorer citizens, as M. Crassus the Rich did in his consulship. (Plutarch, *Crassus*, c. 2, 12.)

It does not appear, then, that the chief supply of corn for the city of Rome during the Republic was furnished in the regular way of trade. It was the business of the State to keep the proper supply of corn for the city in the public warehouses; but the supply was not always equal to the demand, and it also often happened that many people could not afford to pay the price. Scarcity was not uncommon both under the Republic and the Empire.

In Livy (iv. 12) we have a notice of the creation of a Praefectus Annonae, or Superintendent of Provision, L. Minucius, B.C. 440, in a season of scarcity. He exercised his office in an arbitrary manner, by compelling persons to state what corn they had in their possession, and to sell it; and he endeavoured to raise a popular clamour against the corn-dealers, if Frumentarii here means private dealers. Cn. Pompeius Magnus was intrusted with the superintendence of Provision for five years. (Cicero, *Ad. Attic.*, iv. 1.) Augustus, at the urgent importunity of the people, took on himself the office of Praefectus Annonae, such as Pompeius held it. (Dion Cassius, liv. 1.)

Under the early Republic many parts of Italy were well cultivated, and Rome, as already observed, derived supplies of corn from various parts of the Peninsula. But the civil wars which devastated Italy near the close of the Republic were injurious to agriculture. Murder and proscription thinned the numbers of the people, and life and property were insecure. Many of the lands changed owners, and the property of those who were cut off by violence fell into the hands of others, and chiefly of the soldiers. These and other causes made Italy less productive about the time of the Christian æra than it had been some centuries earlier. Even under the peaceable administration of Augustus, 60,000,000 modii of wheat were annually imported into Italy and Rome from Egypt and the Roman province of Africa. The modius is estimated at 1 gallon and 7·8576 pints, English measure. But this did not prevent scarcity: there was a great famine at Rome in the latter part of the administration of Augustus. (Dion Cassius, lv. 26; Vell. Paterc. ii. 104; Suetonius, *Augustus*, c. 42.) The general administration of Tiberius, the successor of Augustus, is commended by Tacitus (*Annal.* iv. 6). He endeavoured to secure a proper supply of corn by intrusting to the Publicani the management of the tenths of grain from the provinces; but there was a great famine in his time, and the high price of grain almost caused an insurrection. The emperor showed that he had not neglected this important part of the administration: he published a list of the provinces from which corn was brought, and he proved that the importation was larger than in the time of Augustus. (Tacit. *Annal.* vi. 13.) Again, under the administration of the Emperor Claudius, a famine in Rome occurred. (Tacit. *Annal.* xii. 43.) Tacitus observes that during the scarcity Claudius was assailed with menaces while he was seated on the tribunal in the forum, and he only escaped by the aid of his soldiers. He adds that there were only fifteen days' provisions in the city; and 'formerly Italy used to export supplies for the legions to distant provinces; nor is Italy now barren, but men prefer cultivating Egypt and Africa, and the existence of the Roman people is intrusted to ships and the dangers of the sea.' Claudius subsequently paid great attention to the supplying of Rome with corn. Under Nero, the successor of Claudius, there was a famine at Rome. (Suetonius, *Nero*, c. 45.)

The comparison of antient and modern prices of grain is a difficult subject, and the results hitherto obtained are not satisfactory. It is also necessary to be careful in considering the circumstances when any prices are mentioned. P. Scipio on one occasion (B.C. 200) sent a great quantity of corn from Africa, which was sold to the people at four asses the modius. (Livy xxxi. 4.) In the same book of Livy (c. 50) another sale is mentioned at the rate of two asses the modius. But on these, as on many other occasions, these prices were not the market-prices at which wheat would have sold, but they were the lower prices at which the State sold the grain in order to relieve the citizens. Rome, both under the Republic and the early Empire, suffered occasionally from scarcity or from high prices of grain. It is possible that a supply might have readily been procured from foreign parts if there had been a body of consumers in Rome to pay for it. But the export of grain to Rome was not a regular trade; it was, as above explained, a system by which the Romans drew from their provinces a contribution of corn for the consumption of the capital, and it was not regulated by the steady demand of an industrious class who could pay for it. The reign of Tiberius appears to have been a period of scarcity; the complaints were loud, and the emperor fixed the price of corn in Rome, and he promised to give the merchants a bounty of two sesterces on the modius. This seems to mean that the emperor fixed the prices for all grain, including whatever private merchants might have; but to make them amends for any loss, he paid them part of their prices out of the treasury. After the fire at Rome, in the time of Nero, Tacitus speaks of the price of corn being lowered to three sesterces the modius. The Emperor Diocletian, by an edict, fixed the prices of all articles through the Roman Empire. The reason for this measure is stated, in the preamble to the edict, to be the high market-price of provisions, which is attributed to the avarice of the dealers, and was not limited even when there was abundance. (Inscription of Stratoniceia; see an Edict of Diocletian, fixing a maximum of prices throughout the Roman Empire, A.D. 303, by Colonel Leake, London, 1826, 8vo.)

It does not appear whether the grain which was brought to Rome from the provinces was brought in public ships, or in private ships, by persons who contracted to carry it. There seems, however, to be no doubt that there was also importation of corn by private persons, and that there were no restrictions on the trade, for the object was to get a full supply. A constitution of Valentinian and Valens (De Canone Frumentario Urbis Romæ, Cod. xi. tit. 23) declares that merchants (nautici) were to make a declaration of the grain which they imported before the governors (of provinces) and the magistrates, and that they had only good corn on board; and it was the business of the authorities to see that the grain was good. The provisioning of Constantinople, Alexandria, and probably other great cities, under the later Empire, was subject to regulations similar to those of Rome, and there were public granaries in those cities.

It is almost impossible to collect from the scattered notices in the Roman writers a just notion of the nature of the trade in grain. So far as concerns Rome, we can hardly suppose that there was a regular trade in our sense of the term. The chief supply of grain was provided by the state. That which is best left to private enterprise was undertaken by the government. It is true that the condition of Rome was peculiar under the late Republic and the Empire. The city was full of paupers, who required to be fed by occasional allowances of corn. The effect, however, of the State purchasing for the people was not a certain supply, but occasional scarcity. Whether a State undertakes to buy for the people what they may want for their consumption, or regulates the trade by interfering with the supply, is immaterial as to the result. In either case the people may expect to be starved whenever corn is scarce. The Roman system was to import all that could be got into Rome, but it was not left to private enterprise. There was no exclusion of foreign grain in order to favour the Italian farmer; nor can it be said that the Italian farmer suffered because foreign grain was brought into Rome and other parts of Italy; he could employ much of his land better than in growing corn for Rome and sending it there. Corn came from countries which were better adapted to corn-growing than many parts of Italy; and besides this, the transport of grain from many foreign parts to Rome, such as Sardinia, Sicily, and the province of Africa, would be as cheap as the transport of grain by sea from the remote parts of Italy, and much cheaper than the transport by land. The English foreign corn-trade is regulated with the avowed purpose of giving the English wheat-grower a high or what is considered a sufficient price, without any consideration of the pecuniary resources of those who have to buy corn. By interfering with the free trade in grain, the English system keeps the price unsettled, and exposes the people in times of scarcity to the danger of famine; for when a bad harvest occurs in England, the deficency must be made up from abroad, and the price must be paid for it, whatever that price may be, which must always be paid for an article that is suddenly in demand, and is not an article of regular supply. The two systems were equally bad, but bad in a different way. The Roman system was founded on ignorance of the true nature of trade, and it was closely connected with the vices of the political constitution. The English system is founded partly on ignorance, and partly on the wish of the landowners, who possess a preponderating political power, to keep up their rents, which are derived from the lands which their tenants cultivate.

The essay of Dureau de la Malle, 'De l'Economie Politique des Romains,' and the treatise of Vincentius Contarenus, 'De Frumentaria Romanorum Largitione,' in Grævius, 'Antiq. Rom. Thesaurus,' vol. viii., contain most of the facts relating to the supply of corn to Rome; and both have been used for this article.

CORNBRASH, a thin calcareous member of the oolitic formations. It constitutes the uppermost band of the Bath oolite formation, and is extremely rich in Echinodermata and Conchifera, but somewhat remarkably deficient in Belemnites.

CORNEL-TREE. [CORNUS, P. C. S.]

CORNSTONE. The peculiar limestone, often mottled in colour, of the old red-sandstone of Hereford, Salop, and South Wales, receives this title. (Murchison, 'Silurian System.')

CORNULITES, an obscurely characterized genus (of Polypiaria?), which occurs in the Silurian limestones and sandstones very frequently, as at Dudley, Usk, Marloes Bay, &c. (Murchison, 'Silurian System,' pl. 26, f. 5.)

CORNUS, a genus of plants, the type of the natural order Corneæ. It has a calyx with a very small 4-toothed limb; with four oblong sessile petals; six stamens; one style; a baccate drupe marked with traces of a calyx; the stone 2-celled, rarely 3-celled; the seeds solitary, pendulous; the albumen fleshy; the radicle of the embryo shorter than the cotyledons. The species are trees, shrubs, or low herbs, with opposite leaves, and white, sometimes yellowish flowers.

C. sanguinea, Dog-wood, Wild Cornel-tree, has arborescent straight branches; ovate cuspidate leaves, green on both sides; the cymes flat, without an involucre. This plant is a shrub, reaching a height of five or six feet. Its branches are of a reddish colour. It is a native of Great Britain, in hedges and thickets. It also inhabits North America, in Canada and New York; but has been supposed to be introduced there. It has a dark purple fruit, which is very bitter. Matthiolus says that it contains an oil which is sometimes expressed, and is used for lamps. The wood is used for making charcoal from which gunpowder is made. The fruits are sometimes mistaken for those of buckthorn, but do not possess the active properties of that plant. The wood is used for making skewers for butchers. It is called in the country Female Cornel, Prick-wood, Dogberry-tree, Hound's-tree, Gaten and Gaten-tree.

C. suecica, Dwarf Cornel, has herbaceous stems, the leaves all opposite, sessile, ovate; the nerves separate almost to the base; the flowers umbellate, shorter than the 4-leaved petaloid involucre. It is found in high mountain pastures in England and Scotland. It is not so large a plant as the last, and has purple flowers with yellow stamens. The berries are red and sweetish, and are supposed by the Highlanders to create an appetite, of which their name for them, *Lus-a-chrasis*, is expressive.

C. florida has shining branches, ovate acuminated leaves, pale beneath, beset with adpressed hairs; the flowers umbellate; the leaves of involucre large, roundish, retuse, the drupes ovate. It is a native of moist forests in the United States, especially on the borders of swamps. The bark of this tree is a powerful tonic, astringent, and antiseptic, resembling Cinchona in its action on the system, and much valued by American physicians. The young branches stripped of their bark, when rubbed against the teeth, render them extremely white. The bark of the roots yields a colouring matter which dyes cloth scarlet.

C. sericea, Silky Dogwood, has spreading branches; woolly branchlets; ovate acuminate leaves, clothed with rusty pubescence beneath; the corymbs depressed, woolly; the nucleus compressed. It is a native of North America, in moist woods. It has the same properties as the last species, and is used for the cure of intermittent fevers. It is probable that these plants contain an alkaloid identical with quinine, but it has not yet been separated.

C. mas, Male Cornel, Cornelian Cherry, has smoothish branches; leaves oval, acuminate, rather pubescent on both surfaces; flowers rising before the leaves; the umbels about equal in length to the 4-leaved involucre; the fruit elliptic. It is a native throughout the continent of Europe, but is not found in Great Britain. It has yellow flowers, which are succeeded by an elliptical fruit of a bright shining scarlet colour, of the size and form of a small acorn. This plant was formerly cultivated for the sake of its fruit, but it is very inferior to many others that can be more easily produced, so that it is not now often used. The fruit is called *Corbet* by the Turks. The wood is very durable.

The species of Cornus form good plants for shrubberries, and many of them will grow under the drip of trees, and in spots where other plants will not thrive. They may be propagated by cuttings, layers, or suckers.

(Don, *Gardener's Dictionary*; Lindley, *Flora Medica*; Babington, *Manual of British Botany*.)

CORONER. The 58 Geo. III. c. 95, which made provision for conducting the election of coroners similar to those for the election of knights of the shire, was repealed in 1844 by 7 & 8 Vict. c. 92, which substituted other regulations on the ground that the former mode of election was inconvenient and attended with great and unnecessary expense. This act applies only to county coroners, and the coroners of the City of London and Borough of Southwark, of the Queen's Household and the Verge of the Queen's Palace, and Admiralty coroners, are specially exempted. Counties may be divided by the justices into two or more districts for the purposes of this act, and alterations may be made in existing divisions. The justices, in making such divisions, are in the first place to petition her majesty, and notice is to be given to each coroner by the clerk of the peace of the time when the justices will take such petition into consideration. Any coroner of the county may present a petition to her majesty touching the proposed division or alteration of districts. Her majesty, with the advice of the privy council, may order that such county shall be divided into so many districts as may be considered convenient, and determine at what place within each district the court for the election of coroner for such district shall be held. The justices are to direct the clerk of the peace to make out a list of the several parishes, townships, or hundreds in each of the coroner's districts into which the county is divided, specifying the place within each district at which the court for the election of coroner is to be held, the place or places at which the poll is to be taken, and the parishes or places attached to each polling-place. The justices may then assign one district to each coroner; and whenever a vacancy occurs the election is to be made in the manner prescribed by the act. The coroner must reside in the district for which he is elected, or in some place wholly or partly surrounded by such district, or not more than two miles beyond its outer boundary; the election must be made in the district; and the coroner chosen by a majority of persons duly qualified who shall reside in such district: no voter can poll out of the district where his property lies. Within not less than seven or not more than fourteen days after the sheriff shall have received the writ De Coronatore Eligendo, he is required to hold in the district for which a vacancy has occurred a special county court for the election; and if a poll be demanded, it may be kept open for two days, eight hours each day, from eight o'clock in the morning. The sheriff is to erect polling-booths; poll-clerks are to be sworn; and an inspector of poll-clerks is to be appointed on the nomination of each one of the candidates. Electors may be required by or on behalf of any candidate to make oath respecting their qualification. The result of the poll is to be declared by the sheriff. The coroner, although elected for a district, is to be considered as a coroner for the whole county; but he is only to hold inquests within his own district, except in case of the illness or unavoidable absence of the coroner for another district; and his inquisition must certify the cause of his holding such inquest.

County coroners were entitled to a fee of 20*s.*, under 25 Geo. II. c. 29, and now, by 1 Vict. c. 68, to an addition of 6*s.* 8*d.* By 7 & 8 Vict. c. 92, coroners may be paid travelling expenses, although in the exercise of their discretion they may have deemed it unnecessary to hold an inquest. The sum paid to coroners out of the county rates in 1834 was 15,648*l.* In 1838 and 1839 about 35,000 inquests were held in the two years. By 7 & 8 Vict. coroners are prohibited from acting professionally in any case in which they shall have sat as coroner.

The act 1 Vict. c. 68, authorises the justices of the peace in England and Wales, at their quarter-sessions, and the town councils of every borough which has a coroner's court, at their quarterly meetings, to make a schedule of the fees, allowances, and disbursements which the coroner is allowed to pay (except the fees payable to medical witnesses, under 6 & 7 Will. IV. c. 89), on holding any inquest. This schedule regulates for each county or division of a county the expenses to be paid to the constable for summoning witnesses, &c. There is usually a small sum allowed to each juryman, generally 1*s.* 6*d.* in counties and 1*s.* in boroughs. The following are extracts from the schedule of fees settled by the magistrates of the county of Warwick, which are to be fixed by the coroner according to his discretion, but are not to exceed the sums stated:—

	s.	*d.*
To the Keeper of any Inn or other public-house for the use of a room for a dead body until the Inquest is held	20	0
To the Keeper of any Inn or other public-house for the use of a room for holding an Inquest .	5	0
To a Witness residing in the parish where the Inquest is held, for loss of time in attending to give evidence	5	0
To a Witness who does not reside in the parish, is allowed per mile	0	4
To every Witness in the three professions of law, physic, and divinity, for each day . .	42	0
To each Juryman residing in the parish where an Inquest is held	1	6
To each Juryman not residing in the parish where the Inquest is held	3	0
To any person for taking a dead body out of the water, extinguishing fire in the case of a person burning, or removing a dead body when found to some convenient place till an inquest can be held, and giving notice to the proper authorities .	7	6
To a Chemist, Engineer, or other scientific person per day	42	0
For interring the body of a *Felo de se*, including horse and cart, and other trouble (exclusive of burial fees, if any)	10	0
For digging the grave for interring the body of a *Felo de se*	8	6
To bearers of the body of a *Felo de se* . .	10	0
Coffin for a *Felo de se*	7	0

Under 7 & 8 Vict. c. 92, jurors and witnesses who neglect to attend an inquest may be fined any sum not exceeding 40*s.* The power of punishing witnesses who refuse to give evidence, for contempt of court, and the right to exclude persons from his court, are incidents of his office.

By 1 Vict. c. 68, the fees of medical witnesses are to be paid at once by the coroner, instead of by an order on the churchwardens, as directed by 6 & 7 Wm. IV. c. 89.

For their services when acting for the sheriff, coroners were not allowed any fees before the passing 7 & 8 Vict., but this statute secures to them the same amount of fees as the sheriff would be entitled to.

The average cost of the coroner's court for the borough of Birmingham, averaged 899*l.* for the five years ending 31st of December, 1844; coroner's fees, 1*l.* 6*s.* 8*d.*, annually averaged 337*l* 4*s.*; and the expense of 1416 inquests averaged 3*l.* 3*s.* 5¼*d.* each. The disbursements, independent of coroner's fees, averaged 561*l.* 8*s.* 2¾*d.* a year. In 1844 the average expenses of each inquest held in the borough of Nottingham was 19*s.* 2½*d.*; in the borough of Norwich, 1*l.* 2*s.*; in the county of Middlesex, 1*l.* 5*s.* 4*d.*, including in each case the fees of medical witnesses. In the borough of Bristol the average expense of each inquest was 1*l.* 1*s.* 8*d.*, exclusive of the fees to medical witnesses.

CORONILLA, a genus of plants belonging to the natural order Leguminosæ. It has a campanulate short 5-toothed calyx, with the superior teeth approximated and partially united; the claws of the petals distinctly longer than the calyx; the keel acute; the stamens diadelphous; the legume tapering, slender, finally separating into oblong 1-seeded joints; the seeds ovate or cylindrical. The species are shrubs or herbaceous plants, with unequally pinnated leaves; the peduncles axillary, bearing an umbel of stalked flowers.

C. Emerus, Scorpion-Senna, is a shrubby glabrous plant, with small stipules; 5-7 obovate leaflets; 3-5-flowered peduncles. It is a common plant all over the south of Europe, in hedges and among bushes. It has bright yellow flowers. Its leaves act as a cathartic, resembling the leaves of senna, but are less active. It is a pretty shrub, and well adapted for the front of a shrubbery. It thrives in almost any soil, and blossoms nearly all the year round.

C. varia is an herbaceous plant, with distinct lanceolate petals; the leaflets 9-13 oblong, elliptic, mucronate, the lower ones approaching the stem; the umbels 16-20 flowered; the legumes angular, very long, straight. It inhabits meadows and waste places in the South of Europe and in the Crimea. The leaves have a diuretic action on the system, and also purge. The juice is said to be poisonous when taken in large quantities; although this is the action on the human system, cattle feed on this plant with avidity, and it has been proposed to cultivate it in this country as fodder. It probably does not develop its active secretions in climates north of its native districts. In a good soil the stems grow to the height of five feet, so as amply to repay its cultivation, especially in a dry season. When once planted it is difficult to eradicate. *C. globosa* and *C. iberica* have the same tendency.

The species of Coronilla are numerous, and are all shrubs or herbs, adapted for ornamental cultivation. Of the hardy shrubby species, ripened cuttings root freely, and may be planted in open ground in the autumn. The frame and greenhouse species are of easy culture. They grow best in a mixture of loam and peat; cuttings strike readily in sand under a hand-glass, and may be turned out into the open border in spring, where they will flower all summer. Many of them are well adapted for rock-work, but are apt to be killed during a severe winter.

(Don, *Gardener's Dictionary*; Loudon, *Encyclopædia of Plants*; Lindley, *Flora Medica*.)

CORRA'DI, DOME'NICO. [GHIRLANDAIO, P. C.]

CORRECTING PLATE. [SAILING, P. C.]

CORRIGI'OLA (diminutive of *corrigia*, a shoe-string), a genus of plants belonging to the natural order Paronychieæ. It has 5 sepals slightly cohering at the base; 5 petals equalling the sepals; 5 stamens; 3 sessile stigmas; a 1-seeded indehiscent fruit; the seed suspended by its cord, which arises from the base of the capsule; the petal, as the sepal, inserted upon an obscurely perigynous ring at the bottom of the calyx. The species are procumbent glaucous herbs, with alternate stipulate leaves.

C. littoralis, Strap-wort, has the stem leafy on the part only which bears the flowers. It is the only British species of the genus. It is found on sandy shores in England, but it is not an abundant plant. There are three or four other species described, natives of America and Africa.

(Babington, *Manual of British Botany*.)

CORT, CORNELIUS, a designer and very celebrated engraver, born at Horn in Holland in 1536. He worked in his youth for Jerome Cock, a printseller of Antwerp. He went later, about 1566, to Italy, where in Venice he was received by Titian into his house, and engraved several of his pictures for him in, at that time, an unusually large size; they are dated 1566. Cort however settled finally in Rome, and established a school of engraving there, in which Agostino Caracci is said to have studied, which is doubtful, as Agostino was only twenty years of age when Cort died, if 1578, as is believed, from the letters on an old portrait, was the year of his death. Nor is there any mention that Agostino studied in Rome in his youth, nor are any of his own prints dated earlier than 1582, four years after the death of Cort.

That Agostino studied the prints of Cort is more than probable; his works are much in the same style. Cort's prints are large and his outline correct; they display gr mastery of the graver, but a want of perception of the more delicate qualities, such as colour and relative distance; he was also deficient in discriminating the more delicate indications and varieties of expression. His works, for their size and style, and considering the comparative shortness of his life, forty-two years, are very numerous; they exceed one hundred and fifty. He made the first engraving after the Transfiguration by Raphael; he engraved also the Battle of the Elephants, and the Battle of Constantine, after Raphael. He executed also several prints after Federigo Zuccaro, and others after Taddeo Zuccaro, G. Muzziano, Polidoro da Carravaggio, Correggio, Michelangelo, Sabbatini, and many other celebrated masters, Italian and Flemish; and likewise some from his own designs.

(Gandellini, *Notizie Istoriche degli Intagliatori*, &c.; Heineken, *Dictionnaire des Artistes*, &c.)

CORYDA'LIS, a genus of plants belonging to the natural order Fumariaceæ. It has a calyx composed of 2 sepals, or absent; 4 petals, the upper one spurred at the base; the stamens diadelphous; the pod 2-valved, many seeded, compressed. The species are mostly small glaucous herbs, with ternate or pinnated leaves, and fusiform tuberous or fibrous roots. Upwards of forty species of this genus have been described. They are natives of the temperate parts of the earth in the four quarters of the globe.

C. claviculata, White Climbing Fumitory, has a fibrous root; pinnate leaves, with acuminate bracts, the pinnæ ternate; footstalk ending in tendrils. It has small pale yellow or nearly white flowers. It has a slender climbing stem, 1-4 feet long. It is found in bushy places in hilly districts of Great Britain and throughout Europe.

C. lutea, Yellow Fumitory, has a fibrous root, triternate leaves; minute oblong cuspidate bracts; shining seeds, granulate-rugose, with a patent denticulated crest. This plant is a native of the South of Europe, in the fissures of rocks and old walls. It is now naturalized in Great Britain, and forms a picturesque object on the old walls of ruins, as at Castleton in Derbyshire, and Fountain's Abbey, Yorkshire. It is a very common plant in gardens.

C. solida has a tuberous solid root, with biternate cut leaves, the lowest petiole a leafless scale, the bracts palmate. It is found in Great Britain, but has been undoubtedly introduced.

C. Fabacea has a nearly simple erect stem, scaly under the lower leaf; the leaves stalked biternate; the bracts ovate, acute, longer than the pedicles. It is a native of shady mountainous places in Sweden, Denmark, and many other parts of the continent of Europe. This species, as well as *C. tuberosa*, a native of the South of Europe, has a tuberous root. The root of both the species is very bitter and rather acrid. That of *C. tuberosa* is hollow. On the Continent these roots are used under the name of *Radix Aristolochiæ*, and are employed as external applications to indolent tumours.

Many of the species are cultivated in Great Britain, and, having escaped from gardens, are occasionally found wild; but only *C. claviculata* is a native; *C. lutea* is naturalized. In cultivation they require a light rich soil. They are well adapted for flower-borders and rock-work. The perennial species may be propagated by dividing the roots, the annual by seeds, which should be sown where they are intended to remain. They will grow well under trees, if the soil be not very dry.

(Don, *Gardener's Dictionary*; Lindley, *Flora Medica*; Loudon, *Encyclopædia of Plants*; Babington, *Manual of British Botany*.)

CORYMBI'FERÆ, one of the primary subdivisions in the system of Jussieu, of the natural order Compositæ: comprehends most of the Tubulifloræ of De Candolle. It is characterised by the absence of albumen, an erect seed, a hemispherical involucre, and the florets of the ray, if present, ligulate. This division comprises by far the largest number of the genera of the large order Compositæ. The species of Corymbiferæ produce more active secretions, and have been used more extensively by man than those of the other subdivisions of the order. They generally represent the Cichoraceæ [CICHORACEÆ, P. C. S.] in hot climates, and this will perhaps account for their more active properties. In Great Britain the Corymbiferæ are more numerous than either the Cynaraceæ or Cichoraceæ. The number of species in Babington's 'Manual of British Botany' is—

Corymbiferæ .	62
Cichoraceæ .	51
Cynaraceæ .	26
	———
Compositæ ·	139

De Candolle estimates that the species of the Compositæ form a tenth part of the flowering plants in the world, and this is about the proportion in which they occur in Great Britain.

The following is a synopsis of the British genera of Corymbiferæ:—

Tribe I. EUPATORIACEÆ.
  Section I. *Eupatoreæ.*
    Eupatorium, 1 species
  Section II. *Tussilagineæ.*
    Petasites, 1 species
    Tussilago, 1 „
Tribe II. ASTEROIDEÆ.
  Section I. *Astereæ.*
    Aster, 1 species
    Erigeron, 3 „
    Bellis, 1 „
    Solidago, 1 „
    Chrysocoma, 1 „

Section II. *Inuleæ.*
Inula, 3 species
Pulicaria, 2 „
Tribe III. Senecionideæ.
Section I. *Heliantheæ.*
Bidens, 2 species
Section II. *Anthemideæ.*
Anthemis, 5 species
Achillea, 4 „
Diotis, 1 „
Chrysanthemum, 2 species
Pyrethrum, 3 species
Matricaria, 1 „
Artemisia, 5 „
Tanacetum, 1 „
Section III. *Gnaphalieæ.*
Filago, 3 species
Gnaphalium, 5 „
Antennaria, 2 „
Section IV. *Senecioneæ.*
Doronicum, 2 species
Cineraria, 2 „
Senecio, 9 „

The properties of this division of Compositæ are characteristic. Bitterness, with an aromatic odour, is common to all the species. Whether the bitterness depends on an alkaloid or not chemists have not determined. Many of the species possess properties very similar to those possessed by quinine, and are administered in the same diseases as cinchona; among these are species of the genera Inula, Piqueria, Mikania, and Emilia. This bitter principle seldom however gives the character to the plant alone, but is combined with some aromatic oil, which gives the plant the properties of both a tonic and a stimulant. Such a combination is found in many of the species of the genera Anthemis, Artemisia, Diotis, Santolina, Chrysanthemum, Eupatorium, Liatis, &c. Sometimes the volatile oil is more prominent than the bitter principle; and this is obvious in the species of Pyrethrum, Tanacetum, Stenactis, Erigeron, &c. In some of these the volatile oil assumes the characters of turpentine and the oil of juniper, and acts as a diuretic; hence a certain number of these plants have the reputation of stimulating the action of the kidneys. In some the volatile oil assumes an acrid character, as in Bidens, and acts as a sialogogue, as in Pyrethrum and Spilanthes; in Maruta it is sufficiently active to produce vomiting. In some a secretion is produced, similar to that which gives the character to Cichoraceæ. Thus Buphthalmum salicifolium is said to possess narcotic powers, and the Arnica montana is stated by Burnett to have yielded a principle identical with Cytisine, the active principle of the laburnum. Some of the species yield a fixed oil. In addition to the acrid oil in Pyrethrum officinale there is a butyraceous matter, consisting principally of stearine. The seeds of the species of Helianthus yield a fixed oil on expression, and this is probably not confined to the seeds of this genus. These seeds also contain nutritive matter (protein ?), and are the support of birds and sometimes of man, in America. Another group yield colouring-matters: Anthemis tinctoria, and the species of Calendula and Bidens, are used for dyeing yellow; the Tanacetum vulgare, for dyeing green. The roots of many species contain starch, and in quantities large enough to afford food for man, as in the tubers of Helianthus tuberosus. Many of the species also yield the peculiar form of starch known by the name of Inulin, named after the Inulas in which it was first found. Some of them appropriate potash in the spots where they grow, and a species of Erigeron is remarkable for the large quantities of this alkali which it contains. Gum is a secretion found in considerable quantities in some species, as of Gnaphalium, Conyza, and Tussilago, and on this account they have been used in medicine as demulcents. Tannin is not found in any quantity in this tribe of plants, so that they seldom exert an astringent action upon the system; the Achillea millefolium seems however to possess this property. Many of the ornaments of the garden belong to the Corymbiferæ. The Dahlia, Chrysanthemum, Xeranthenum, Aster, Erigeron, Solidago, Cereopsis, and Tagetes, are amongst the genera that afford the most showy and highly valued flowers in the autumn of the year. Although the properties and uses of these plants in relation to man are important, yet in proportion to the position they occupy in the vegetable kingdom, they are few. Many orders which yield a much smaller number of species afford much more abundant materials for the use of man.

(Lindley, *Flora Medica*; Lindley, *Natural System*; P. C. S., No. 54. Babington, *Manual of British Botany*; Burnett, *Outlines of Botany.*)

CORYNE'PHORUS, a genus of British grasses, belonging to the tribe Avenineæ, with the following character:—Awn club-shaped, straight, jointed in the middle, the upper portion clavate, a tuft of hairs at the joint, panicle lax, glumes 2-flowered. There is but one species, *C. canescens*, which has a rather dense elongated panicle, the glumes acuminate, longer than the flower, the awn coming from near the base of the palea, the leaves setaceous. It is a native of the sandy coasts of Norfolk and Suffolk and Jersey.

(Babington, *Manual.*)

COSCINO'PORA, a genus of fossil corals, proposed by Goldfuss. C. infundibuliformis occurs in the chalk of Ireland.

COSMAS INDICOPLEUSTES. This is the name given to the author of a Greek work who lived in the sixth century of our æra, under the Emperor Justinus. Photius, who gives an account of the work in his 'Bibliotheca' (Cod. 36), says that the title is *Χριστιανῶν βίβλος ἑρμηνεία εἰς τὴν ὀκτατευχον*, 'A Book of the Christians, an Exposition on the Octateuch.' This is the literal version of the title; but it is observed that the title does not agree with the contents, which are not an exposition on the first eight books of the Holy Scriptures; and accordingly the title is explained by some critics to mean a work in eight books. For though there are twelve books, Photius speaks of the last four as not dedicated to any person, while the first six are dedicated to Pamphilus, the seventh to Anastasius, and the eighth to Peter.

The work as it exists in the MSS. is entitled *Χριστιανικὴ τοπογραφία παντὸς κόσμου*, 'Christian Description of the Whole World.' Photius does not mention the writer's name; and it has been conjectured that the name Cosmas Indicopleustes, or Indopleustes, has been given to the unknown author, from the title of his work Cosmus (*Κόσμος*), and the fact of his having travelled to India. He had seen India and Ceylon, and acccordingly it has been conjectured that he was originally a merchant.

The object of Cosmas was to reconcile the natural phenomena of the universe with the account in the Bible. He says that the habitable earth is flat and rectangular, the length being twice the breadth, and that it is surrounded by the ocean, which flows into the earth by four passages, the Mediterranean Sea, the Caspian, the Arabian Gulf, and the Persian Gulf. The opinion that the Caspian communicated with the ocean was firmly established before the time of Cosmas, though Herodotus, 450 years before the Christian æra, had declared that the Caspian was a lake. The rest of his cosmography is of a piece with that which has been stated.

In the second book the author speaks of the monument of Adule, which he had seen, and which he has transcribed into his work. [Adule, P. C.] In the eleventh book he gives a description of Taprobane, or Ceylon, and the animals of India. The work of Cosmas is of some value, owing to the passages that he cites from authors who are now lost. The Christian Topography is printed in B. Montfaucon's 'Collectio Nova Patrum,' Paris, 1707, fol. The description of Ceylon and of the products of India was edited by M. Thevenot, with a French translation, in the first volume of the 'Relations des divers Voyages curieux,' Paris, 1666, fol.

(Fabricius, *Biblioth. Graeca*, iv. p. 251, edit. Harles; Schoell, *Geschichte der Griech. Litt.* iii. 327.)

COSTUS. [Putchuk, P. C.]

COSWAY, RICHARD, R.A., was born in 1740, at Tiverton in Devonshire, where his family, originally Flemish, had been long settled, and his father was master of the public school. He was placed by his uncle, the mayor of Tiverton, with Hudson, and afterwards at Shipley's drawing-school in the Strand. Smith, in his Life of Nollekens, gives a different account. He speaks of him as Shipley's servant, who waited upon the pupils at the school; a very improbable story, judging from Cosway's connexions. However, at this time Cosway was very diligent: he obtained in a few years, between the fourteenth and twenty-fourth years of his age, five premiums from the Society of Arts. His chief excellence was in miniature painting, for which he had very great ability, and in which, professionally, he was successful to the utmost degree. He was patronized by all the rank and wealth of his time: the Prince of Wales, afterwards George IV., was among his friends and patrons. He made a large income; but he was sumptuous and hospitable in his habits, and his expenditure probably kept pace with his income.

He was elected a member of the Royal Academy at the same time with Nollekens and Barry, in 1771, according to

Smith, and, as if in acknowledgment of the honour, he painted several fancy portraits for its exhibitions. He exhibited 'Rinaldo and Armida,' 'Cupid,' 'St. John,' 'Venus and Cupid,' 'Madonna and Child,' and 'Psyche,' all of which were portraits of some of his titled patrons, good likenesses, and successful works in their style.

About this time he was married to Maria Hadfield, though of English parentage, a native of Leghorn, where her father had kept an hotel which was much frequented by English travellers. The late Charles Townley, collector of the Townley marbles, gave the bride away. Her story is remarkable: she was the fifth child of her parents, but the four elder children had all died in a remarkably sudden manner when infants, facts which had excited many strange surmises. Soon after the birth of Maria however the mystery was explained. One day a favourite maid-servant went into the nursery, and taking up the child and dandling it, said, 'Pretty little creature! I have sent four before thee to heaven: I hope to send thee also.' This extraordinary speech, which was overheard by another servant, caused the arrest and examination of the girl, who confessed that she had herself destroyed the other four children out of love, 'for of such was the kingdom of heaven.' The deluded creature was imprisoned for life. Maria was placed in a convent to be educated, where she was taught music and drawing; arts which she eventually pursued with such success as to excite universal admiration, in Italy and in England, wherever she was known. After her marriage with Cosway she became a very distinguished exhibiter at the Royal Academy, and her musical parties, in which she was the chief performer, at her house, formerly Astley's, in Pall-Mall, and afterwards at 20, Stratford Place, Oxford Street, were among the chief attractions of the age. 'The guests were numerous, and of all ranks and callings that had any pretensions to the elegant; the writer of the last new poem; the speaker of the last best speech in the Commons; some rising star, real or imaginary, in art; the man who made the last miraculous escape from shipwreck, or who had walked into the remotest latitude: in short, all the lions of London were there, to see and be seen. Lady Lyttleton, the Honourable Mrs. Damer, the Countess of Aylesbury, Lady Cecilia Johnston, and the Marchioness of Townshend, were her intimate friends. General Paoli, Lord Sandys, Lord Erskine, and the Prince of Wales, were not unfrequent visitors; and when she desired to have something worthy of public notice, the foreign ambassadors were ready to swell the number of those who listened to the music of the charming Mrs. Cosway.'

The house in which these parties were held was furnished in the most costly and gorgeous style imaginable: almost every room was a museum of works of art and unique furniture of the most elaborate workmanship, adorned with natural and artificial curiosities from the four quarters of the globe. In his dress also Cosway was proportionably magnificent, a sort of modern Parrhasius; and all this magnificence and splendour was the fruit of his industry. His wife was equally industrious, and painted many portraits and other works of a poetic and imaginative nature, but Cosway would not allow her to paint portraits professionally. There are several prints after her works by Bartolozzi, V. Green, and others.

Cosway died in 1821, aged eighty, and his widow retired to Lodi, established a ladies' college there, and became widely known and respected. She had spent some years at Lodi previously, during the war, for the benefit of her health, and had acquired a strong attachment for the place.

(Smith, *Nollekens and his Times*; Cunningham, *Lives of the most eminent British Painters*, &c.)

COTES, FRANCIS, R.A., one of the originators of the Royal Academy of Arts in London, was born in London, in 1725, where his father was an apothecary. He was the pupil of George Knapton, and distinguished himself by his portraits in crayons, in which he was unrivalled; he was also a good painter in oil, and, in the opinion of Hogarth, a better portrait-painter than Reynolds: both painters had recourse to the same artist, Toms, for the painting of their draperies. Cotes was in great practice, and lived in the house in Cavendish Square which after his death was occupied by Romney, and is now the residence of Sir M. A. Shee. Walpole mentions a few of his best works, as a full-length of the queen of George III. holding the princess royal on her lap, engraved by W. W. Ryland; Mrs. Child, of Osterly Park; the beautiful daughter of Wilton the sculptor, afterwards the wife of Sir Robert Chambers; his own wife; O'Brien, the comedian; and Polly Jones, a woman of pleasure. Many of his portraits have been engraved by Bartolozzi, Green, MacArdell, and others. He died, in consequence of taking soap-lees for the stone, in 1770, before he had completed his 45th year: the circumstance is noticed by Mary Moser, afterwards Mrs. Lloyd, R.A., in a letter to Fuseli when at Rome.

(Walpole, *Anecdotes of Painting*, &c.; Edwards, *Anecdotes of Painting*, &c.; Smith, *Nollekens and his Times*.)

COTMAN, JOHN SELL, an artist whose masterly etchings of architectural subjects—old buildings and other antiquities, have obtained for him the honourable distinction of the English Piranesi, was born at Norwich, about the year 1780, and educated at the free school of that city, on quitting which he immediately took to his pencil as his future profession. He first practised chiefly in water-colour painting, in which he displayed a vigour and boldness very unusual at that period; but though he did not entirely abandon that branch of art, he afterwards applied himself more particularly to architectural drawing and engraving—and to etch upon copper views made for that purpose by himself. His first publication of the kind was his 'Miscellaneous Etchings of Architectural Antiquities in Yorkshire,' &c., in 28 plates, folio, 1812; immediately succeeded by the 'Architectural Antiquities of Norfolk,' fol., 1812-1817; and he at the same time brought out the 'Sepulchral Brasses in Norfolk,' 84 plates, large 4to., 1813-1816. In 1817 he went to France, where he spent some time in collecting the materials for his next, and the finest of all his works, the 'Architectural Antiquities of Normandy,' which appeared in two volumes folio, 1820, with 100 plates, and descriptive and historical letter-press by Mr. Dawson Turner of Yarmouth, who zealously patronized him during his residence in Norfolk. He afterwards settled entirely in London, and for a few years before his death, which took place some time in 1843, held the appointment of teacher of drawing in King's College, Somerset Place.

COTONEASTER, a genus of plants belonging to the natural order Rosaceæ, and to the tribe Pomeæ. The segments of the calyx 5; the petals 5; the styles 2-5; the fruit turbinate, its nuts adhering to the sides of the calyx, but not cohering at the centre; the stamens erect, as long as the teeth of the calyx. The species are shrubs, with simple entire leaves, woolly beneath. This genus was separated from Mespilus by Lindley. There are several species. Only one is British, *C. vulgaris*. It has roundish ovate leaves, rounded at the base, flower-stalks and margins of the calyx downy. The petals are rose-coloured. It is a native of Europe. It is found in North Wales upon the cliffs at the Great Ormeshead. There are other species natives of the south of Europe and various parts of the East Indies.

All the species are adapted for shrubberies, and many of them are very commonly cultivated in Europe. They are easily propagated by laying down the branches, or by cuttings, which should be placed in a sheltered situation under a hand-glass. They may be also increased by dividing their roots, and by seeds.

(Lindley, *Linnean Transactions*, xiii.)

COTTAGE ARCHITECTURE. The term cottage has for some time past been in vogue as a particular designation for small country residences and detached suburban houses, adapted to a moderate scale of living, yet with all due attention to comfort and refinement. While in this sense of it, the name is divested of all associations with poverty, it is convenient, inasmuch as it frees from all pretension and parade and restraint. For this reason those who possess both town-houses and country mansions, have frequently their 'Cottage' also, as an occasional retreat. With the name, something also has been assumed of a mode of building intended to answer to it—one of homely and rustic character—rejecting architectural rules, yet requiring a studious observance of appropriate expression and picturesque physiognomy. The cottage style is therefore considered by some as a hybrid branch of the art, or as hardly belonging to it at all, it being subject to no other laws than mere fancy and caprice. Gwilt dismisses it very summarily in his 'Encyclopædia,' merely remarking that it is a nondescript sort of building, and a branch of practice requiring a minimum of mind on the part of the architect. Yet it certainly requires much more than the minimum of taste, or of a knowledge of principles, to guide where no positive rules can be laid down. There certainly is very little mind, or taste either, shown in the majority of the publications, and they are not a few, which profess to give designs for picturesque cottages, &c.; a proof that it requires some nicety of tact to succeed in a species of architectural composition which requires, if no great mechanical science, at least a painter's eye for all the happy accidents of light and shade, and contrasts of masses and lines,—matters not to be learnt mechanically, like the proportions of the orders, nor to be learnt at all by formal precepts. Not only a different, but almost an opposite, mode of treatment from that required for what is called 'regular architecture,' and might be termed rhythmical or metrical design, must here be adopted. What would be blemishes and defects in the latter become merits in the other, and *vice versâ*. Overlooking this distinction, and perhaps feeling quite at a loss when released from those conventional trammels which are their support, and the observance of which ensures a certain respectability of design, some architects have signally failed when they have condescended to this apparently very inferior and illegitimate branch of their art. Soane, Gandy, and others, who have published books of designs for the purpose, have chiefly manifested how little feeling they had for picturesque quality, and how very ill they perceived or understood the elements—too complex and subtle for ordinary methodical analysis—which constitute it. It seems to have been thought that whatever deviated from ordinary rule would be picturesque as matter of course; accordingly there is frequently in designs of that stamp something not only disagreeably formal and frigid, but finical also, and a certain pert spruceness which savours far more of townish vulgarity aping rusticity, than of unaffected simplicity. In endeavouring to shun formality, others, again, have run into quite the contrary extreme, have thought they could not carry irregularity too far, and that whatever was odd, fantastical, and whimsical, must be picturesque likewise; whereas a mere jumble of parts without any one idea pervading it, is far from either producing artistic variety or manifesting any imagination.

Where no direct instructions can be laid down, general directions and hints must suffice, especially where the subject can only be glanced at: the mode of treatment must be regulated in some degree by the actual purpose of the buildings: for a bailiff's residence, or gate-keeper's lodge, the genuine cottage character may be adhered to more strictly; study of design being chiefly bestowed on rendering it a picturesque, and so far an ornamental object, though it may not happen to be at all an ornamented one. A cottage within the vicinity of the house, for the purpose of a dairy or something of that sort, will properly admit of being more fanciful in design, and even of avowedly decorative character. In a cottage intended for the proprietor's residence, whether a permanent or merely occasional one, the expression above all to be aimed at is that of homeliness, including comfort, and a look of homeishness as essential to it. To this quality no less than to picturesque effect, irregularity of plan contributes not a little, because it indicates that internal convenience has been chiefly attended to, and that the diversity of shape of the exterior is the result of accident; not, indeed, of mere purposeless chance, but of circumstances. Thus, instead of being affected, the picturesque variety so pleasing in a class of buildings where regularity would be only insipid monotony and dull formality, grows up spontaneously, and is in a great measure suggested by actual convenience, although the degree of it which is prompted in the first instance may be afterwards increased for the sake of artistic effect. On the other hand, the necessity for breaking up external regularity will suggest agreeable combinations of arrangement for the interior, and will provide many spaces for bays, recesses, closets, lobbies, &c., that would never present themselves in a plan intended to secure perfect uniformity of design externally. Irregularity, however, has its limits, neither is it essential that there should invariably be a marked degree of it. In some instances it will be sufficient just to break up the sameness of uniformity by bringing out either a porch or a bay window on one side of the centre; or to divide the composition into two unequal masses, slightly varied in their features.

One condition of a cottage style is moderateness of scale,—that is, rooms of comparatively small dimensions and low proportions, and only a single chamber-floor; or, if another be required, it ought to have its window in gables, or in lucarnes on the roof. Such smallness of scale does not prevent the house itself from being of considerable extent; for it may very properly appear to have spread out to its actual dimensions, by additions having been made from time to time, a process which structures of the kind readily admit of. The mere size thus produced by grouping together small parts, is a very different thing from greatness; and both that and stateliness are quite out of the question for cottage architecture, whereas the villa may, although upon a limited scale, without impropriety, affect stateliness and dignity of character. Though a house of the latter description may not rank as a mansion calculated for the accommodation of a numerous establishment, it may contain spacious and lofty rooms, and everything both within and without may be allowed to announce the splendour of art. The cottage style, on the contrary, utterly rejects the studied pomp of art; and, in his treatment of it, the architect ought to be guided by somewhat the same principles as those which direct the landscape-gardener in the laying out grounds: like the latter, he has a certain type to keep in view, but at the same time is expected to refine upon it; for the fidelity of imitation that would give us the coarse rusticity of a real cottage, would be downright absurdity, and to be in keeping with such a residence, a dunghill in front of it might be substituted for a parterre. So far is uncouthness from being a requisite, that considerable ornateness is allowable, the degree of it being regulated by circumstances, and the character of it being in accordance with the particular architectural style professed to be followed; for various modes of domestic architecture may be employed for buildings coming under the denomination of the cottage class, although the most obvious and natural one is that derived from English houses of the fifteenth and sixteenth centuries, many of which now exhibit a degree of picturesque rudeness that did not originally belong to them, having been converted into farm-houses and smaller tenements. Parts of Elizabethan buildings also afford excellent studies; and both that and the immediately preceding or Tudor style supply strongly marked and characteristic forms and features arising entirely out of construction, such as chimneys carried up externally from the ground, and terminating in clustering shafts, which together with gables in various situations, and frequently of quaint design, serve to give great play of outline, and variety to the whole mass, whether it be seen in shadow against the sky, or relieved by a darker background of foliage behind it. In regard to colour, that of the materials should be preserved: the timber and woodwork ought to be merely stained to take off its rawness, and varnished just enough to bring out its grain, and protect the wood from the weather. At any rate, the painting ought to be of neutral hues, somewhat broken so as to avoid a uniform smooth surface; the mellowing of colour must then be left to sun and weather. In few instances perhaps ought green to be employed externally; green doors, green window-frames, and green verandas, are rarely in accordance with the principles of true taste.

COTTON, CHARLES, was born in 1630, at Beresford Hall in Staffordshire, the seat of his father, which was afterwards his own property and the chief place of his residence. He was educated at Cambridge, and travelled on the Continent, after which he married and lived principally in the country. He died at Westminster, in 1687. His name is best secured against forgetfulness by his friendship for Izaak Walton, and his co-operation in the later editions of the 'Complete Angler.' [WALTON, IZAAK, P. C.] But he was an active translator from the French, of Montaigne's 'Essays,' of historical and other prose works, and of Corneille's tragedy 'Horace;' and he published also various productions in verse, both serious and comic. His most ambitious poem of the former class is 'The Wonders of the Peak;' but neither this nor his other serious poems have kept their ground even in the favour of studious critics, while by all other readers they are completely neglected. He is more generally known as the author of 'Scarronides, or Virgil Travestie,' a burlesque imitation of three books of the Æneid. This work has by some been rated very high: but the value set on it has always been in an inverse ratio to the purity of taste possessed by its judges. Its kind of wit is as low as its tone of moral feeling. His prose imitations of Lucian, and his 'Voyage to Ireland' in verse, are much better specimens of his talents for humour. There are several incomplete collections of his works.

The translation of Montaigne has great merit. Cotton's genuine version was afterwards spoiled, or, as it is expressed in the preface to the edition of 1759, 'it was polished or rather modernized in some pages of our last edition; but in the present one (1759), it is corrected and improved throughout, besides the rectifying of many mistakes, which Mr. Cotton probably would not have been guilty of, if he had been assisted by those dictionaries published since his time, that are the best explainers of the Gascon language, which was Montaigne's mother tongue.' If this second translation has corrected mistakes, it has certainly not improved the style of Cotton's version.

COTYLE'DON, a genus of plants belonging to the natural order Crassulaceæ. It has 5 sepals shorter than the tube of the corolla; the petals cohering in a tubular 5-cleft corolla;

the stamens 10, inserted on the corolla; 5 hypogynous scales; 5 carpels. The species are succulent shrubs, mostly natives of the Cape of Good Hope.

C. Umbilicus, Navel-Wort, has the lower leaves peltate, concave, orbicular; the bracts entire; flowers pendulous. The flowers are of a greenish yellow colour, and the stem is 6-12 inches high. It is found on rocks or walls in the West of England. It is also a native of Portugal.

C. lutea has the lower leaves somewhat peltate, upper leaves crenate or toothed, the bracts toothed, flowers erect. The flowers of a bright yellow. It has been found wild in England, but is probably not a native.

Many of the species of this genus have been separated under the genus Umbilicus, the type of which is the first species named—which is called *U. erectus*. The species of Umbilicus closely resemble those of Cotyledon. In the cultivation of the species of both genera, they should be placed in pots well drained, with a soil of sandy loam or brick rubbish. They may be propagated by cuttings, which should be laid to dry for a few days after they have been cut off, before they are planted, as they are apt to rot at the wound if otherwise treated. The best situation for these plants is the shelves of a greenhouse.

(Don, *Gardener's Dictionary;* Babington, *Manual of British Botany.*)

COUNCIL, OF THE CHURCH, an assembly of prelates who meet, being duly convoked by the legitimate authority, for the purpose of defining questions of doctrine, or making regulations or canons in matters of discipline. There are various sorts of councils: 1st, General or Œcumenic councils, which are considered as a representative and legislative assembly of the whole church, and to which all bishops are summoned. A list of these councils will be given hereafter. In the early ages of the church the general councils were convoked by the Roman emperor; they have been since convoked by the pope, at least for the Western or Roman church. The authority of the general council is considered as binding on the whole church only in matters of faith, when the canon establishes a dogma which it enjoins all the faithful to believe, under pain of anathema and heresy. In matters of faith the Roman church considers the general council to be infallible; some say however only after its canons have been confirmed by the pope. All bishops have a right of attending and voting in the general council; the abbot and generals of monastic orders have also been admitted to vote in most councils by consent of the council. Priests and monks have also attended the councils as theologians and advisers, with a consultative but not a deliberative vote. In the Western church, the pope, or his legate for him, presides in the council. For a council to be legitimate, it is required that all the bishops should be called to it, whether they attend or not, except those who are declared by the church to be schismatic or heretical, and all deliberations should be free and unconstrained.

2nd, National councils, consisting of the bishops of a whole kingdom or state, which can be convoked by the respective sovereigns; but their authority is not considered universal over the whole church.

3rd, Provincial councils are convoked by the respective metropolitans, with the consent of the sovereign. A bishop may also convoke a diocesan council, with the consent of his superior. (Benedict XIV. *De Synodo Diocesana.*)

The Church of Rome reckons several councils, though not œcumenic, previous to that of Nice; the earliest of which seems to be that held at Jerusalem about the year 50 of our æra, and which was attended by the apostles Peter, John, James, Paul, and Barnabas, and which is mentioned in the xvth chapter of the Acts of the Apostles.

SERIES OF GENERAL OR ŒCUMENIC COUNCILS.

NICE, THE COUNCIL OF [P. C.], was convoked by Constantine, A.D. 325, condemned Arius, and framed the Confession of Faith, or Symbol of Nice.

Constantinople, First Council of, convoked by the Emperor Theodosius I., A.D. 382, confirmed the canons of the council of Nice, and established the dogma of the divinity of the Holy Ghost against the attacks of Macedonius. The council consisted of 150 eastern bishops who decided among other questions that the Bishop of Constantinople should take rank next to the Bishop of Rome. The canons of this council were acknowledged by Damasus, bishop of Rome, and the other western prelates.

Ephesus, Council of, convoked by Theodosius II., A.D. 431, consisted of about 200 bishops, and was attended by the legates of Celestinus, bishop of Rome. It condemned Nestorius. [NESTORIANS, P. C.]

Calchedon, Council of, convoked by the Emperor Marcianus, A.D. 451, consisted of 630 bishops, and the legates of Leo I., bishop of Rome. It condemned the spurious council of Ephesus of A.D. 449, which had approved the doctrine of Eutyches and of Dioscorus concerning the two natures in Jesus Christ. [EUTYCHIANS, P. C.]

Constantinople, Second Council of, convoked by Justinian, A.D. 553, condemned the tenets of Origenes, as well as the doctrines known by the name of the 'three chapters.' The canons of this council were first disapproved, and afterwards sanctioned, by Vigilius, bishop of Rome. [ORIGENES, P. C.; VIGILIUS, P. C.]

Constantinople, Third Council of, A.D. 680, convoked by the Emperor Constantine Pogonatus, confirmed the canons of the five previous œcumenical councils, and condemned the tenets of the Monothelites, an offshoot of the Eutychians.

Nice, Second Council of, convoked by the Emperor Constantine, son of Irene, A.D. 787, consisted of above 350 bishops, and was attended by the legates of Pope Adrian I. It condemned the Iconoclasts, and sanctioned the worship of images in the churches. The authority of the above seven councils is acknowledged by the Greek as well as the Latin churches.

Constantinople, Fourth Council of, convoked by the Emperor Basilius, A.D. 869, and attended by the legates of Pope Adrian II., condemned the schism of Photius, and restored Ignatius to the see of Constantinople. [PHOTIUS, P. C.]

Lateran, First Council of, styled the Ninth Œcumenic, was convoked by Pope Callixtus II., in 1123, and consisted only of the Western or Latin bishops; the Greek church having completely separated itself from that of Rome long before. It made several canons of discipline against simony, clerical concubinage, and the alienation of church property: it placed the incumbents of parishes under the superintendence of the respective bishops, and bestowed indulgences on those who took the cross for the defence of Palestine.

Lateran, Second General Council of the, convoked by Innocent II., A.D. 1139, condemned the antipope Anacletus, and his patron Roger Count of Sicily: condemned also the heresies of Peter of Bruis, and of Arnaldo of Brescia, and made several canons of discipline.

Lateran, Third Council of, convoked by Pope Alexander III. in 1179, after his reconciliation with the Emperor Frederic I., made many canons of discipline and morality, and in its last canon, after anathematizing Cathari, Patarini, Albigenses, and those who afforded them protection, it stated that, although the church abhors the shedding of blood, it does not refuse the countenance and support of the temporal laws of Christian princes, because the fear of corporal punishment is sometimes efficacious in producing spiritual reformation. The church therefore allows the faithful to take up arms against the anathematized heretics, Cotteraux, Brabançons, and others, who were carrying desolation everywhere, and places those who will fight them under its own especial protection. These Cotteraux, &c., appear to have been a kind of lawless partizans in the pay of turbulent barons, who were mixed up with the sectarian feuds of the times, especially in France. Jews and Saracens were forbidden by the council to possess Christian slaves.

Lateran, Fourth Council of, convoked in 1213 by Pope Innocent III., met in November, 1215, and was attended by the Patriarchs of Constantinople and of Jerusalem, Constantinople being then in the hands of the Latins, and by above 400 bishops. It was opened by the pope in person. It sanctioned seventy canons, or decrees, which had been framed by the pope, especially on matters of discipline, and its regulations are often quoted by canonists on questions of marriage, benefices, the election of bishops and abbots, &c. It enforced auricular confession, at least once a year, on all the faithful who have reached the age of discretion, forbidding the confessor to reveal any part of the confession, under pain of deposition and confinement for life in a monastery. It enjoined that, to every cathedral or collegiate church, there shall be appointed a teacher of grammar and other arts, for the poor of the laity as well as of the clergy, who shall be taught gratis. In the metropolitan churches there was to be also a professor of theology, to teach and explain to the priests and other churchmen the Holy Scriptures and the care of souls. The council likewise promulgated an exposition or profession of faith, in which the doctrine of transubstantiation was expressly included. The council anathematized all heresies contrary to any part of the said profession;

and decreed that heretics, after being condemned by the church, shall be given over to the secular powers, which are enjoined to drive away from their territories all such heretics; and if the temporal lord neglect to do so, he shall be excommunicated by the bishop; and if, within a year, he does not make his submission, information shall be given to the pope, who will release his vassals from their oath of allegiance, and will give the lands of the refractory feudatory into the hands of an orthodox feudatory, saving the rights of the superior or paramount lord, provided the latter makes no obstacle to the execution of this ordinance. The Gallican theologians however reject this canon, as an abuse of power on the part of the council, or rather of the pope who had framed the canon.

(Richard, *Analyse des Conciles; Concile Quatrième de Latran*.)

Lyon, First Council of, convoked A.D. 1245 by Pope Innocent IV. for the extirpation of heresy and schism, for the affording of assistance to the Christians of Palestine, and also to judge of the charges against the Emperor Frederic II., whose councillor, Thaddeus of Suessa, undertook to defend his master. After listening to his defence, the council excommunicated Frederic, and then the pope, in presence of the council, pronounced sentence of deposition against that emperor. It was not the council that assumed to depose Frederic; nor did Innocent IV., as Bossuet remarks, support his sentence by alleging the sanction of the council to it, as he alleged in other decrees which he issued in the same council; the pope merely says that he pronounced the sentence of deposition in the presence of the holy council assembled. The council also ordered a new crusade for the recovery of the Holy Land, and made provision for the funds required for the purpose.

Lyon, Second Council of, convoked in 1274 by Pope Gregory X. for the object of reforming discipline and the morals of the clergy, for the reunion of the Greek church, and for the assistance of the Christians of Palestine. The assembly was very numerous, consisting of more than 500 bishops and 1000 inferior dignitaries of the church, besides the ambassadors of many princes, especially of Michael Comnenus, Emperor of Constantinople, who wrote to profess his adherence to the orthodox Roman Catholic faith, and to acknowledge the primacy of the see of Rome. Thirty-eight Greek prelates sent in likewise their act of adhesion.

The council made several excellent regulations concerning the election of bishops, and the appointment of parish incumbents, and the administration of church property.

Vienne (in Dauphiny), *Council of*, convoked by Pope Clement V. in 1311, condemned the order of the Templars, and the pope suppressed the order and confiscated their property. [TEMPLARS, P. C.] It likewise condemned the so-called Beggars, Fratricelli and other heretics, and made several regulations of discipline concerning monasteries and hospitals. It also promulgated a profession of faith concerning the human nature of Jesus Christ, according to the testimony of St. John.

CONSTANCE, COUNCIL OF [P. C.], assembled in 1414, condemned Huss and his disciples, deposed Pope John XXIII. and two antipopes, and elected Martin V., who dissolved the Council in 1418.

The next general council is that of *Basle*, which, on account of its importance in the history of the church, deserves more particular notice. The council of Basle was convoked by Pope Martin V. in 1430, in conformity to a decree of the council of Constance, session 39, which had provided that a new general council should assemble within five years. Pope Martin appointed Cardinal Julian Cesarini, his legate in Germany, to preside over the council. Soon after Martin died (February, 1431), and his successor, Eugenius IV., confirmed Cesarini as president of the council. The first session, or meeting, took place in December, 1431, when Cardinal Julian opened the council by an eloquent speech, in which he exhibited the evils of the church resulting chiefly from the relaxation of its discipline; and, having exhorted the fathers and the clergy in general to give the example of regularity and piety to their flocks, he stated the two great objects of the present council to be, one, the reunion of the Eastern and Western churches, and the other, an effectual reform of the church in general in all its members. The council then appointed its various deputations, or committees, to examine at length the matters laid before each of them and make their reports thereon, which were to be taken into consideration by the whole council assembled in session, and there put to the votes.

The second session of the council took place in February, 1432. In the interval between the first and second sessions it became known at Basle that Pope Eugenius intended to dissolve the council as likely to prove troublesome to him if allowed to sit much longer, and that he had actually framed the bull for its dissolution. In consequence of this, the council issued a decree declaring that it held its power immediately from Jesus Christ, the Head of the Church; and that every person, even the pope, was bound to obey its decisions in matters of faith, as well as for the extirpation of schism, and likewise for the reformation of the church. Meantime the pope had issued his bull of dissolution. Cardinal Julian then wrote two forcible letters to Eugenius, maintaining the rights of the council, and asserting that according to the canons of the council of Constance, by which he himself, Eugenius, held the papal dignity, as successor to Martin V., who had been elected by that council after it had deposed Pope John XXIII. and the other claimants to the papal crown, the pope had no power of dissolving a general council once lawfully convoked and assembled, until that council had performed the task for which it had been convoked. The fathers sent likewise a synodal answer, of the same meaning, to the papal bull, in which they asserted that the pope, although the ministerial head of the church, was not exalted above the whole mystical body of the church, as that mystical body, even exclusively of the pope, cannot err in matters of faith, being under the inspiration of the Holy Ghost; whilst the pope, although the head of the church, might err, as experience showed. The body of the church represented in the general council had deposed popes who had erred in matters of faith, but no pope had ever assumed to condemn or excommunicate the whole body of the church.

In the third session, April, 1432, the council summoned Eugenius to revoke the bull of dissolution; and to attend the council in person in three months' time, or to send persons with full powers to represent him.

In the fourth session, June, same year, a sauf conduit was given to the Bohemian deputies who proposed to appear before the council to arrange matters for the religious peace of their country. Pope Eugenius being reported ill at the time, the council decreed that in case of his death, the council should not proceed to the election of his successor any where else but in the body of the council. Any other election was declared beforehand to be null and void.

In the fifth session, in August of the same year, three judges were appointed to examine questions of faith. The Bishop of Taranto, sent by Eugenius as his legatee, delivered a high flown speech, exalting the papal authority as the only fit judge of the place and time for the holding of councils, and he stated that as the pope could not then leave Italy, he offered to remove the assembly to any town in the Papal states which the fathers might fix upon. The council replied that to dissolve or remove a council lawfully assembled would be to renew schism in the church, and would be contrary to charity and the inspiration of the Holy Ghost.

In the sixth session, September, the council decreed that as Pope Eugenius did not make his appearance, he should be declared 'contumax' after being cited three times at the gate of the church.

In the 7th session, November, the decree of the fourth session was confirmed, forbidding the cardinals to hold a conclave, in case of the pope's demise, without permission from the council.

In the eighth session, December, a further delay of two months was granted to Eugenius to revoke his bull of dissolution, after which the council would proceed canonically against him. It was also decreed that any other council convoked elsewhere, would be a cabal and a schism, as there could not be more than one general council assembled at a time. The Bohemian deputies arrived at Basle in January, 1433. They laid before the council the demands of their constituents, namely the sacrament 'sub utraque' for the laity; that the clergy should have no power over temporal things, and that the word of God should be preached fairly and freely. The council upon this appointed deputies to repair to Bohemia to confer upon these matters on the spot.

In the ninth session, January, 1433, the Emperor Sigismund having by letters patent taken the council and all its members under his especial protection, the council on its part declared that it would protect Sigismund from any arbitrary act of the pope against him.

Tenth session, February, 1433. The council was proceeding to declare Eugenius 'contumax,' but the emperor and

Cardinal Julian interposed, and offered to write to the pope, upon which the council adjourned its proceedings.

Eleventh session, April same year, it was decreed that if the pope henceforth neglected to assemble a general council every ten years, as ordained in the ninth session of the council of Constance, the right of convocation should devolve upon the bishops without the pope's permission. The fathers likewise confirmed the decree of the council of Constance, by which a general council, once assembled, could not be adjourned, transferred or prorogued by the pope without the consent of two-thirds of the members. Meantime Eugenius had sent two legates to the council, with full powers; but the council would not admit them, as the pope had not revoked his bull of dissolution.

Twelfth session, July. The council summoned Pope Eugenius to revoke within two months' time his declaration of transferring the council to another place. It also passed several regulations of discipline, against simony, &c. Eugenius on his part abrogated by a bull the decrees of the council against himself, and declared the council to have been in error when it asserted its superiority above the pope.

Thirteenth session, September. At the request of the Duke of Bavaria another month was allowed to Eugenius before the fathers passed judgment upon him.

Fourteenth session, November. The Emperor Sigismund was present at the council. Three months were granted to Eugenius to revoke all his acts against the council.

Fifteenth session. Eugenius, having at length listened to the mediation of France, Burgundy, and other powers, revoked the bulls which he had launched against the council, and issued another bull according to the form sent to him by that assembly, in which he declared that although he had dissolved the council of Basle lawfully assembled, yet, in order to avoid dissension, he now declared that the council had been lawfully continued since its first beginning, and that he approved of all its decisions, and declared the bull of dissolution to be null and void. He then appointed four cardinals to preside in the council together with Cardinal Julian.

Sixteenth session, February, 1434. The letters of Eugenius were read in full council and presence of the Emperor Sigismund. The papal legates were introduced and incorporated with the council.

Seventeenth session, April. The legates were made to swear to support the dignity of the council, and to observe its decrees as well as those of the Council of Constance, and that their authority should be dependent on that of the council and not coactive with or compulsory upon the Council.

Eighteenth session, June. The council confirmed the decrees of the fourth and fifth sessions of the Council of Constance. John, Patriarch of Antioch, read a thesis in favour of the superiority of the general council above the pope.

Nineteenth session, September. Conferences with the ambassadors of John Palæologus, emperor of Constantinople, concerning the projected union of the Eastern and Western churches. Legates appointed by the council to proceed to Constantinople. The council decreed that in every university there shall be professors of Hebrew, Arabic, Greek, and Chaldæan.

Twentieth session, January, 1435. Decrees of reform of church discipline, penalties against concubinarian priests, &c.

Twenty-first session, June. Decree against the 'annates,' or first fruits, and other payments and fees exacted by the court of Rome. Three years of undisturbed possession of a benefice, obtained by legitimate title, to be considered as affording a prescriptive title to the possessor. Several decrees on public worship and other matters. Pope Eugenius remonstrated strongly against the suppression of the 'annates,' urging that the council ought at least to make compensation for the support of the Holy See. Cardinal Julian's reply to the pope's remonstrances.

Twenty-second session, October. Condemnation of a book written by an Austin friar, who had ascribed some attributes to the human nature of Christ which properly belong to his divine nature.

Twenty-third session, March, 1436. Decrees concerning the free election of the pope, his profession of faith, the number of cardinals reduced to twenty-four, &c. All reserved benefices, mandates, and other grants applied by the popes to their own profit, declared null and void.

Twenty-fourth session, April. The legates of Eugenius urged the fathers to fix upon a town where to assemble a new council, in order to meet the Eastern emperor and his retinue and prelates, for the purpose of effecting the reconciliation of the two churches. A congregation was held in consequence, which was attended by 357 prelates, two-thirds of whom voted for the city of Basle, if the Greeks should agree to it, and if not, they proposed Avignon or some town of Savoy. A deputation was sent to Eugenius to entreat him to crown the labours of the present council by the reunion of the Eastern with the Western churches, and inviting him to come in person and expedite the necessary bulls. Eugenius however, supported by a minority in the council, was for holding a new council in some town of Italy, and many months elapsed in fruitless negotiations upon this subject.

Twenty-fifth session, May, 1437. The council decreed that the œcumenic council for the union of the two churches should sit either at Basle or at Avignon. Most of the fathers did not wish to go to Italy, where they would have been too much in the power of the pope. A division then occurred in the assembly. A minority joined the Papal legates, and made a decree by which they assumed the authority and name of a council, and transferred the council to Ferrara. Eugenius hastened to issue a bull which confirmed this decision, and immediately caused a squadron of galleys to be equipped at Venice, to proceed to Constantinople with three Papal legates, for the purpose of bringing the emperor and the Eastern prelates to Ferrara. The council of Basle, that is to say the majority of that assembly, which had kept together, sent likewise galleys for a similar purpose, but they were too late, and the emperor repaired to Venice with the Papal legates on board the Venetian galleys. Cardinal Julian, who was still at Basle, proposed to the council to send a deputation to Venice to receive the emperor on his landing, and, by explaining to him how matters stood, to endeavour to bring him to Basle. The fathers however hesitated and lost time. Up to this period the council of Basle is considered by most Catholic theologians to have been truly œcumenic and legitimate, as Pope Eugenius had solemnly acknowledged it as such since November, 1433, and had since acted in union with it by means of his legates. Some ultramontane divines however, and Holstenius among the rest, controvert the authority of the council altogether. Pope Nicholas V. however, who succeeded Eugenius, in his bull beginning 'Ut pacis,' dated Spoleto, July, 1449, speaks of the council of Basle with respect as a council, and not as a conciliabulum, and Eugenius himself in his letters to his legates in Germany, dated Rome, August, 1446, inserted in the Annals of Raynaldus, speaks of the general councils of Constance and Basle, as being by him acknowledged and venerated, without prejudice however to the right and preeminence of the Holy See.

The council of Basle, in its Twenty-sixth session, July, 1437, again summoned Eugenius to appear before it, and Eugenius answered by a bull for the dissolution of the council, appointing the meeting of a new council, to which he invited all Christian prelates, and forbidding under heavy canonical penalties the making of any more synodal acts at Basle, after the period of thirty days which were to be employed in winding up the negotiations with the Bohemian deputies. King Charles VII. of France forbade his bishops to repair to Ferrara.

In their 27th session, September, the fathers at Basle declared null and void the creation of two cardinals recently made by Eugenius.

In the 28th session, October, the period assigned to Eugenius for his appearance being expired, the fathers declared him 'contumax' and resolved to proceed canonically against him. Eugenius at the same time issued a bull, transferring the Council to Ferrara. In his letters to his legates in Germany he speaks of the Council of Basle as a legitimate assembly until the order for transferring it to Ferrara.

In the 29th session, October, the fathers rejected the bull of transfer to Ferrara, and assigned their reasons for it.

In January, 1438, one Cardinal Nicholas, Eugenius's legate, opened the new Council at Ferrara. Cardinal Julian, who still remained at Basle, quitted that town with four other prelates, and joined the Council of Ferrara. The Council of Basle was declared henceforth null, and all its future acts were declared void. Several theologians date from this epoch the termination of the legality of the Council of Basle. That assembly however went on holding its sessions for five years longer, and a schism in the church was the result. The Council of Basle deposed Eugenius in 1439, and elected Amadeus VIII. of Savoy, by the name of Felix V. These measures however were discountenanced by the great majority of the Catholic world; France, England, and Germany disapproved of them. Most of the bishops withdrew from Basle, and their places were filled up by archdeacons, friars, provosts, and doctors, and other churchmen not of episcopal rank. From that period it is impossible to consider the Council of Basle any longer as œcumenic. The last session of this self-styled Council of Basle was held in May, 1443, when it decreed that within three years a council, or rather a continuation of the council, should be held at Lyon. It however met ultimately at Lausanne, in 1449, when Felix having abdicated, the remaining fathers of the Council of Basle made their peace with Nicholas V.

In the collection of the Acts of General Councils, handsomely published in Greek and Latin, by order of Pope Paul V., 'Conciliorum generalium Ecclesiæ Catholicæ,' 4 vols. folio, Rome, 1628, the Council of Basle is altogether omitted, but that of Constance is inserted. The following writers have treated especially of the Council of Basle:—Æneas Sylvius Piccolomini (afterwards Pope Pius V.), who was for a time secretary to the council, in his 'Opera,' which also contain the two celebrated epistles of Cardinal Julian to Pope Eugenius, maintaining the paramount authority of the council; le Père Alexandre, a Dominican, 'Dissertationes de Conciliis Senensi et Basiliensi,' in the eighth volume of his 'Historia Ecclesiastica,' Paris, 1714, and Venice, 1749; Richer, 'Responsio Synodalis data Basiliæ, Oratoribus D. Eugenii P. P. IV., in Congregatione Generali III., Non. Septemb., 1432: De Auctoritate cujuslibet Concilii generalis supra Papam et quoslibet Fideles, pars præcipua, et in eam Commentarius,' Coloniæ, 1613; Lenfant, 'Histoire de la Guerre des Hussites et du Concile de Basle,' which refers chiefly to the transactions of the Bohemian schismatics and their negotiations with the Council of Basle, on particular points of rite and discipline; Richard, 'Analyse des Conciles.'

Ferrara, Council of, was attended by Pope Eugenius, the Emperor John Manuel Palæologus, the Patriarch of Constantinople, Mark, archbishop of Ephesus, and about twenty more Eastern bishops. The discussions between them and the Latin prelates turned first upon the dogma of the proceeding of the Holy Ghost and the word 'filioque' said to have been added by the Latins.

In 1439 the council was transferred to Florence, and the discussions were continued. The two parties effected a reconciliation, excepting Mark of Ephesus, upon the dogma of the Holy Ghost, that of purgatory, and the supremacy of the pope, which the Greeks acknowledged, 'saving the privileges and rights of the patriarchs of the East.' The act of union was signed by the vicars of the patriarchs of Alexandria, Antioch, and Jerusalem, and by several metropolitans, but it was soon after disavowed by the great body of the Eastern church. [Greek Church, P. C.] The Eastern prelates, about thirty in number, left Florence in August, 1439, to return to their country. After their departure, Pope Eugenius continued the council, although it could no longer be called general, the reunited Eastern church being no longer represented in it. The fathers of Basle, who had deposed Eugenius, were declared heretical, as well as Felix V., who was declared to be a schismatic antipope. After several other decrees the Council of Florence was closed in April, 1442. The French and other divines do not recognise the authority of the Council of Florence, which however is fully acknowledged at Rome. The same may be said of the following:—

Lateran, the Fifth Council of, was convoked by Pope Julius II., in 1512, to oppose the acts of the pretended Council of Pisa, when a certain number of prelates hostile to Julius had assembled under the influence of the king of France, then at variance with the pope. After declaring all the acts of Pisa null and void, and summoning the French prelates to appear at Rome, Pope Julius died in February, 1513, but his successor, Leo X., continued the council, and Louis XII., giving up the 'Conciliabulum' of Pisa, sent in his adhesion to the Council of the Lateran. The French prelates however did not attend, under various excuses. The council continued assembled till March, 1517. It chiefly concerned itself with matters of discipline. Among others, it established a general ecclesiastical censorship on all printed books, under pain of excommunication. [Censorship of the Press, P. C. S.] It confirmed the concordat made at Bologna between Pope Leo and Francis I., concerning the sees and benefices of France, and annulled the previous pragmatic sanction promulgated by King Charles VII., conformably to the decrees of the councils of Constance and Basle. The concordat took away from the chapters the right of electing to vacant sees, and gave the nomination to the king, subject to the papal sanction and ordination.

Trent, the Council of, is the last œcumenic council of the Latin church, and is acknowledged as such by the Roman Catholic world, although some of its decrees in matters of discipline are not sanctioned by the laws of many states [Trent, Council of, P. C.]

The principal collections of the acts of the councils are: Labbé and Cossart, 'Sacrorum Conciliorum nova et amplissima Collectio,' with additions by Coleti and Mansi, 31 vols. fol., Florence and Venice, 1759-98; 'Concilia generalia Ecclesiæ Catholicæ Pauli V. Pont. Max. auctoritate edita, 4 vols. fol., Rome 1628; 'Concilia Generalia,' edita a T. Merlino, 2 vols. fol., Cologne, 1530; 'Concilia Omnia, tam generalia quam particularia,' a Petro Crabbe, 2 vols. fol., Cologne, 1538-40; 'Collectio Regia maxima Conciliorum, seu Acta Conciliorum et Epistolæ Decretales, ac Constitutiones Summorum Pontificum ab anno Christi 34 ad 1714, studio Joh. Harduini Soc. Jesu; cum novis indicibus,' 12 vols. fol., Paris, 1714-15.

There are also collections of national councils:—'Collectio Conciliorum Hispaniæ, diligentia Garsiæ Loaisa elaborata,' fol., Madrid, 1593; 'Concilia Magnæ Britanniæ et Hiberniæ a Synodo Verolamiensi, A.D. 446 ad Londinense A.D. 1717, a D. Wilkins collecta,' 4 vols. fol., 1737; 'Sacra Concilia Ecclesiæ Romano—Catholicæ in Regno Hungariæ celebrata, ab anno 1016 ad 1734,' fol., Vienna, 1742; 'Concilia antiqua Galliæ, cum Epistolis Pontificum, Principum Constitutionibus, et aliis Gallicanæ rei Ecclesiasticæ monimentis, Opera et Studio T. Sirmondi,' 3 vols. fol., Paris, 1629; 'Collectio maxima Conciliorum omnium Hispaniæ et novi Orbis, cura et studio Jos. Saenz de Aguirre, editio altera novis additionibus aucta a Jos. Catalano, cum indicibus,' 6 vols. fol., Rome, 1753; 'Conciles de Toulouse, Béziers, et Narbonne, ensemble les ordonnances du Comte Raimond contre les Albigeois, par Arnaud Sorbin, D.D.,' 8vo., Paris, 1569; 'Atti dell' assemblea degli Arcivescovi e Vescovi della Toscana tenuta in Firenze, l'anno 1787,' 4to., Firenze, 1787; 'Atti e decreti del Concilio Diocesano di Pistoja dell' anno 1786,' 4to. Firenze, 1788; 'Salmon, Traité de l'etude des Conciles et de leurs Collections,' Paris, 1724.

Some of the old Spanish councils are very important, such as the Council of Iliberis, A.D. 303, which concerned itself chiefly with the morals of the faithful, exposed as they were to the bad example of their heathen countrymen. Its canons, to the number of eighty, have come down to us, which is not the case with most of the previous councils. Several of the councils of Toledo are also very important for the elucidation of church history and controversy, especially on questions of discipline.

The Greek or Eastern Church, since its separation from Rome, has held its own general councils or synods under the presidency of the œcumenic patriarchs of Constantinople. [Greek Church, P. C.; Russian Church, P. C.]

The Protestant and Reformed Churches have also held their councils or synods, such as Dort, Synod of, P. C. The Synod of Embden, in 1571, and that of Sandomir, for the Protestant churches of Poland; the synods of the Scottish church, and the convocations of the church of England, are also a sort of national councils; but the Protestants in general do not admit the divine inspiration and consequent infallibility of the councils, whether general or national, though they acknowledge the doctrines propounded by the first two œcumenic councils of Nice and Constantinople.

COUNT. [Declaration, P. C.; Pleading, P. C.]

COUNTERPART. [Deed, P. C.]

COUNTERPOISE is, generally, a mass of brass or iron so disposed as to keep a part of some instrument or machine in equilibrio.

The instruments employed in practical astronomy are generally mounted so that their centres of gravity are supported, in which case they require no counterpoise: but a reflecting circle, for example, when placed in any position except one which is horizontal, has its centre of gravity on one side of the pillar which supports it; and a mass of brass, so connected with the axis of the circle as to be always on the side of the pillar which is opposite the latter, serves the purpose of keeping the instrument steady.

A transit instrument, or a mural circle of considerable magnitude and weight, whose pivots would press heavily on their supports, is sometimes provided with counterpoises, one for each point which is to be relieved: this is applied at one end of a lever which is supported by the pillar or stand of the instrument, the other end being connected, near the pivot, with the axle; and thus the pressure is diminished or wholly removed.

A bridge which is capable of being turned on horizontal joints at one of its extremities [Drawbridge, P. C.] usually has its weight relieved, or almost wholly removed, by a counterpoise, so that the machinery employed to raise it has little except the resistance arising from friction to overcome. The counterpoise is at one extremity of a chain, which passes over a pulley at the top of a pillar, and is attached at the other extremity to some part of the bridge.

Now, since a drawbridge, in being raised or lowered, exerts on the suspending chains a strain which increases as the bridge declines more from a vertical position, it is necessary, in order that this strain may be always in equilibrio with the constant weight serving as a counterpoise, that the latter should move on a surface whose figure is determined consistently with that condition. The rules for the resolution of forces give expressions for the strains to which the two parts of the chain are subject in the directions of their lengths; and, making these equal to one another, there is obtained an equation which may be shown to be that of an epitrochoid: such, consequently, is the figure which should be given to the surface on which the counterpoise is to slide. It should be observed that, in the investigation, the effective weight of the drawbridge is not its absolute weight (acting at the centre of gravity); but is equal to this latter weight diminished in the inverse ratio of the distances of the fulcrum, or joint, from the centre of gravity and from the point at which the chain is attached to the bridge, generally the opposite extremity of the latter.

If the pulley over which the chain passes is close to the elevated extremity of the bridge when the latter is in a vertical position, the length of the chain will, of course, be equal to the diagonal of a square of which the length of the bridge is one side: then, a circle whose centre corresponds to the joint of the drawbridge, and whose radius is the whole length of the chain, being supposed to revolve on the circumference of a fixed circle of equal radius; a point supposed to be on the produced radius of the revolving circle, or epicycle, at a distance from its centre equal to the difference between twice the length of the radius, or chain, and the length of the bridge will, by revolving with the epicycle, describe the required curve.

The great telescope recently executed by Lord Rosse, at Parsonstown, Ireland, turns upon a joint at its lower extremity; and, being intended to decline from a vertical position both towards the north and the south, it is provided with two counterpoises, in order to facilitate its elevation or depression. One of these weights is on a chain which is attached, at one extremity, to a point near the object end of the telescope, and, at the other, to a fixed point at the top of the wall; this point being so situated that, in elevating the telescope, the weight descends, and describes, by its gravity, a circular arc coinciding nearly with the proper epitrochoid. The other weight is at the end of a lever projecting horizontally, from the lower extremity of the telescope, when the latter is in a vertical position; and then, consequently, it acts with the greatest power: its action diminishes, by the lever being elevated or depressed, as the telescope declines from the vertical towards the north or south.

COUNTY COURT. [Courts, P. C.]

COUNTY RATE. County rates are taxes levied for the purpose of defraying the expenses to which counties are liable. They are levied either under the authority of acts of parliament, or on the principle that as duties are imposed upon a county there must be a power to raise the money for the costs incurred in the performance of such duties.

The antient purposes of the county rate 'were to provide for the maintenance of the county courts, for the expenses incidental to the county police, and the civil and military government of the county; for the payment of common judicial fines; for the maintenance of places of defence (sometimes however provided by a separate tax common to counties and to other districts, called *burgbote*), prisons, gaols, bridges (when these were not provided for by a separate tax common to counties and to other districts, called *brukbote*), and occasionally high roads, rivers, and watercourses, and for the payment of the wages of the knights of the shire. Additions to these purposes, some occasional and some permanent, were made from time to time by statutes. The king's aids, taxes, and subsidies were usually first imposed on the county, and collected as if they had been county taxes. But the first statute defining any of its present purposes (though now repealed as to the mode it prescribes for imposing the tax) was passed in the 22nd Hen. VIII. From that time up to the present new purposes have constantly been added, and new and distinct rates were constantly created for purposes of comparatively little importance, and to raise sums of money quite insignificant in amount.' (*Report on Local Taxation*, by the Poor Law Commissioners.)

The assessment and collection of separate county rates was not only very inconvenient and troublesome, but so expensive that the charge of collection and assessment frequently exceeded the sum rated. For remedying this evil the 12 Geo. II. c. 29, was passed, whereby justices of the peace at general or quarter sessions were enabled to make a general rate to answer the purpose of the distinct rates previously leviable under various acts of parliament for the purposes of bridges, gaols, prisons, and houses of correction, such rate to be assessed upon every town, parish, and place within the county, to be collected by the churchwardens and overseers, along with the poor rates of every parish, and paid over to the high constables of hundreds, by them to treasurers appointed by the justices, and again by them to whomsoever the justices should direct. The county rate for lunatic asylums is however, by statute, a special rate, and so is likewise the county rate for shire-halls, assize-courts, session-houses, judges' lodgings, &c.; but the provisions of the statutes under which these rates are levied are disregarded, and the justices pay the expenses out of the general county rate. This is the case also with the rate for the county and district police force, where such force is established, though it is directed to be a special rate. There are some other special rates which are required to be separate rates, one of which is the rate for reimbursing to overseers the costs incurred in the burial of dead human bodies found on the shore of the sea. The contributions of a whole parish to this rate would perhaps not amount to a farthing, and the expense is of course defrayed out of the general county rate.

In places where there is no poor's rate the county rate was directed by 12 Geo. II. c. 29. to be levied by the petty constable or other peace officer of the place in the same manner as poor rates are levied, and paid over by him to the high constable of the hundred. The counties of York, Derby, Durham, Lancaster, Chester, Westmoreland, Cumberland, and Northumberland, were excepted from the compulsory direction that the county rate should be levied along with the poor's rate, and it was left discretionary with the justices of those counties at quarter-sessions to direct the county rate to be levied either by the churchwardens and overseers along with the poor rate, or by the petty constable by an assessment after the manner of the poor rate. The rates so levied are applicable to the repair of bridges, gaols, prisons, or houses of correction, on presentment made by the grand jury at the assizes or quarter-sessions of their wanting reparation. The act gave to the churchwardens and overseers a right of appeal against the rate on any particular parish to the justices at the next sessions. It also contained provisions enabling the justices to contract for repairs, to oblige collectors to account, &c. It was not the object of this act to impose any new rates, nor to vary the obligation to pay, but merely to facilitate the collection of the amounts previously leviable: it therefore contained an exception of places not theretofore liable to the payment of all or any of the county rates referred to in the act, and also a provision that the rate should be assessed in every parish or place in such proportions as any of the rates by the former acts therein referred to had been usually assessed. But this last provision is now to be interpreted with reference to the next-mentioned act as applying only to the fair and equal proportionable rates.

By the 55 Geo. III. c. 51, further improvements were made in the assessments to county rates. The justices of counties at quarter-sessions were by it empowered to make a fair and equal county rate when circumstances required, for all the purposes to which the county stock or rate was then or should thereafter be made liable by law, extending to all parts of the county except liberties or franchises having a separate coextensive jurisdiction. The act contained numerous provisions giving powers for enforcing payment of the rate; for ascertaining the value of property for the purpose of assessment; for regulating the right of appeal given by the former act; extending the provisions of the former act to that act; enabling counties where the rates had been regulated by local acts to make use of that act; extending the provisions of the act to places having commissions of the peace within themselves, &c.

By the 56 Geo. III. c. 49, extra parochial and other places, though not rateable to the relief of the poor, were made subject to county rates, and certain powers were given for the ascertainment of boundaries between counties, ridings, &c.,

and other places of separate jurisdiction, for the purpose of assessing and levying county rates.

By the 57 Geo. III. c. 94, the provisions contained in the 56 Geo. III. c. 49, as to appeals, were repealed, and other regulations established in that respect; and it was provided that where there were no high constables, the constables of the parish or place might levy the rates on the warrant of the justices.

By 58 Geo. III. c. 70, all such parts of former statutes as provided that rewards should be paid out of the public revenue to prosecutors upon conviction for various crimes, were repealed, and it was enacted that in future the county rates were to be charged with the allowances to prosecutors in such prosecutions. By subsequent statutes the costs in the prosecution of certain misdemeanours are paid out of the county rates. By 7 Geo. IV. c. 64, the principle of compensation to witnesses and prosecutors at the expense of the county was carried into effect more extensively. In 1836 however the government determined that one-half of the expense of prosecutions and the conveyance of prisoners should be defrayed out of the public revenue.

By the 1 Geo. IV. c. 85, the powers of former acts were extended to places where there were no separate churchwardens, and where no separate or distinct poor-rate has been made for any place extending into two or more counties, ridings, or other divisions; justices were empowered to appoint persons to tax and assess the county rate in extra-parochial places where no poor-rate exists, and certain regulations were made as to distress for rates.

By the 4 & 5 Wm. IV. c. 48, all business relating to the assessment and application of county rate is to be transacted in open court held upon due notice.

By the 5 & 6 Wm. IV. c. 76, § 112, after a grant of a separate court of quarter-sessions has been made to any borough, the justices of the county in which such borough is situate are not to assess any property therein to any county rate thereafter to be made, but (§ 113) such boroughs are to bear the expenses of prosecutions at the assizes.

By 7 & 8 Vict. c. 33, high constables are relieved from the duty of collecting the county rate and paying it to the county treasurer, and these functions are to be undertaken by the Boards of Guardians.

Several local acts have been passed from time to time for regulating the county rates in particular counties. On this subject see Burn's 'Justice of Peace,' 29th edit., *County Rate*, where the different purposes for which county rates may be levied are enumerated at length.

The expenditure of county rates in England and Wales in 1792 and 1832 was as follows:—

	1792. £.	1832. £.	Inc. per Cent.
Bridges	42,237	74,501	76
Gaols, Houses of Correction, &c.	92,319	177,245	92
Prisoners' Maintenance, &c. .	45,785	127,297	178
Vagrants	16,807	28,723	70
Prosecutions . . .	34,218	157,119	359
Lieutenancy and Militia . .	16,976	2,116	
Constables	659	26,688	4338
Professional	8,990	31,103	248
Coroners	8,153	15,254	87
Salaries	16,315	51,401	215
Incidental	17,456	32,931	88
Miscellaneous, Printing, &c. .	15,890	59,061	
	315,805	783,441	

The amount disbursed in 1834 under the different heads of expenditure for which provision is made by the county rates was as follows:—

	£.
Bridges, Building and Repairs, &c. . .	72,532
Gaols, Houses of Correction, &c., and Maintaining Prisoners, &c.	222,787
Shire-Halls and Courts of Justice, Building, Repairing, &c.	13,951
Lunatic Asylums	12,371
Prosecutions	131,416
Clerks of the Peace	31,880
Conveyance of Prisoners before Trial . .	31,030
Conveyance of Transports	10,370
Vagrants, Apprehending and Conveying . .	7,621
Constables, High and Special . . .	14,007
Coroners	15,648
Debt, Payment of Principal and Interest . .	78,022
Miscellaneous	52,112
	693,747

The expenditure in the following years was as under:—

	£.		£.
1835 .	705,711	1840 .	855,552
1836 .	699,845	1841 .	1,026,035
1837 .	604,203	1842 .	1,230,718
1838 .	681,842	1843 .	1,295,615
1839 .	741,407		

In the last three years the county police expenditure, which in 1843 amounted to 243,738*l.*, is included.

From 1830 to 1838 the proportion of five heads of expenditure was 69 per cent. of the total expenditure:—Bridges, 9·3 per cent.; Gaols, 9·7; Prisoners' Maintenance, 25·8; Prosecutions, 19·9; Constables and Vagrants, 4·3 per cent.

The county rate is levied on the same description of property as the poor's rate, that is, on lands, houses, tithes impropriate, propriations of tithes, coal-mines, and saleable underwoods: the term 'lands' includes improvements of lands, by roads, bridges, docks, canals, and other works and erections not included under the term 'houses.' Under 'houses' are comprehended all permanent erections for the shelter of man, beast, or property. Mines, other than coal-mines, are exempted, and the exemption extends to limestone and other stone quarries, or to other matter that is obtained by quarrying. The county rate is to be assessed upon parishes 'rateably and equally according to the full and fair annual value of the messuages, lands, tenements, and hereditaments, liable, or which might be liable, to be rated to the relief of the poor.' The sum assessed in 1833 was about 8¾ per cent. (or rather more than one-twelfth) of the levy for the poor, out of which fund it is paid, and in 1843 the proportion was between one-sixth and one-seventh. About five-eighths of the assessment is paid by land, and three-eighths by houses, mills, manors, canals, &c.

The act 55 Geo. III. c. 51, already mentioned, has not been found very successful in correcting unfair valuations, as the overseers on whom the re-valuation depends have an interest as owners or occupiers in a low rateable value. 'In some counties the contribution to the Land Tax serves as a scale for the proportionate contribution. In these cases the proportion has been unchanged since the year 1792, notwithstanding the subsequent alterations in the value of property In other counties the valuation to the Property Tax made in the years 1814-1815 determines the scale of contribution. In other counties some ancient scale, of which the origin is unknown to the respective clerks of the peace, determines the proportion. In other counties the nominal valuation to poor's rate, uncorrected by the application of the powers of 55 Geo. III. c. 51, and made in some counties in or very early after the year 1739, and in other counties at various periods between that date and the present time, serves as the basis of the contribution to the county rate. All these various practices are alike complained of as unequal in the counties in which they are adopted.' (*Report on Local Taxation.*) In the session of 1845 a bill was brought in to amend the law relating to the assessing, levying, and collecting of county rates. It proposed that the justices at general or quarter sessions should appoint a committee to consist of not more than eleven nor less than five justices, whose duty it should be to prepare a fair and equal county rate, with power to alter and amend it from time to time as circumstances might require. This bill has not yet passed (July, 1845).

The proportion in the pound to the county rate valuation in England and Wales and for several of the counties is as follows:—

England, 3¼*d.*; Wales, 3⅓*d.*; Northumberland, 1½*d.*; Bedford, 12½*d.*; Westmoreland, 2¼*d.*; Middlesex, 3½*d.*; Lancaster, 1⅓*d.*; Anglesey, 24*d.*; Pembroke, 1*d.*

COUPLING, in machinery, is, in a limited sense, the name given to various contrivances for effecting the longitudinal connection of shafts; though, in a more general sense it may be extended to embrace the arrangements by which the parts of a machine may be connected or disconnected at pleasure, or by which a machine may be disengaged from, or re-engaged with, a revolving wheel or shaft, through which it receives motion from a steam-engine, water-wheel, or other prime mover.

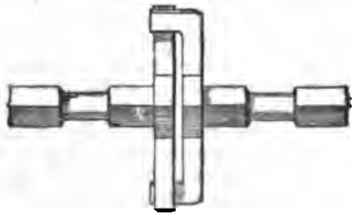
When it is required to communicate motion to a considerable distance from the source of power, as in the distribution of power to the various apartments of a cotton-mill, by gearing such as that represented under WHEELS, P. C., p. 314, it is frequently necessary to construct the long shafts by which the motion is distributed in several pieces, not only owing to the impossibility of making them accurately of the required length, but also because, if they were so made, their expansion and contraction would occasion much inconvenience. It is further desirable, in many cases, to have the option of detaching one portion of a shaft from the moving power without stopping the adjacent portion.

In such cases each distinct shaft, or portion of shaft, may be perfectly supported by bearings of its own, near each end; or, under certain circumstances, the coupling may be so constructed as to render one of the bearings unnecessary.

The simplest mode of connecting shafts which are supported by bearings near each end, is to make that portion of each shaft which projects beyond the bearing of a square shape, and to unite the adjacent ends by means of a *coupling-box*, which may be described as a square collar fitting the ends of the shafts, and capable of sliding along them in such a way that it will either embrace the ends of *both* shafts, in which case they must turn together like one piece, or that, when it is required to disconnect them, it may be slid fully on to *one* of the shafts, leaving the other entirely free. Holes are provided in both the coupling-box and the shaft, by which a pin may be inserted to hold the coupling-box in whichever position it may be required to retain. Sometimes, instead of the coupling-box being in the form of a sliding box or collar, it is formed in two halves, which may be separated at pleasure, and secured, when put together, by bolts or keys. On account of the greater facility of making them perfectly true, round couplings and coupling-boxes are occasionally used; but as their efficiency in transmitting power depends wholly upon the connecting pins, of which there should be two, passing completely through the shaft at right angles with each other, they are not so strong as square couplings.

Couplings are often effected without coupling-boxes, by the use of what are termed *clutches* or *glands*, in which projections of various forms from arms or discs attached to the ends of the shafts, are employed to lock them together, in some cases only while the machinery is in motion; while, by the removal of one of the engaging members, by sliding it back upon the shaft, the connection may be broken at pleasure. Such contrivances admit of infinite variety, and may be made to disengage themselves whenever the moving power ceases, by fixing one of the engaging members upon a pivot in such a manner that, when the pressure upon it is relaxed, it falls out of the way. This is especially the case with such clutches as act on the principle of the ratchet and click. *Fig.* 1 represents a clutch with projecting arms, which engage with each other by mere contact, and will turn in either direction. As the engaging members of this clutch are not attached to each other, it affords scope for expansion and contraction without occasioning the straining and injury which might be occasioned by a more rigid connection, and it also obviates the difficulty of throwing all the machinery into motion at the same moment, since one shaft may have to turn nearly half round before it has to impel the adjoining one. Sometimes however a similar coupling is so constructed that the connection is made by pins passing through the two arms. In some couplings the arms or glands are single, so that the connection may be compared to a common crank, instead of being double, and forming a double crank, as in *Fig.* 1; and, when it is desired to prevent the machinery from turning the wrong way, the arms may be jointed with a kind of hinge-joint, similar to that of a common two-foot rule, which will cause the bar to be quite stiff to resist a strain in one direction, although, if the motion be reversed, the joint will give way, and the connection will be broken.

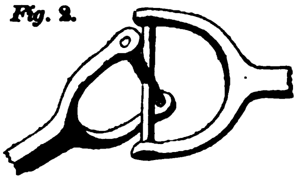
Fig. 1.



When each length of shaft has only one bearing, the coupling must be of such a construction as not merely to compel one shaft to turn with the other, but also to cause the supported end of one shaft to sustain, by a scarfed or mortice and tenon joint, or by some similar contrivance, the unsupported end of the adjoining shaft.

Fig. 2 represents one of various forms of the ingenious contrivance known as Hooke's universal joint, an apparatus by which shafts which do not lie in a right line with each other, or which are liable to change their relative positions in this respect, may be made to turn each other. While it may be used as a substitute either for an ordinary coupling or for bevil gear, this joint or connection will accomplish what neither of those contrivances can do. As an illustration of the circumstances under which such a coupling may be employed, we may allude to a scheme patented in 1825, by Mr. James, for propelling railway carriages on steep inclinations by communicating the rotatory motion generated in a locomotive engine to all the wheels of every carriage in the train, through the medium of a system of rods thus connected, and consequently capable of receiving and imparting motion, whether the train were in a straight line or on a curve so great as to cause the side of one carriage to form an angle of 30° with that of the adjoining one. The details of this specimen of ingenuity, which is here referred to simply as affording a striking illustration of the powers of the universal joint as a coupling, are given in Hebert's 'Engineer's and Mechanic's Encyclopædia,' vol. ii. pp. 465, 466.

Fig. 2.



When power is conveyed to a considerable distance by means of a series of revolving shafts, the motion often becomes irregular and uncertain; but this evil may be, in a great measure, rectified by placing a fly-wheel to equalize the motion at or near the extremity of the series.

In all contrivances for disengaging and re-engaging machinery while in motion, it is necessary to consider the effect of inertia, which renders it both difficult and hazardous to bring a machine suddenly from a state of rest to one of rapid motion. When the connection is formed by toothed or cogged wheels this difficulty is especially felt, and consequently, while it is very easy to disconnect such wheels, or, as it is commonly termed, to throw them *out of gear*, either by removing the axis of one of the wheels, or by sliding one wheel along its axis until its teeth are disengaged from the other, they cannot be re-engaged without great risk of breaking the teeth. In this respect, as shown under WHEELS, P. C., p. 312, a connection by means of straps or cords is far preferable. Such a connection always has some degree of elasticity and power of yielding under the effect of sudden strains, and when employed in connection with the fast and loose pulley, a contrivance illustrated under SAW-MILL, P. C., pp. 478, 479, it affords perhaps the safest method known of starting and stopping machinery. Sometimes a similar effect is produced by the use of an endless cord or band passing round two pulleys, one of which is on a moveable axle, by the shifting of which the tension of the band may be destroyed. Where neither the axle of the driving pulley, nor that of the driven one, can be made moveable, the same effect may be produced by the use of a third pulley or drum, so mounted that by pressing it against the band the tension may be increased to any desired amount, or by removing it out of the way it may be destroyed. The small wheels, *e*, *e*, in the cut of part of Brunel's block machinery, given under SAW-MILL, p. 481, *Fig.* 6, though merely employed for increasing the tension, and not for taking it off to stop the revolving saw, will illustrate such a contrivance. Bands are sometimes applied to a sliding pulley which may be locked to the machinery at pleasure by engaging it with revolving glands, or with a bayonet coupling; but in such a case the shock of starting is not avoided, though the elasticity of the band, and its power of slipping on the pulley under the effect of sudden resistance, render it less hazardous than with cog-wheels.

Clutches or bayonet connections are sometimes employed to start a train of wheelwork in which the teeth themselves are never actually thrown out of gear. The disadvantages of such a mode of coupling may be in a great measure avoided by the use of a *friction clutch*, in which the driving arms or projections are attached to an elastic open hoop or band of metal, sprung on to a smooth wheel or drum, and fitted with tightening screws, by which it may be pressed to any degree of tightness; so that while it will slip round until the inertia of the machinery is overcome in starting, or under the effect of accidental resistance, its friction will be sufficient, under ordinary circumstances, to cause it and the drum to turn together as if they were one piece.

In another contrivance of the same character the connection is effected by pushing a solid conical wheel or drum, mounted upon one shaft, into a hollow cone attached to an adjoining shaft, in doing which the friction, and consequent power of transmitting motion, increases in proportion to the advance of the solid into the hollow cone. Friction wheels, with their peripheries formed of the end of the grain of wood, which may be compared to a collection of indefinitely small teeth, pressed together by levers, or friction wheels or discs placed side by side so as to be either a little separated or pressed together at pleasure, are also occasionally used. A coupling which starts the machinery gradually by friction may be connected with a fixed clutch or bayonet coupling in such a way that, when once started, the connection of the machinery shall be rigid, and no longer dependant upon mere friction.

Very full details upon the subject of this article are given in the excellent 'Practical Essays on Mill-Work and other Machinery,' by Robertson Buchanan, with additions by Tredgold and George Rennie, 8vo., Lond., 1841, pp. 262-306, where allusion is made to couplings which disengage themselves under the influence of any undue strain upon the machinery, and a plan is proposed for diminishing the risk of engaging cogged wheels, by introducing spring spokes in the larger wheel of the pair, the teeth of which are more likely to break than those of the pinion. The subject is also treated at some length in Barlow's 'Treatise on Manufactures and Machinery,' in the 'Encyclopædia Metropolitana,' sect. 46-51.

COURT BARON. [MANOR, P. C.]

COURT, CUSTOMARY. [COPYHOLD, P. C. and P. C. S.]

COURT ROLLS. [COPYHOLD, P. C. and P. C. S.]

COURTOIS, JACQUES, a celebrated battle-painter, commonly called le Bourguignon, was born at St. Hippolite, near Besançon, in Franche-Comté, in 1621. He was instructed in his art by his father, an obscure painter, and having made the acquaintance of a French officer at Milan, whither he had gone very young, he entered the French service, and followed the army for three years, drawing from the life all the most striking incidents and scenes of the camp, the march, and the battle-field, by which means he learned to portray such subjects with extreme boldness and truth. He made afterwards the acquaintance of Guido and Albani at Bologna, and thus had every opportunity of perfecting himself in the technical part of his art. In Rome likewise he made the acquaintance of the principal painters of his time—Pietro da Cortona, M. A. Cerquozzi, and others.

After spending some years in the execution of various works in Florence and in Venice, during which time he became a husband and a widower, he returned to Rome, and entered as a lay-brother into the order of the Jesuits, for whose establishment he painted several religious works, besides many battles for strangers and others unconnected with the institution. He was most successful in small works; his style did not require large figures, and he had little ability to paint them. His pictures are not uncommon; there are several in most of the principal galleries of Europe, and they never fail to attract notice, by their surprising spirit of conception and execution; in colouring also they are warm and characteristic. He died of apoplexy, at Rome, in 1676.

Courtois appears in Italy to have Italianized his name into *Giacomo Cortese*, as some of his etchings are so marked, and his name is so written by Italian writers: he was also called *Borgognone* in Italy.

His younger brother GUILLAUME COURTOIS, born in 1628, became also a very celebrated painter, but in a different style. He was the pupil of Pietro da Cortona, and the friend of Carlo Maratta, and lived chiefly at Rome, where he died, in consequence of taking some quack medicine for the gout, in 1679. His subjects are chiefly from sacred history, painted in Roman churches, but he frequently assisted his brother; and one of his own masterpieces is a great battle of Joshua, in the palace of Monte Cavallo, painted for Pope Alexander VII. His style was correct, and perfectly free from manner. Several of his works have been engraved, and he etched a few plates himself. His Battle of Joshua was engraved by A. Clouvet, in four sheets, and dedicated to Casimir, King of Poland.

(Pascoli, *Vite de' Pittori*, &c.; D'Argenville, *Abrégé de la Vie des plus fameux Peintres.*)

COURTS, ECCLESIASTICAL. [ECCLESIASTICAL COURTS, P. C. S.]

COUSIN, JEAN, a very celebrated French painter, sculptor, and geometrician, contemporary with Il Rosso and Primaticcio in the sixteenth century. The date neither of his birth nor death is known; but he was born at Soucy near Sens, was the first Frenchman who attained distinction in historical painting, and was the principal favourite at the French court in the reigns of Henri II., François II., Charles IX., and Henri III. He is sometimes in the vague language of false criticism termed the founder of the French school, which however means nothing more than that he was the first distinguished French historical painter. He married the daughter of a French general officer, Lieut.-Gen. Rousseau, of Sens, and he was established chiefly as a painter on glass there, but he generally spent a portion of the year at Paris. His most celebrated picture is the Last Judgment, painted for the Minims of Vincennes, and now in the Louvre. Though not a work of a high order, it is carefully executed, and in parts well drawn though harsh, well foreshortened, and well though highly coloured; it was engraved by Peter de Jode the elder, in twelve sheets: the whole print is four French feet high, by three feet four inches wide, and one of the largest prints in existence.

Many of the old painted windows of the churches of Sens and Paris and elsewhere were from the designs of Cousin. He was also a writer of ability; he wrote on geometry and perspective, and a small work on the proportions of the human body, with illustrative wood-cuts, which went through many editions; the first work was published in 1560, and an edition of the second was printed in 1625, in 4to, under the following title—'Livre de Pourtraicture de Maistre Jean Cousin, Peintre et Geometrien très excellent,' &c.

In sculpture his principal work is the monument of Admiral Chabot, in the church of the Celestines. There are still some remains of his paintings on glass in the church of St. Gervais, which were his principal works of this class at Paris. He was still living in 1589, and much advanced in years.

Cousin, from the circumstance of his having placed a pope in hell, in his picture of the Last Judgment, is supposed by many to have been a Protestant, or of the pretended reformed church, as Felibien expresses himself, but such an unfounded report, he continues, with considerable simplicity, is refuted by the life he led, by the regularity of his conduct, and the correctness of his principles.

(Felibien, *Entretiens sur les Vies, &c., des Peintres.*)

COUSTOU, the name of two very distinguished French sculptors, brothers, of Lyon.

NICOLAS COUSTOU was born in 1658, and having received some instruction from his father, who was a carver in wood, he went in his nineteenth year to Paris, and became the pupil of his uncle, Antoine Coysevox, a distinguished sculptor. When only 23 years of age he obtained the grand Academy prize in sculpture, and went in consequence as a pensioner to Rome. In Rome Coustou paid more attention to the modern than the antient works in sculpture. His favourite masters were Michelangelo and Algardi, whom he studied for their opposite qualities, endeavouring to combine in his own works the merits of each; to modify the harsh vigour of Michelangelo by the less evident grace of Algardi. He remained in Rome three years, but from his peculiar taste and the character of his studies, it was not to be expected that he could have appropriated much of the symmetry and dignity of the antique.

His first great work in Paris was the colossal group representing the junction of the Seine and Marne, now in the garden of the Tuileries: there are four other statues by Coustou in the same garden, of which the best is the Berger Chasseur. He made also the celebrated group of the Tritons of the rustic cascade at Versailles. But his work of highest pretensions is the Descent from the Cross in the choir of the cathedral of Notre Dame, generally called le Vœu de Louis XIII.; the figures of Louis XIII. and Louis XIV., which were on each side of it, until 1831, when they were destroyed, were by Guillaume Coustou and Coysevox respectively. He executed many other distinguished works at Lyon and at Paris, for which he was well rewarded by Louis XIV., and a small pension was settled upon him by the city of Lyon: he enjoyed two pensions from the crown, amounting together to 6000 francs. He died in 1733, having been forty years a member of the French Academy.

GUILLAUME COUSTOU was born in 1678, and was also the pupil of his uncle Coysevox. He went likewise to Rome as a pensioner of the French government; it appears however that he never enjoyed the pension, or it was at least paid with such irregularity that he was forced to earn his own maintenance, for which he was chiefly indebted to Le Gros, who employed him on his bas-relief of St. Louis of Gonzaga.

After his return to Paris he executed many excellent works, several of which were for the gardens of Marly, but are now at the Tuileries; others are at Versailles: the two celebrated grooms checking restive horses, somewhat in the actions of the antient groups of Monte Cavallo, now at the entrance of the Champs Elysées, were at Marly until 1794. Still more celebrated works are the statues of the façade of the Château d'Eau opposite the Palais Royal; and the more extensive bas-reliefs of the principal entrance of the Hôtel des Invalides. He executed also the colossal bronze figure of the river Rhône for the monument of Louis XIV. at Lyon; the corresponding figure of the Saône was by Nicholas Coustou, and they are now both preserved in the town-hall of Lyon; the statue of Louis XIV. was destroyed during the revolution. He died in 1746, director of the Royal Academy of Painting and Sculpture. The French are not agreed as to the relative merits of these two sculptors, some preferring Nicholas, and others Guillaume: the style of the latter in design varied less than that of Nicolas from the antient standard of proportions, but they were both more French in their tastes than Greek.

Guillaume Coustou the Younger, likewise a distinguished artist, was the son of the elder Guillaume. He was born at Paris in 1716, obtained also the grand prize of the Academy in sculpture, studied five years in Rome, and died treasurer of the Academy in 1771. He designed the sculptures of the front of the church of St. Geneviève, which were removed when that building was converted into the Pantheon: they were executed by a sculptor of the name of Dupré.

(De Fontenai, *Dictionnaire des Artistes*, &c.; D'Argenville, *Vies des fameux Architectes et Sculpteurs*; Galignani, *History of Paris*.)

COUTO, DIOGO DE. [Barros, P. C.]

COWLEY, MRS. HANNAH, whose maiden name was Parkhouse, was born at Tiverton, in Devonshire, in 1743. She was married, about 1772, to Mr. Cowley, a captain in the East India Company's army, by whom she had three children. Her husband was a man of taste, whom she consulted in the composition of her works: and the first of her plays, 'The Runaway,' was commenced half in jest, on her husband rallying her for expressing, in the theatre, a belief that she could write a drama. Her life was spent in the dignified quiet of an English lady, mixing but little in the world, and, notwithstanding her dramatic turn, visiting even the theatre very seldom. She died at Tiverton on the 11th of March, 1809, having survived her husband about ten years. 'The works of Mrs. Cowley, Dramas, and Poems,' were published in a collected edition, 1809-1813, 3 vols. 8vo. Among them are three narrative poems of considerable length, but indifferent merit, 'The Maid of Aragon,' 'The Scottish Village,' and the 'Siege of Acre.' The artificial character of her poetical taste is indicated by the fact that she was the 'Anna Matilda' who corresponded with Mr. Merry under his newspaper signature of 'Della Crusca.' Her two tragedies likewise are worthless. Of her nine comedies several are much better. One of them, 'The Belle's Stratagem,' which first appeared in 1780, still maintains its place as a lively and excellent acting play: and 'A Bold Stroke for a Husband,' a play somewhat similar, has been repeatedly revived both in its original shape and with alterations.

COXIE, MICHAEL, a very celebrated old Flemish painter, born at Mechlin, in 1497. He studied first under Bernard van Orley, and devoted afterwards much time to the study of the works of Raphael at Rome, and even there obtained distinction as a fresco painter. He returned with an Italian wife, and with a good stock of Italian art, to his own country, where he enjoyed great renown and amassed a large fortune by his works. They were chiefly altar-pieces, and many of the best of them were carried to Spain, but he kept a considerable gallery of some of his choicest productions, in three houses or palaces which he possessed at Mechlin. He died at Antwerp in 1592, aged ninety-five, in consequence of a fall from a scaffolding, whilst engaged in painting a picture in the town-house of that place.

Though the works of Coxie had much merit he is now better known for his elaborate copy of the adoration of the Lamb, in the church of St. Bavon, at Ghent, by the brothers Van Eyck, than for his own original productions. It is a large altar-piece with folding-wings, in two horizontal divisions, an upper and a lower division, each with two wings on a side; six of these wings are now in the royal gallery of Berlin, and the other parts are still at Ghent. Coxie's copy of the two centre pictures of this altar-piece is also in the Berlin Gallery, God the Father, and the actual Adoration of the Lamb; other parts are in the Pinakothek of Munich, and in the royal gallery of the Hague: in Munich are the large figures of John the Baptist and the Virgin Mary; at the Hague are all the wings. The copy was made by Coxie for Philip II. of Spain, and finished in 1559, after two years of uninterrupted labour, for which he was paid 4000 florins, about 400*l.* sterling, or sixteen times as much as the Emperor Charles V. paid Titian for his portrait in 1530. When painting this picture, Coxie complained to Philip that he could not procure a blue good enough to paint the Virgin's drapery with, upon which Philip wrote to Titian for some ultramarine, which Coxie received, and he used a quantity of the value of thirty-two ducats over the single blue mantle of the Virgin. The copy was painted with extreme care, and kept somewhat softer than the original; it remained for a long time in the chapel of the old palace of Madrid, whence it was removed and sent to Brussels by General Belliard during the French occupation of Spain. Cean Bermudez says that Coxie himself took it to Spain.

(Van Mander, *Leven der Schilders*; *Kunstblatt*, No. 23-27, 1824; Passavant, *Kunstreise durch England und Belgien*; Waagen, *Verzeichniss der Gemälde-Sammlung des Königlichen Museums zu Berlin*.)

COYSEVOX, ANTOINE, one of the most distinguished of the French sculptors, was born at Lyon in 1640: his family was originally Spanish. He distinguished himself at Lyon as early as his seventeenth year by a statue of the Virgin, and he went afterwards to Paris to perfect himself under Lérambert. He was scarcely twenty-seven years of age when he was chosen by the Cardinal de Fürstenberg to decorate his palace at Saverne in Alsace, in which he was occupied for four years. After the completion of these works he returned to Paris with a reputation equal to that of any of his Parisian contemporaries, and he was elected a member of the Academy in 1676. He made two bronze statues of Louis XIV., one for the court of the Hôtel de Ville, and the other, a colossal equestrian statue, for the States of Bretagne. Among his most celebrated works are the two winged horses, in marble, mounted by Fame and Mercury, placed one on each side of the entrance to the garden of the Tuileries from the Place de la Concorde, they were originally in the garden of Marly: the marble is most elaborately worked, but they show considerable manner. The horse of Mercury has a bridle, and that of Fame is without one, a conceit which is said to have much pleased Napoleon. In the garden of the Tuileries there are also a young fawn, a flute-player, and two other figures, by Coysevox. He made also for the garden of Marly the groups of Neptune and Amphitrite, for Chantilly the marble statue of the great Condé, and many works for Versailles, including two personifications in bronze of the rivers Dordogne and Garonne. Some also of the finest sepulchral monuments in Paris are by Coysevox, those of—Cardinal Mazarin at Quatre Nations, Prince Ferdinand de Fürstenberg at St.-Germain-des-Prés, Mansard at St. Paul; and the most elaborate of all, that of Colbert at St. Eustache. Coysevox was also an eminent sculptor of busts. When he died, in 1720, he was chancellor of the Royal Academy of Painting and Sculpture.

(De Fontenai, *Dictionnaire des Artistes*, &c.; D'Argenville, *Vies des fameux Architectes et Sculpteurs*; Galignani, *History of Paris*.)

CRAB, a kind of portable windlass, or machine for raising weights, or otherwise exerting force, by winding a rope or chain round a horizontal barrel.

Some confusion is occasioned by the indefinite manner in which such terms as windlass, crab, and crane, to which we might perhaps add capstan, are applied to various machines for the efficient and economical employment of human power upon the mechanical principles explained under Wheel and Axle, P. C., p. 307. Windlass, P. C., p. 444, is sometimes used as a general term for all such contrivances, though in a more restricted sense it is applied to such as consist simply of a horizontal barrel turned round by means of handspokes, handspikes, or levers, inserted in holes made near its extremities. The term *capstan* is usually confined to a similar apparatus with the barrel placed vertically, as described under Windlass. Winch and Axle, P. C., p. 436, is a name given to several varieties of windlass, distinguished from the machine specially so called by being turned, not by handspikes or simple levers, but by the peculiar kind of handle called a *winch*. *Crabs* are windlasses usually, though not always, turned by means of winch-handles, and generally having a provision for multiplying the power by means of toothed gear, as described under WINCH AND AXLE. They are usually mounted in a strong heavy framework of wood or iron, and, when employed for a temporary purpose, but one which involves considerable strain, they are either bolted down to a temporary foundation, or loaded with heavy weights put upon the framework. Crabs are much used in building operations, they being often placed on the ground, and employed to raise weights by means of a rope carried over a pulley fixed to an elevated part of the scaffold, as in the case represented under SCAFFOLDING, P. C., p. 499, *fig.* 3. In like way they are applied in raising the weights or rammers of pile-driving engines. In the kind of railway scaffold described under SCAFFOLDING, pp. 497, 498, the uppermost carriage supports a crab which lifts a stone or other weight vertically, by being brought directly over it; and in some cases a crab is employed to exert power horizontally, or nearly so. In all cases it is most important to provide a crab with a ratchet and click, or some similar contrivance, to prevent it from running back when the application of the power is suspended; and as serious accidents have occurred even where such have been employed, owing to some failure in their action, or to the fracture of part of the apparatus, it is well to have two separate detents, either of which may suffice to stop the machine if the other should fail. An ingenious contrivance for controlling the motion of a crab by means of a brake, intended especially for crabs employed to regulate the descent of heavy bodies, is described under SUBMARINE DESCENT, P. C., p. 192.

Crabs are sometimes termed portable cranes, but the term crane is properly confined to a different class of machines, though used for a similar purpose. [CRANE, P. C. S.]

CRAG, the uppermost of the distinctly tertiary strata of England—using this term in a sense which is perhaps gradually passing away, to be replaced by the larger meaning of Cainozoic, suggested in this work. The crag of Norfolk and Suffolk is partly a calcareous mass rich in delicate corals; partly a subcalcareous sand rich in shells; and partly a rudely aggregated deposit of sand, shells, pebbles, and bones. To these divisions, whose origin is due to different local conditions, and successive times, Mr. Charlesworth has assigned the titles of Coralline Crag, Red Crag, and Mammaliferous Crag. In Mr. Lyell's classification they rank as Pleiocene deposits.

CRANACH, LUCAS, one of the most celebrated of the old German painters, was born at Cranach, near Bamberg, in 1472. According to a prevailing custom of the time he was called after the place of his birth, sometimes also Meister Lucas, and Lucas Mahler, or Luke the painter, from which appears to have originated the false name of Lucas Müller; his family name was Sunder.

He was apparently instructed by his father, and in his twenty-third year (1495) was appointed court painter to the elector of Saxony; he served in this capacity the electors Frederic the Wise, John the Constant, and John Frederic the Magnanimous. In consequence of this appointment, Cranach settled in Wittenberg, the residence of Frederic the Wise, lived there forty-six years, and earned wealth and reputation in abundance; he was owner of several houses there, and was for many years burgomaster of the place. The incidents in his life are not many, though he lived in an eventful time, and there are some few worthy of note. In 1493 he accompanied the elector Frederic the Wise to Palestine to the Holy Sepulchre, and made drawings of all that was remarkable and interesting there. For this elector Cranach painted a series of portraits of his ancestors, and in allusion to Catherine of Henneberg, Frederic expressly ordered him to take great pains with the Henneberg hen, for she had laid the house of Saxony a good egg: Frederic the Strong had obtained the county of Henneberg with her as a marriage portion. Cranach was particularly attached to the elector John Frederic, and when that prince was taken prisoner by Charles V., after the battle of Mühlberg, in 1547, he interceded with the emperor in his behalf, but to little purpose, though he drew a promise from him. Charles was well disposed towards Cranach, and requested him to accompany him to the Netherlands. He had a portrait of himself as a boy, by Cranach, at Mechlin, and he asked the painter when it was painted: Cranach informed him when he was eight years old, and that to attract his attention so as to enable him to paint the portrait, a beautifully painted arrow was stuck in the wall opposite to where the emperor sat. The narration pleased the emperor, and he dismissed him with a present of a silver plate of Hungarian ducats, of which however Cranach took very few; and he persisted in his refusal to accompany the emperor to the Netherlands. He would not leave his prince the elector John Frederic, with whom he shared his five years' imprisonment at Innsbruck, and upon his release in 1552, his eldest son and Cranach were his only companions on his return home. Cranach retired to Weimar, and died there in the following year, which was the eighty-first of his age, according to the inscription to his memory in the church of St. Jakob.

Cranach was acquainted with many of the principal men of his time and country: he and Luther were intimate friends, and he is said to have brought about the marriage of Luther and Catherine Bora: he appears to have painted Luther's portrait many times, nearly all of which have been engraved, some of them by several engravers. He was acquainted with Melanchthon and Bugenhagen. Cranach had several sons and daughters; Johann, the eldest, studied painting in Italy, and died young at Bologna, in 1536: another son, Lucas Cranach the younger, was born in 1515, and died in 1586 as burgomaster of Wittenberg, and with the reputation of a distinguished painter.

After Cranach's death a medal was struck at Wittenberg to his honour, with his portrait on one side, and the arms granted to him by Frederic the Wise in 1508, consisting in a crowned winged serpent upon a gold ground, on the other.

The principal works of Cranach were executed between 1506 and 1540, and they are nearly all still in Germany, especially in Upper Saxony. In the Dresden Gallery there are twelve, in that of Vienna fourteen, at Munich eight, and at Berlin there are twenty-three attributed to him, but they are mostly of small dimensions. His masterpieces are his altarpieces in various Saxon churches, and one of the principal of these is the large mystical representation of the Crucifixion in the church of Weimar. It is painted on a large panel, with folding wings, which are painted on both sides. The composition is scarcely intelligible, and is selected without taste; it contains portraits of John Frederic and his family, and of Cranach and Luther which are the best figures in it: it is executed with all the laborious care and exactness of the best German painters of that period, of whom Cranach himself was inferior to Albert Dürer alone in his best period, but Dürer's superiority is confined to design and composition. A description of this altarpiece, more remarkable for its execution, size, and singularity, than any other qualities, was published, with engravings, by H. Meyer, at Weimar, in 1813.

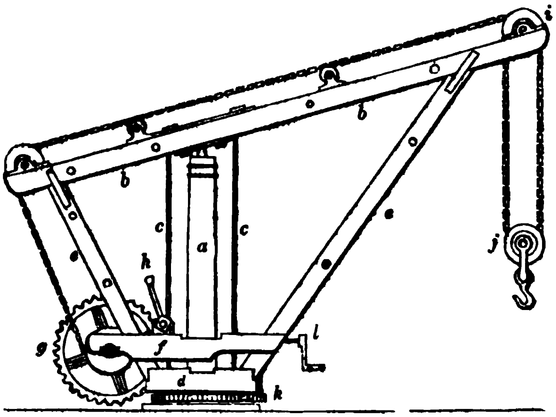
In colour and in all respects except elegance of design, unity of effect and composition, in which he was wholly deficient, Cranach was one of the most distinguished painters of his time; and in execution he was one of the most laborious artists that have ever lived. He was a good portrait painter, an excellent animal painter, and also a good miniature painter, and illuminator of manuscripts: there are several manuscript volumes containing drawings in miniature by Cranach in the library of the University of Jena. Cranach is said to have also engraved both in copper and wood, and many works are attributed to him, but with very little certainty; there are however many prints in both styles after his works, but few of them probably were executed by himself.

There are many German notices of Cranach, more or less detailed, early and recent, and there are at least three distinct lives of him. The first was written by Professor Christ, and published in the 'Acta erudita et curiosa de Franconia,' Nürnberg, 1726; a second was published in 1761, at Hamburg, by C. E. Reimer, 'Historisch-critische Abhandlung über das Leben und die Werke Lucas Cranachs;' the last is the very full life by J. Heller, 'Lucas Cranachs Leben und Werke,' Bamberg, 1821; and Schadow's 'Wittenbergs Denkmäler der Bildnerei, Baukunst, und Malerei,' &c., Wittenberg, 1825, contains descriptions and engravings of works of both the Cranachs. Concerning the engravings and wood-cuts attributed to Cranach, see Bartsch, 'Peintre-Graveur.'

CRANE, a machine employed for raising weights vertically by means of a rope or chain acted upon by a windlass, but carried over a pulley or wheels attached to the extremity of a projecting arm or jib, from the supposed resemblance of which to the neck of a crane the machine is said to derive its name.

The common warehouse crane, which is usually formed of iron, may be compared to an inverted L, the vertical portion of which is so mounted as to form a pivot or axis upon which the whole may be swung round, so that the horizontal arm, which is strengthened by diagonal struts, may either project from the face of the building to which it is attached, so that a rope dropped from its extremity will reach a weight which has been brought within a few feet of the wall in a cart or barge, or may be drawn round with its load, after it has been wound up to the required height, until the load is landed upon one of the floors of the warehouse, through an opening in the side wall. Such a crane may be mounted near the top of the building, and employed for landing goods upon any floor which has an opening immediately under it; and when out of use it may be so turned that the horizontal arm lies parallel with and close to the wall. The rope or chain of such a crane is conducted along the horizontal arm, round one or more pulleys or sheaves, into the warehouse, where it is connected with a kind of windlass or crab, which is usually provided with two sets of gearing, for working at different velocities, so that in raising light goods a much greater speed may be given to the chain with the same motion of the winch-handles than when the load is very heavy. A provision is sometimes added to allow the chain, with its grapnels or hooks, to descend very quickly when unloaded, without detaching it from the handles, or leaving it to descend and unwind itself from the windlass merely by its own weight. Where it is allowed to descend by gravity alone, a brake or fly should, in all cases, be added to regulate and control its descent.

Wharf-cranes are frequently of somewhat different construction, owing to the circumstance that they usually stand alone, that is to say, that they are self-supported, instead of being attached to and supported by a wall, or a post secured to a wall. The annexed cut represents such a crane of approved construction. In this figure *a* is a vertical pillar of iron or wood, the lower end of which is firmly secured to a foundation of masonry, while the upper end terminates in a pointed or conical pin, upon which, as a pivot, the revolving part of the crane rests and turns; *b*, *b* is the jib, which is fixed in an oblique direction, and projects, though unequally, on each side of the pillar; *c*, *c* are wrought-iron rods descending from the jib *b* to support a massive collar *d*, which is so constructed as to turn smoothly and steadily round the base of the pillar; and *e*, *e* are struts or braces abutting upon the collar *d*, and supporting the ends of the jib. Both the jib and its struts may be made double, and connected by blocks and transverse rods, the ends of which are shown by small circles in the cut. *f* is a massive framework attached to the revolving part of the crane, and giving support to the windlass *g*, which may be compared to a crab. The barrel is fixed on the axis of the large toothed wheel, which is turned by a small pinion on the axis of the winch-handle *h*. From the barrel the chain or rope is conducted over the wheels or pulleys *i*, *i*, mounted at the ends of the jib, between the two parallel pieces of which it consists, and under the moveable pulley or runner *j*, which carries the hook or grapnel to which the load is to be attached. The end of the chain is then carried up and secured firmly to the jib. By this arrangement the power is multiplied in proportion to the difference between the diameters of the wheel and pinion by which the chain-barrel is worked, and is further doubled by the adoption of the runner [PULLEY, P. C., p. 118] or moveable pulley to which the hook is attached. Where so great a power is not required the runner *j* may be dispensed with, and the hook may be attached to the end of the chain, in which case the load will be raised in half the time, but, supposing the power applied to the windlass to be the same, the weight to be lifted cannot exceed one-half of what may be raised with the runner. Immediately beneath the collar *d* is a large horizontal cogged wheel, fixed firmly upon the pillar *a*; and at *k* is a pinion engaging with it, and worked, through the medium of bevil gear not shown in the cut, by turning the winch *l*. By this contrivance the crane may be turned round so as to bring the hook over any object lying within its circular range, and, after it is raised from the boat or carriage from which it is to be unloaded, the whole machine may be turned round again to deposit it upon any other point within the sweep of its projecting jib.



The above is only one form out of many which might be represented, but it may serve to convey an idea of cranes generally. Though it is in most cases a convenient arrangement, it is by no means essential that the windlass should form part of the revolving structure of the crane. In some cases the turning of the windlass is effected not by winch-handles, but by a tread-wheel worked by men, or even by horses or oxen. In others the waste or surplus power of a steam-engine is made available for the purpose. Barlow (*Treatise on Manufactures and Machinery*, in the 'Encyclopædia Metropolitana,' sections 396, 397) describes two methods of working cranes by this or other mechanical power: one being by the compression of air into a strong vessel; and the other by exhausting a vessel or receiver. In these plans, as well as in Bramah's plan for working cranes by hydrostatic pressure, which is described in the same work, the power may be transmitted to a considerable distance, and connected with or disconnected from the crane by the turning of a cock. Among other modes of working cranes, one which claims notice for its singularity rather than for any decided merit or advantage, was patented by Mr. L. Wright, and brought into operation at the West India Docks, in which the power applied by winch-handles in turning an axis, is communicated by cranks to a series of levers, which, acting in succession upon friction-rollers projecting laterally from the rim of a large wheel mounted on the axis of the chain-barrel, forces it round very slowly, but with great power. Representations of this and also of Revis's patent crane, in which the barrel is, by the intervention of ratchet-wheels, turned round by the alternating motion of a single lever of considerable length, are given in Hebert's 'Engineer's and Mechanic's Encyclopædia,' art. 'Crane.' In Jamieson's 'Dictionary of Mechanical Science,' art. 'Crane,' is a full account and detailed representation of Watt's jib-crane, a machine peculiarly adapted for building purposes, owing to its portability, power, and perfect control not only over every point lying in a circular line of which the projecting jib is the radius, but also over every point embraced within that circle. In this crane the central pillar, when the machine is required to be portable, is held fast by guy-ropes, and the jib, instead of lying across its upper extremity, is placed in a position resembling the struts marked *e* in the above cut; its lower end abutting upon a collar at the base of the pillar, while the upper end is supported by tackle connected with the top of the pillar, which tackle, being worked by a separate winch, affords the means of changing the angle formed by the jib with the pillar at pleasure, and consequently of bringing the load nearer to or removing it farther from the centre of motion, as circumstances may require. Some portable cranes are made to balance, by means of counterweights, so as not to need guy-ropes. Such may be mounted upon a base furnished with wheels or rollers. Some cranes also are furnished with an apparatus for weighing as well as lifting their load. Several of these varieties of the ordinary crane are described by Jamieson, who also, under 'Cellar-crane,' notices a simple but useful contrivance for raising and lowering casks through a cellar opening, by means of a windlass attached to a portable framework.

The beautifully simple and efficient apparatus described by some writers as the Chinese crane, a contrivance which might be advantageously substituted for many complicated, cumbrous, and expensive machines employed for raising weights, is described under WINCH AND AXLE, P. C., p. 436. Other machines employed for similar purposes are noticed under CRAB, P. C. S.

CRANK, in machinery, is a bend in an axle by which a reciprocating motion in a rod is made to produce a revolving motion of the axle and of a wheel which may be connected with it.

The formation of a crank is well known, and it is evident that while the plane of the crank makes any angle with the rod, a movement of the latter in, or nearly in, the direction of its length will cause the axle and, with it, the wheel to turn round: when the plane of the crank is coincident with the rod the latter can, of course, have no power to produce rotation; but the momentum which the crank and axle may have previously acquired in turning, immediately carries the plane of the former beyond that position, when a movement of the rod contrary to the direction of the former movement continues the circular motion of the crank and axle.

Mr. Tredgold has computed a table in which are shown the forces exerted by rods of different lengths, in turning the crank, and also the strains on the axle at the different angles which the plane of the crank may make with that in which it coincides with the direction of the rod; and it is in order to equalize, as far as possible, the motions produced by these variable forces that a fly-wheel is generally employed with a crank.

The sun and planet wheel which was devised by Mr. Watt for the purpose of converting a reciprocating into a circular motion is an apparatus consisting of a toothed wheel, which is fixed to the axle, and one which is attached to the lower end of the reciprocating rod. The latter wheel does not turn on its centre, but, as the rod moves upward and downward, the teeth, driving those of the other wheel, cause the latter, and with it the axle, to revolve. This contrivance, though still in use when a considerable velocity of rotation is required, since it causes the axle and wheel to make two revolutions in the time that one only would be produced by a crank, is now superseded, in steam-engines, by the latter. [STEAM-VESSELS, P. C., p. 506.]

CRATÆVA, a genus of plants belonging to the natural order Capparidaceæ. It has 4 sepals; 4 unguiculate petals larger than the calyx, and not closing over the stamens during æstivation; 8-28 stamens; the torus elongated or hemispherical; the berry, stalked between ovate and globose, pulpy within; a thin pericarp. The species are unarmed shrubs or trees with trifoliate leaves and terminal cymes or racemes of large flowers.

C. gynandra, Garlic Pear, has 20-24 stamens inserted on the cylindrical receptacle, longer than the petals; the berry ovate; the leaflets ovate, acute; the petals lanceolate. It is a native of bushy places and thickets near the sea-side in Jamaica. The whole plant has a nauseous smell and a burning taste. The bark of the root is said to blister like cantharides.

C. Tapia, the Tapia or Common Garlic Pear, has 8-16 stamens, declinate, about three times as long as the petals; the stipe of the ovary as long as the stamens; the stigma sessile, capitate; the fruit globose. This plant is a tree about twenty feet high. Its fruit is the size of a small orange. It is brought both from the West India Islands and from South America. The fruit has the smell of garlic, and communicates its odour to animals that feed on it. The bark is bitter and tonic, and has been employed in the cure of intermittent fevers.

C. Marmelos, the Bilva or Mahura, is a small tree bearing a large spheroidal berry with a hard shell, and 10-15 cells which contain, besides the seeds, a large quantity of a tenacious transparent gluten, which on drying becomes very hard, but continues transparent; when fresh it may be drawn out into threads of one or two yards in length, and so fine as scarcely to be perceptible to the naked eye, before it breaks. This plant is now however transferred to the family Aurantiaceæ, under the generic name Ægle. It is the Feronia pellucida of some authors. It is found in all parts of the East Indies. The fruit is nutritious and aperient, and very delicious to the taste. It is recommended by European physicians in the East as a valuable remedy in habitual costiveness, and it is said never to fail to produce its aperient effects. The root, bark, and leaves are also used in fevers by the Malabar physicians.

(Lindley, *Flora Medica*; Don, *Gardener's Dictionary*.)

CRAYER, CASPAR DE, one of the most distinguished Flemish historical painters, was born at Antwerp in 1582, and was instructed by Raphael, the son of Michael Coxie. He first distinguished himself at Brussels, where he painted several great altar-pieces, but he settled eventually at Ghent, where his greatest works are still preserved in the museum and in various churches: many of his works however are scattered over Germany and the Netherlands. He died at Ghent in 1669.

The works of Crayer, in their style, subjects, and dimensions, are generally of the highest pretensions, and they are in a great degree successful, but yet are frequently formal and cold. Besides other great works, he painted at Ghent twenty-one large altar-pieces for the principal churches of that city, some of which, for their fulness and dignity of subject, correct and vigorous design, and the judicious bestowal of extra care in the execution of their more important parts, command our highest admiration, notwithstanding a very sensible coldness of effect and a certain formality of treatment. Even the gorgeous taste of Rubens was vividly impressed with the great merits of Crayer: upon seeing one of his pictures in the refectory of the abbey of Affleghem, he is said to have exclaimed, 'Crayer! Crayer! no one will ever surpass you.'

There are fourteen of his works in the museum of Ghent, comprising some of his principal pictures, as — St. Rosalia crowned by the infant Christ; the Martyrdom of St. Blaise, his last work, painted in his eighty-sixth year; and three of the pictures painted for the triumphal arches erected at Ghent upon the occasion of the formal entry of Prince Ferdinand, Infant of Spain, into Ghent, in 1625. One is Francis I. surrendering his sword to Lannoy after the battle of Pavia in 1525; another, the descent of Charles V. upon the coast of Africa in his expedition against Tunis, ten years afterwards: the figures of these works are colossal, and they are slight in their execution, but at the same time remarkably vigorous and correct. There are a few works by Crayer in Spain, and he is supposed to have visited that country in the reign of Philip IV. Few of his great works have been engraved, and they have comparatively seldom been moved; they are too large for the commerce of picture-dealers. The large altar-piece of the Virgin and Child enthroned amongst angels and surrounded by saints, in the gallery of Munich, about 19 feet by 12, and by no means one of the best of his works, cost, with the copy that was substituted in its place, 20,000 rix dollars. Sir Joshua Reynolds saw this picture in the gallery at Düsseldorf, and makes the following just observations upon it in his 'Journey to Flanders and Holland:'—'Though it cannot be said to be defective in drawing or colouring, yet it is far from being a striking picture. There is no union between his figures and the ground; the outline is everywhere seen, which takes away the softness and richness of effect: the men are insipid characters, and the women want beauty.'—'The dead and cold effect of this picture, as well as many others of modern masters in this gallery, sets off those of Rubens to great advantage.' It was painted in 1646, and the lower figures are portraits of Crayer and his family.

(Descamps, *La Vie des Peintres Flamands*, &c.)

CREDI, LORENZO DI, one of the best of the old Florentine painters and sculptors, was born at Florence about 1453. His real name was, according to Vasari, Lorenzo Sciarpelloni, and he acquired the name of Credi from his master, a distinguished goldsmith at Florence in that time Lorenzo however did not remain long with Credi: his skill in drawing warranted his exchanging the art of the goldsmith for that of the painter, though he had distinguished himself as a goldsmith, and he accordingly entered the school of Verrocchio, in which he was the fellow-pupil of P. Perugino and of Lionardo da Vinci, the latter of whom he afterwards imitated.

Lorenzo was Verrocchio's favourite pupil; and when Verrocchio went to Venice, to make the bronze equestrian statue of Bartolomeo Colleoni [VERROCCHIO, P. C.], he left Lorenzo in charge of all his affairs at Florence. Lorenzo visited his master several times while he was engaged at Venice, and after his unexpected death in 1488, brought his body home to Florence. Verrocchio made Lorenzo di Credi his principal heir, and expressed a desire in his will that he might be intrusted with the completion of the monument of Colleoni, adding the observation, 'quod est sufficiens ad id perficiendum,' because he is equal to the undertaking. Credi did not take possession of any of Verrocchio's property, except his drawings and works of art: the rest he made over to his relations.

It is not enough to say that Lorenzo di Credi was a good painter for his time: he was an excellent painter for any time. His Birth of Christ, formerly in the monastery of Santa Chiara, but now in the gallery of the Academy at Florence, is one of the best works in that excellent collection: it is excellent in expression, in colouring, and in the execution both of the principal and the accessory parts. His best work however, in the opinion of Vasari, is the picture of the Madonna and Child, with Saints Julian and Nicolas, painted for a chapel of the Convent of Cestello, but at present in the Louvre at Paris, No. 958, and in excellent preservation. Vasari mentions many of Lorenzo's works, several of which are now lost, but there are still a few Holy Families by him in Florence and in other parts of Italy. Credi when old, having become wealthy by his labours, retired into Santa Maria Nuova at Florence, and died there, according to Vasari, in 1530, aged seventy-eight; but the date Gaye has shown to be incorrect, whatever the age may be, for he was still living in 1536, but ill and bed-ridden. If therefore he was only seventy-eight years of age when he died, he cannot have been born earlier than 1458, and was consequently only twenty years of age when he brought the body of Verrocchio from Venice, which is highly improbable, as he had some time managed the affairs of that sculptor at Florence, and was recommended by him as fit to complete the statue of Colleoni. He must have died therefore at a much more advanced age than seventy-eight, supposing 1536 to have been the year of his death. Gianantonio Sogliani, who lived with Credi twenty-four years, was his most distinguished scholar, and in some respects improved the style of his master: in tone both were the imitators of Da Vinci.

(Vasari, *Vite de' Pittori*, &c.; Gaye, *Carteggio d'Artisti*.)

CREDIT, in commerce and in political economy, signifies the trusting or lending of one man's property to another. The man who trusts or lends is said to give credit, and he who is trusted is said to obtain it. The one is called a creditor, and the other a debtor.

Credit is given either in goods or in money. By the former mode goods are supplied to a purchaser, for which the payment is deferred for some fixed period, or indefinitely, and the person who supplies them indemnifies himself for the delay by an increased price. By the latter mode, money is advanced, upon security or otherwise, and interest is charged upon the loan. [Interest, P.C.; Mortgage, P. C.] Both these modes are used, in conjunction with each other, in the large transactions of commerce. A manufacturer, for example, sells to a merchant, for exportation, goods to the value of a thousand pounds. The merchant however is unable to pay for them until he has received remittances from abroad; and the manufacturer, aware of his solvency, is contented to receive in payment a bill of exchange, due at some future period. [Exchange, Bill of, P.C.] But in the mean time he is himself in need of money to carry on his business; and instead of waiting for the payment of the bill when it shall become due, he gets it discounted by a banker or other capitalist. Thus having given credit to one person in goods, he obtains credit from another in money. In this and other ways capital is circulated and applied to the various purposes for which it is required. But without entering further upon the practical methods by which the mercantile system of credit is conducted, it is proposed to inquire into its causes and into its economical uses and results.

There can be no system of credit until there has been a considerable accumulation of capital; for when capital first begins to be accumulated, those who possess it apply it directly in aid of their own labour. They have no superfluity which they can afford to lend to others; and they are generally engaged in some business in which their savings can be profitably employed. As a country increases in wealth, many persons acquire capital which they cannot employ in their own business, or can only employ by offering inducements to purchase in the shape of deferred payments. Others, again, inherit capital from which they wish to derive an income without the trouble of personally superintending its application. It is from these classes of persons that lenders of capital arise; and they have no difficulty in finding borrowers. Setting aside that countless class of mankind whose maxim it is to get money or money's worth, honestly if they can, but all events to get it—who will borrow whenever others will lend, and reckon the loan as so much money earned, most men have an instinctive perception that the next best thing to having capital of their own is to have the use of the capital of others. The efficacy of capital is very soon discovered as an instrument for the production of wealth, and those who have it not are willing to pay for its use; or, in other words, to share with a capitalist the profits of their own industry, on condition that he intrusts to them such funds as they require for making it productive. Thus as soon as a sufficient capital exists, a system of credit has a natural tendency to arise, and will continue to grow with the increase of capital, unless it be checked by a general insecurity of property, by imperfect legal securities for the payment of debts, or by a want of confidence in the integrity of the parties who desire to borrow. When the society and laws of a country are in a sound state, and capital is abundant, credit comes fully into operation.

The precise use of credit as an agent in the production of wealth is that it gives circulation to capital, and renders it available wherever it can be most profitably employed. It does for capital what division of employments does for labour. Without augmenting its quantity it increases its utility and productiveness. Credit, in fact, may be best understood by regarding it as one of the many forms in which the division of employments facilitates the production of wealth. Without the aid of capital, the labour of man is comparatively ineffectual; and credit, by circulating capital among those who are engaged in the productive employment of labour, promotes the most essential of all divisions of industry—that which uses and makes effective the ingenuity of men in those pursuits for which they are adapted. [Division of Employments, P. C. S.]

To employ capital productively is a business requiring great knowledge, skill, and industry; and is rendered more effective by a division of superintendence, as manual labour is facilitated by a judicious distribution of employments among several hands. Every man who borrows money for the legitimate purposes of industry, and applies it with judgment, is really the agent of the capitalist, in executing duties which the capitalist himself would be unable to perform. A man's capital would be comparatively useless without an active superintendence, and a union of skill and industry in a particular business. These qualities are placed at his disposal by the system of credit, and stimulated to exertion by a share in the profits arising from the use of his capital. If the capitalist should trust persons improvidently, these useful results will not follow; but it is his peculiar province, as it is his interest, to exercise caution and judgment in the investment of his own capital; and if he fail to do this, his fortune will suffer in precisely the same manner as if he superintended a factory himself without understanding the business, and employed idle and ignorant foremen and unskilled operatives.

These illustrations will suffice to explain the nature and uses of credit; but it must always be borne in mind that in circulating capital and making it available in aid of industry, it calls no new capital into existence. It makes the existing capital of a country more productive, and consequently accelerates the accumulation of fresh capital; but credit cannot be, in itself, a substitute for capital. A man without any capital of his own may carry on business by the aid of credit; but he is merely using the capital of another. No man can lend his money, and still use it himself. It is not ubiquitous—nor can it serve two purposes at once. If a man does not use his own capital, he may lend it to another to use; but it is impossible that he can both use it himself and allow another to use it at the same time. He cannot use it in person and by proxy.

Stated in this manner, the truth of these principles is obvious; yet so great is the influence of credit in stimulating enterprise, that it is constantly mistaken for a distinct productive agency. Thus it is said, for example, that wherever credit is freely obtained in a country, great prosperity is the result; and it is undeniable that facilities in obtaining credit and prosperity are ordinary concomitants; but they are both equally the results of an abundance of capital seeking employment, under circumstances favourable for its profitable use. If credit be granted too freely for the amount of capital by which it is supported, or if it be forced beyond the natural demands of trade, speculations and improvidence are encouraged which are ruinous to the parties concerned, and deeply injurious to society. An apparent prosperity exists for a time, but when the day of reckoning arrives, it is discovered that credit, instead of creating capital, has merely diverted it from one investment to another more speculative and hazardous, which at best can only be made ultimately profitable by a continuance of the credit by which it was encouraged. But if this credit be limited or withdrawn, what becomes of the fictitious capital upon which so much reliance had been placed? Without any failure of the enterprise, the capital by which it was conducted is gone at once. This could not happen if credit created capital; but it is perfectly accounted for when it is understood that capital, however it may be circulated and made accessible by credit, in order to be applied to any new object must have been withdrawn from another, to which it is liable to revert. As one of the forms in which capital is distributed, a system of credit is of the highest value; but if relied on as an independent equivalent of capital, it is delusive or fraudulent.

As yet that description of credit which consists in deferred payments for goods has only been generally adverted to; but we cannot close this article without a special notice of its peculiar character and effects. This system of credit is generally resorted to by tradesmen to increase their business; and it is undeniable that deferred payments offer a strong temptation to purchase. We are always eager to possess, and the cost of possession appears small in remote perspective. When a customer buys an article for which he is not to pay for twelve months, he becomes indebted for its value, and he has also, in fact, borrowed that amount of the tradesman, to whom he must ultimately repay—1st, the cost price of the article; 2ndly, the profit upon the sale; and, 3rdly, the year's interest upon the amount advanced. The tradesman, if he have capital, and can rely upon ultimate payment, is very glad to encourage purchases, and not only to sell his goods, but to charge a high rate of interest for deferred payments. If he have not a sufficient capital, he must borrow money from others to enable him to give credit; and, of course, he will charge to his customers a higher interest than he has paid himself. In either case he runs considerable risk, for the debts contracted in this manner are devoid of all security. The goods are supplied and consumed; and if the parties fail in payment, there can be no restitution or compensation. When the system is fully established, many persons avail themselves of it dishonestly; others are improvident, and, without intentional fraud, exceed their means, and become insolvent; and various accidental circumstances may prevent the tradesman from recovering his debts. His risk, therefore, is exceedingly great; and in charging interest for his loans, he must cover all his losses. He consequently charges not only a reasonable interest for the risk which he runs in each case, but also an insurance against all the losses which he may incur in his business. Thus a customer pays the price of his own purchases, a high rate of interest for his loans, and a portion of the unpaid debts of other people. Nor can any check be placed upon the creditor, as in other forms of credit. No specific sum is advanced with a stipulated interest; but a gross amount is due, in which the rate of interest is concealed. It may be exorbitant, and out of all proportion to the value of the article supplied and the accommodation given; but it is not separable from the delusive price. This circumstance is an obvious encouragement to fraud; and it has a tendency to raise prices injuriously to the consumer; an evil which even extends itself, in a great measure, to purchases paid for in ready money.

It is the abuse, however, or the excessive use of this form of credit, which is mischievous. If properly used, and within reasonable limits, it is as useful as credit in any other form. A few examples will suffice to illustrate this position. The receipts of different consumers are irregular; their consumption constant. Within the year their receipts and expenditure may be about the same; but in point of time, they cannot be accurately balanced and adjusted one to the other. This system of credit enables them to provide for themselves and their families without privation, and at the cost of no one else. By an operation scarcely perceptible, their receipts and expenses are adjusted. If, instead of satisfying their wants, they had suffered privation, trade would have been injured and capital employed less fully. Again, a man who pays for everything he consumes a year hence practically adds to his capital a sum equal to the value of his consumption. He gains a whole year of productive industry in advance of his own subsistence. It is true that he will ultimately have to pay for it, together with a high interest; but if he has been able, in the meantime, to apply this additional capital so productively as to leave a balance in his favour, he has enriched himself and the community. The tradesmen who have trusted him, and the capitalists by whom they have been aided, will have made a profit upon his consumption, and have realized the interest upon their loans; while he will have given more employment to capital and to labour than he would have been able to give, if he had been compelled to pay for his own subsistence from day to day.

In various other ways credit, in this form, is a valuable auxiliary to capital and industry; but whenever it is injudiciously given or accepted it becomes injurious. In this respect it does not differ from other forms of credit. The precise uses of credit in general have been already explained. In whatever form it is judiciously and honestly applied it is an efficient agent in the circulation and productive use of capital; but whenever it is used without judgment or fraudulently abused, it becomes injurious, and wastes capital instead of encouraging its growth. All great means conducive to social good are, unhappily, liable to perversion and abuse. The public credit of nations and mercantile credit have too often been abused, as recently, in the most signal manner, by the Americans; and the system of tradesmen's credit has also been shamefully perverted; but all alike are conditions inseparable from the application of capital to the infinite purposes for which it is required. The advantages of credit are so great that it will always be extensively used in every form of which it is susceptible; but its evils may be mitigated by the judgment and experience of capitalists, and by improved laws for adjusting the relations between debtor and creditor.

CREDIT, LETTER OF, is an order given by bankers or others at one place, to enable a person to receive money from their agents at another place. The person who obtains a Letter of Credit may proceed to a particular place, and need only to carry with him a sum sufficient to defray his expenses; and it gives him some of the advantages of a banking account when he reaches his destination, as he may avail himself of it only for part of the sum named in it. If it were not for the convenience which a Letter of Credit affords, a person who was intending to make a tour on the Continent, for example, would be under the necessity either of taking with him the whole of the sum which he would require during his absence, or of receiving remittances from home, addressed to him at particular places.

A Letter of Credit is not transferable. By a strict interpretation of a clause in the Stamp Act (55 Geo. III. c. 184), an instrument of this nature would seem to be liable to the same duty as on a bill of exchange payable to bearer or order; but in practice the duty is openly evaded. If the law were more stringently acted upon, evasion of the duty could be easily practised, as a banker, instead of granting a written instrument, could advise his agent privately to pay certain sums to certain parties, according as the agent might be advised.

CREOSOTE. [Creasote, P. C.]

CREPIDO'PTERIS, a genus of fossil ferns, which Presl substitutes for Pecopteris of Brongniart, in the case of two species, one from Stuttgardt, the other from Newcastle.

CREPIS, a genus of plants belonging to the natural order Compositæ, the division Cichoraceæ, and the section Lactuceæ. It has many-flowered heads; a double involucre, the inner of one row, the outer of short lax scales; the fruit terete, narrowed upwards or obscurely beaked. Most of the species of this genus are common weeds in the hedges of Europe. Five of the species are found in Great Britain. The most common is the *C. virens*, which has the outer involucral scales adpressed linear, the inner ones glabrous within; the leaves lanceolate, remotely dentate, runcinate, or pinnatifid, the uppermost leaves linear, arrow-shaped, clasping with flat margins; the stem subcorymbose; the fruit shorter than the pappus, oblong, slightly attenuated upwards, with smooth ribs. This is the *C. tectorum* of Smith, but the true *tectorum* has revolute margins to its upper leaves, and other points of difference, and has never been found in Great Britain.

The other British species are, *C. pulchra*, a rare plant found in Scotland; *C. biennis*, also rare, found in chalky places in England; *C. succisæfolia*, common in woods in the north of England; *C. paludosa*, not uncommon in damp woods and shady places.

(Babington, *Manual of British Botany*.)

CRESCENTIA, a genus of plants belonging to the natural order Solanaceæ. It has a 2-leaved equal deciduous calyx; the corolla campanulate, with a fleshy tube much shorter than the ventricose 5-cleft unequal crisped limb; 4 stamens, didynamous, with the rudiment of a fifth; the fruit gourd-like, 1-celled, with a solid shell, internally pulpy, many-seeded. The species are large spreading trees, with solitary flowers rising from the trunk or branches.

C. Cujete, Cujete or Common Calabash-tree, has oblong acute or obtuse leaves, cuneate at the base, and in fascicles. This plant is a native of the West India Islands and Spanish Main. It is a tree about twenty feet high, and is readily distinguished from all others by its habit. It sends out large horizontal branches, which bear fascicles of leaves at various distances. These leaves are from four to six inches long. The flowers are scattered over the older branches; the corolla is large, somewhat campanulate and constricted below the middle, which gives the upper part a ventricose character. It does not wither up as other corollas, but becomes putrid, giving out a nauseous and intolerable odour. The form and size of the fruit is very variable, being from two inches to a foot in diameter. It is covered with a thin skin, of a greenish yellow colour when ripe, and under this is a hard woody shell which contains a pale yellowish soft pulp, of a tart unpleasant flavour, surrounding a great number of flat seeds. The shell is of great use to the inhabitants; the smaller oblong ones are formed into spoons and ladles, the larger ones form drinking cups, basins, and bowls for every variety of domestic purposes. They will even bear fire, and are used for boiling water in. The Caribs generally carve the outside of these vessels with a variety of grotesque figures. The pulp is sometimes eaten by the natives, but it is not much sought after. A syrup is prepared from it in the West Indies, which has a great reputation as a cough medicine. The pulp is also used as a poultice in cases of abscess or bruises. The leaves and branches and pulp of the fruit are eaten by cattle in times of scarcity. The wood of the tree is tough and flexible, and well adapted for the work of the coach-maker. There are three or four other species, natives of the West Indies and South America, having the same general characters as the above.

The species of Crescentia will grow in a mixture of loam, peat, and sand, and woody cuttings will grow when placed in sand in heat under a hand-glass. They do not however blossom in this country, as they require first to arrive at the full size.

(Don, *Gardener's Dictionary*; Loudon, *Encyclopædia of Plants*; Lindley, *Flora Medica.*)

CRESPI, GIUSEPPE MARIA (Cavaliere), a painter and engraver of Bologna, distinguished in his time, was born at Bologna in 1665. He was the scholar of Canuti and of Cignani, and was called Lo Spagnuolo on account of his gay attire. He was also remarkable for his perseverance in copying the works of the Carracci, Correggio, and Barroccio, and some of his copies are said to have been sold at Bologna as originals. He studied later the effect of Guercino and the composition of Pietro da Cortona. He became eventually one of the most careless and capricious of painters, though all his works exhibit great mastery; and he had a surprising facility of execution: indeed he is in this respect probably unequalled. He was however so careless, that he used any oils or colours indifferently, without investigating their properties, and in many of his works he has left the bare ground of the canvas to perform the office of a tint in the picture. Mengs terms him the destroyer of the Bolognese school. His great facility and equal success seduced the painters of his time to endeavour to obtain celebrity by similar means. There are twelve of his works in the gallery of Dresden, including the Seven Sacraments painted for Cardinal Ottoboni; and an Ecce Homo, which, with all its faults, is a most masterly performance. In colour it is rather green, but in drawing and in character it is excellent, and in boldness and security of touch surprising; it appears to have been painted in one heat, and that a short one, though it contains three half-length figures of the size of life—Christ and two Soldiers. Crespi died in 1747.

His two sons, Luigi and Antonio, followed their father's profession, but not his style. Luigi Crespi, or Don Luigi Canonico, for that is his style, is well known for his writings on art, and especially for his continuation of the 'Felsina Pittrice,' or 'Bologna Paintress,' of Count Malvasia. The count's work is in two volumes, and Crespi published a third, with the same title, in 1769. In it he has written a Life of his father, and an apology for his faults. He died in 1779.

(*Guida di Bològna*; Lanzi, *Storia Pittorica*, &c.; Bartsch, *Peintre-Graveur.*)

CRICACA'NTHUS, a genus of fossil fishes, from the mountain limestone of Armagh. (Agassiz.)

CRICO'PORA, a genus formed by Blainville out of a subdivision of the Milleporidæ, including some fossil species, which chiefly occur in the oolitic formations. C. straminea is found near Scarborough; C. cæspitosa near Bath.

CRIMINAL CONVERSATION. [ADULTERY, P. C.]

CRIMINAL LAW. [LAW, CRIMINAL, P. C. S.]

CRINOÏDEA. [ENCRINITES, P. C.]

CRINUM, a genus of plants belonging to the natural order Amaryllideaceæ. It has a tubular long perianth, with a spreading reflexed or equal limb; 6 stamens, spreading or declinate, inserted into the orifice of the tube; the ovules hardly separable from their fleshy placentæ; the capsule membranous, bursting irregularly; the seeds globose, with a fleshy testa, giving them the appearance of small tubes. The species are handsome plants, and many of them form the greatest ornaments of our gardens.

C. Asiaticum, Poison Bulb (*Radix toxicaria*, Rumph.), has a cylindrical bulb above ground; the leaves lanceolate, smooth at the edge, longer than the scape, flowers on stalked umbels, the segments long, linear, reflexed; the ovary inferior; the style as long as the stamens, declinate; the fruit membranaceous, subglobose. The bulbs of this plant are powerfully emetic, and are used in Hindustan for the purpose of producing vomiting after poison has been taken, especially that of the Antiaris. It is a native of the East Indies.

C. amabile has a very large bulb with a long red neck, the leaves broad, glaucous, smooth at the edge; the umbels many-flowered; the tube shorter than the limb. This plant is a native of the East Indies, but is now common in our greenhouses. Many of the species have been lately introduced. They grow best in a rich loam mixed with a little rotten dung. They should be potted in large pots, where they will flower abundantly. They may be propagated by suckers from the roots, or they may be raised from seed. Should the plant show any indisposition to put out suckers, it should be cut down near to the root, when it will put out plenty.

(Lindley, *Flora Medica*; Loudon, *Encyclopædia of Plants*; Herbert, *Amaryllidaceous Plants.*)

CRIOCERÁTITES. The discoidally spiral Ammonitidæ, whose whorls do not touch each other, receive this generic title. The species occur in the oolitic and lower cretaceous strata.

CRIO'CERIS. [EUPODA, P. C. S.]

CRITHMUM. [SAMPHIRE, P. C.]

CROCUS SATI'VUS—*Medical Properties of.* The saffron crocus is a native of Asia Minor, but extensively cultivated in the more southern countries of Europe. That which is obtained in England, chiefly from Suffolk, is from the Crocus autumnalis, and is scarcely now to be met with, being nearly quite supplanted by the saffron imported from Spain. The officinal part is the stigmata of the flower, with a small part of the style attached. The part of the style receives the name of Föminelle, and the less of this there is, the finer is the saffron. The stigma consists of three narrow club-shaped, somewhat petaloid portions, about one or two inches in length, of a brown or orange-yellow colour, with an aromatic, pleasant, but somewhat stupifying odour, and bitterish aromatic taste. The plant flowers in September and October, and once a day (some say twice) the stigmata are carefully plucked out of the open flowers, and dried on paper or sieves, either in the sun, in a room, or by kilns, if the weather be unfavourable for drying in the sun. The attention necessary for procuring it in perfection may be estimated from the circumstance that nearly 40,000 flowers are required to yield one pound of saffron. The statement that 107,520 or still more 203,920 flowers are required is a gross exaggeration. The good saffron occurs only in the state called *hay*; that which is termed cake saffron is entirely composed of the flowers of a compound plant called Carthamus tinctorius, or safflower. Other sophistications are said to be practised, but they are of rare occurrence, except oiling old saffron, to give it the appearance of fresh. Portions of smoked flesh are easily detected by not yielding colour like saffron. The chemical analysis by chemists agrees as to constituents, but differs as to the respective quantities, a difference arising from the quality of the specimens examined.

	Vogel and Bouillon Legrange.	Aschoff.
Volatile oil	7·5	1·4
Wax	0·5	4·0
Polychroite	65·0	52·0
Gum	6·5	10·4
Soluble albumen	0·5	—
Woody fibre	10·0	19·0
Water	10·0	10·0
Balsamic matter, soluble in æther and alcohol	—	2·0
	100·0	98·8

The volatile oil is yellow, and heavier than water, and possesses a bitter, acrid, burning taste, and is partially soluble in water. By keeping it undergoes some change, for it becomes white, and is then lighter than water. To it is chiefly owing the medicinal properties of saffron, while the colour seems owing to the *polychroite*, which seems to be a combination of a volatile oil and a red bitter substance.

Saffron formerly enjoyed a high repute, both as a perfume, and as a nervine, stomachic, and narcotic drug. That the odour has powerfully affected some very susceptible individuals is undeniable; but so little regard is now paid to it, that it is employed chiefly as a colouring ingredient, or adjunct to other more powerful agents. It is still a popular remedy during the eruptive stage of exanthematous diseases, a remnant of the old doctrine of colours; and to the same notion is to be referred the practice of giving it to canary birds when moulting, a practice reprobated by Bechstein, who judiciously recommends iron to be put into the water at such times.

(Bechstein, *On Cage Birds*, p. 223.)

CROPS. [Emblements, P. C. S.]

CROSS BILL. [Pleading, P. C.]

CROSS REMAINDERS. [Remainder, P. C.]

CROWN SOLICITOR. In state prosecutions in England the solicitor to the treasury acts as solicitor for the crown in preparing the prosecution. In Ireland there are officers called crown solicitors attached to each circuit, whose duty it is to get up every case for the crown in criminal prosecutions. They are paid by salaries. There is no such system in England, where prosecutions are conducted by solicitors appointed by the parish or other persons bound over to prosecute by the magistrates on each committal; but in Scotland the still better plan exists of a crown prosecutor in every county, who prepares every criminal prosecution whatever.

CROWNE, JOHN, an industrious play-writer, of the time of Charles II., was the son of an Independent preacher in Nova Scotia. Coming to England, and serving an old lady for some time as gentleman-usher, he next became an author by profession. He had the equivocal honour of being brought forward by the Earl of Rochester, as a dramatic rival of Dryden; and, even after he had been cast off by his capricious patron, he retained the court favour he had gained. His satires on the Whigs, especially in one of his comedies, were about to be rewarded by a post or pension, when he was disappointed by the king's death. The latter part of his life is very obscure; but he is believed to have died soon after 1703. He left in print seventeen plays. The tragedies, rhymed and bombastic, are among the worst specimens of the corrupt taste which then ruled in the drama. In the construction of the plots they and his comedies are alike perplexed and undramatic. But the comedies are his best works, and have some merit in their portraiture of characters. His two tragedies entitled 'The Destruction of Jerusalem' were highly popular when first represented; and his comedy of 'Sir Courtly Nice,' translated or imitated by him from the Spanish by desire of Charles II., was oftener than once reprinted.

CRY'OPHORUS, from the Greek words *κρύος* (cold) and the root of *φέρω*, to bear, is an instrument which was invented by Dr. Wollaston for the purpose of exhibiting the congelation of water in consequence of evaporation.

It consists of a glass tube about 9 inches long, bent near the two extremities and terminating with hollow balls of the same material. One of these balls is about half full of distilled water, which being made to boil, the air is expelled, the tube together with the other ball becoming filled with aqueous vapour: in this state the tube is hermetically sealed. The expansive force of the vapour, by producing a pressure on the surface of the water, prevents any further evaporation from thence; but, on plunging the ball containing no water into a mixture of snow and salt, the vapour in the balls and tube is suddenly condensed and a vacuum is produced, when an evaporation immediately takes place from the water, and the latter, in two or three minutes, is converted into ice.

CTENACA'NTHUS, a genus of fossil Placoid fishes, from the mountain limestone and old red-sandstone. (Agassiz.)

CTE'NODUS, a genus of fossil fishes, from the coal formation of Yorkshire and Lancashire, and the limestone of Burdiehouse. (Agassiz.)

CTENOID FISHES, a great division of fishes, thus named by Agassiz, from the pectinated appearance of the retral edges of the scales, which are of a horny substance, not bony nor enamelled. Abundant in the actual creation, they are rare as fossils in all but the more recent strata.

CTENO'LEPIS, a genus of fossil fishes, from the oolite of Stonesfield. (Agassiz.)

CUCKING-STOOL. [Tumbrel, P. C.]

CUCU'BALUS, a genus of plants belonging to the natural order Caryophylleæ. It has a 5-toothed naked calyx; 5-clawed petals; 10 stamens; 3 styles; capsule a globose 1-celled berry; reniform seeds. There is but one species of this genus, *C. baccifer*, the Berry-bearing Campion. It differs but little from the species of Silene except in its berried capsule, which is black. It is a native of Europe, and has been found wild in Great Britain. It has been undoubtedly introduced, but is scarcely naturalized.

(Babington, *Manual*.)

CUCUMITES, a genus of fossil plants, from Sheppey. (Bowerbank.)

CULDEES, the name of a religious order in Scotland, Ireland, and the north of England, whose origin may be dated from the middle of the sixth century. The information regarding their origin is chiefly derived from the memoirs of their founder Columba. Their gradual absorption, by the spread of the Romish hierarchy in Scotland, is a subject for which the chartularies and other muniments of the episcopal sees and abbacies in Scotland provide abundant materials from which a curious history might be framed by any one possessed of sufficient industry and minute attention to pursue the subject. There have been so many etymologies of the word Culdee, and they are all so purely hypothetical, that it would be a useless effort to attempt a comparative judgment on them.

Unfortunately, the history and institutions of the Culdees have been the subject of dispute between the supporters of the Episcopal and those of the Presbyterian form of church polity; the one maintaining that this primitive body were a mere collection of monastic institutions connected with the Catholic hierarchy, while it is endeavoured to be proved, on the other side, that they were the prototypes of the Protestant Presbyterians, and that their church polity, destined to predominate in the Christian world, was derived from the fountain-head of Christian truth, and communicated to modern times through the Lollards, before the Culdees were entirely extinguished. They have in this respect been compared with the Waldenses. The Culdees undoubtedly formed a part, if not the whole of that early Scottish church, which had established a different epoch for the celebration of Easter from the Catholic church, a subject subsequently productive of much dispute between the Scottish and English ecclesiastics. The ground on which the former maintained their own peculiar usages was, that they had been derived directly from the apostles, by whom, and not by the ecclesiastical representatives of St. Peter, the church in Ireland had been planted. The practice of the Culdees seems to have so far coincided with the later monastic institutions, that they lived in retirement, practised abstinence, and made devotion and the administration of religious and charitable functions their chief pursuits So far were they however from adopting a rule of celibacy, that marriage was practised and reckoned honourable among them. It is difficult to discover their precise polity. It has been found that they ordained bishops; but it farther appears that the persons bearing that name, instead of having any absolute authority over another class as Presbyters, were themselves under the authority of the president, or head of the establishment, as representing the community. The Culdees had establishments in various parts of Scotland, many of them in the form of colleges, where they kept small libraries of MSS. and gave instruction to youth. Their principal establishments, besides that of Iona, were at Abernethy in Perthshire, the island of St. Serf in Lochleven, Dunkeld, St. Andrews, and Monymusk in Aberdeenshire. Efforts have been made, though apparently without success, to identify these establishments with the episcopal dioceses, and to prove that each college or monastery, with its head and ordinary members, was virtually the dean and chapter of the diocese. The archiepiscopal see of St. Andrews appears to have owed its early predominance to the Culdees, who seem to have had considerable possessions in the neighbourhood. The great abbey of Arbroath is believed to have had a similar origin, and so is that of Melrose. Besides the dispute as to the holding of Easter, and the difference of opinion on the marriage of ecclesiastical persons, the Culdees had many subjects of dispute with the Romish hierarchy, from whose customs they seem to have diverged on the subject of auricular confession, and various others. They were at last obliged to give way before the waxing influence of the Church of Rome. St. Bernard describes the people as beasts and barbarians, who 'neither pay tithes nor first fruits. They do not enter into lawful marriage, they do not go to confession: no one can be found who applies for the prescription of penance, nor any one who will prescribe it.' The erection of the several bishoprics, under the patronage and countenance of the kings of Scotland, raised up powerful enemies to the Culdees who were within the respective territories allotted to them as dioceses; and the order was thus gradually incorporated with the Roman Catholic church.

(Jamieson, *Historical Account of the Ancient Culdees of Iona, and of their Settlements in Scotland, England, and Ireland.*)

CUMBRIAN ROCKS. Professor Sedgwick has given this term to the lowest series of slaty rocks which appear in the ranges of Skiddaw and Grasmoor Fell in Cumberland. They lie below the green slaty rocks of Scafell and the Old Man, which the same writer regards as coeval with the strata of Snowdon, and ranks under the title of Cambrian.

CUNE'GO, DOME'NICO, a distinguished Italian engraver, and one of the best of the eighteenth century, was born at Verona in 1727. He commenced to study as a painter under Francesco Ferrari, but he found engraving more suited to his taste, and, at the age of eighteen, he adopted it as his profession. He was particularly well qualified in one respect, as he was a correct draftsman, and was accordingly enabled himself to make, from the pictures he engraved, the drawings from which he worked. Cunego settled in Rome in 1761, where his first works were a series of Roman Ruins after Clerisseau, for the Count Girolamo dal Pozzo. In 1773 Gavin Hamilton published his 'Schola Italica,' of which the best and the greater part of the plates were engraved by Cunego. He engraved twenty-two, including the three creations—of the water, of the sun, and the moon, and of Adam, from the frescoes of Michael Angelo on the ceiling of the Sistine Chapel; La Fornarina of Raphael, from the Barberini portrait; and Galatea, from the fresco of Raphael in the Farnesina. The others are from Giorgione, Titian, the Carracci, Domenichino, Guido, and other celebrated painters.

In 1785 Cunego was invited to Berlin to superintend an Engraving Institute (Kupferstich-Institute), which was established by a merchant of the name of Pascal; but after a trial of four years the undertaking was abandoned, and Cunego returned in 1789 to Rome. He however executed a great many plates, chiefly portraits, during his sojourn in Berlin, including several mezzotint and line portraits of Frederic II. and the royal family of Prussia, after E. F. Cunningham, a Scotch painter, then in repute at Berlin. Cunego engraved eleven mythological subjects after Gavin Hamilton, besides numerous other works, religious and profane, after various masters. He engraved also an outline of the great fresco of the Last Judgment, by Michael Angelo, in the Sistine Chapel. He died at Rome in 1794. Cunego's execution, as far as respects the mere line, was not the most perfect, but his style was light, elegant, and correct; and he is considered by some critics to have been the best historical engraver in Italy of his immediate time: he was however latterly surpassed by his junior and rival Volpato. His two sons, Aloisi and Giuseppe, likewise practised engraving with success.

(Gandellini, *Notizie Istoriche degli Intagliatori*, &c.; Huber, *Manuel des Amateurs*, &c.; Goethe, *Winckelmann und sein Jahrhundert*; Ticozzi, *Dizzionario degli Architetti*, &c.)

CUNNINGHAM, JOHN, the son of a Scotchman settled at Dublin as a wine merchant, was born there in 1729. An ill-judged passion for the stage tempted him away from home at an early age. His father afterwards became insolvent; and a pride not discreditable to him forbade him to return and be a burden on his family. Accordingly he continued, during his short life, to pursue the precarious career of an itinerant player. For a good many of his later years he was chiefly employed at Edinburgh and in the north of England, where his personal character was highly respected. He was the author of a farce now quite unknown, and of several small volumes of poetry, chiefly pastoral, whose sweetness has obtained for some of them a corner in popular collections, and entitles their author to a place in the list of minor English poets.

CUNNINGHAM, ALLAN, was born at Blackwood in Dumfriesshire, in 1785, of parents in very humble circumstances, though not of humble descent, as one of his ancestors lost the family patrimony in Ayrshire by taking the side of Montrose in the time of the Commonwealth. 'His father,' says Allan Cunningham, 'was a man fond of collecting all that was characteristic of his country;' an inquiry which the son appears to have prosecuted, if not with more zeal, at least with more effect. Young Allan was taken away from school at the early age of eleven, and was bound to a stonemason. Hogg gives us some account of Allan's appearance and character in early life, in his 'Reminiscences of Former Days;' he describes him at the age of eighteen as 'a dark ungainly youth, with a broadly frame for his age, and strongly-marked manly features, the very model of Burns, and exactly such a man.' Hogg continues, that young as Allan Cunningham then was, he had heard of the name, and he thought he had seen one or two of his juvenile pieces.

In 1810 he came to London, and his name first appeared in print at the same time, as a contributor in the collection of Cromek's 'Remains of Nithsdale and Galloway Song.' This collection, purporting to be Nithsdale and Galloway relics, was entirely recast and much of it written by Allan Cunningham, and Hogg states that when he first saw the book, he perceived at once the strains of Allan Cunningham, especially in the 'Mermaid of Galloway,' from the peculiarity of his style, which he had already noticed, and he adds that 'Allan Cunningham was the author of all that was beautiful in the work.' Hogg wrote a review of it, and sent it to Jeffrey, who, after retaining the review for some time, returned it with a note saying, that he had read over the article, and was convinced of the fraud which had been attempted to be played off on the public, but that he did not think it worthy of exposure.

For some time after his arrival in London, Allan Cunningham maintained himself by reporting for newspapers, and contributing to periodicals, especially the 'London Magazine,' to which he was one of the principal supports. At a later period, the situation which he obtained in Chantrey's studio, as foreman or principal assistant in working the marble, enabled him to prosecute his literary taste without hazard. The following are his chief works: 'Sir Marmaduke Maxwell,' a drama; 'Paul Jones,' and 'Sir Michael Scot,' novels; 'Songs of Scotland, ancient and modern, with Introduction and Notes, Historical and Critical, and Characters of the Lyric Poets,' 4 vols. 8vo. 1825; 'The Lives of the most eminent British Painters, Sculptors, and Architects,' in 'Murray's 'Family Library,' 6 vols. 12mo., 1829-33; the Literary Illustrations to Major's 'Cabinet Gallery of Pictures,' 1833-34; 'The Maid of Elvar,' a poem; 'Lord Roldan,' a romance; 'The Life of Burns;' and 'The Life of Sir David Wilkie,' 3 vols. 8vo. 1843, a posthumous publication. Allan Cunningham died on the 5th of November, 1842, aged fifty-seven.

To appreciate duly the songs of Allan Cunningham, probably requires a man to be of Scotch origin: he appears to have been valued by his literary contemporaries of Scotland; by Sir Walter Scott, and particularly by the Ettrick Shepherd. Hogg, after recounting his first meeting with him, says, 'I never missed an opportunity of meeting with Allan when it was in my power to do so. I was astonished at the luxuriousness of his fancy. It was boundless; but it was the luxury of a rich garden, overrun with rampant weeds. He was likewise then a great mannerist in expression, and no man could mistake his verses for those of any other man. I remember seeing some imitations of Ossian by him, which I thought exceedingly good: and it struck me that that style of composition was peculiarly fitted for his vast and fervent imagination.' His 'style of poetry is greatly changed of late for the better. I have never seen any style improved so much. It is free of all that crudeness and mannerism that once marked it so decidedly. He is now uniformly lively, serious, descriptive, or pathetic, as he changes his subject; but formerly he jumbled all these together, as in a boiling cauldron, and when once he began, it was impossible to calculate where or when he was going to end.'

Allan has had however his English admirers also; among the foremost of these was Miss Landon, concerning whom and a few others of his associates, some interesting details appeared in the Britannia newspaper shortly after his death, in November, 1842. Flaxman also, according to Cunningham's own account, must be numbered among his English admirers, as appears from what Cunningham says in his Life of Flaxman.

Allan Cunningham is however better known in England and abroad for his 'Lives of the Painters,' &c. than for his poetry. This popular work contains memoirs of Hogarth, Wilson, Reynolds, Gainsborough, West, Barry, Blake, Opie, Morland, Bird, Fuseli, Jamesone, Ramsay, Romney, Runciman, Copley, Mortimer, Raeburn, Hoppner, Owen, Harlow, Bonington, Cosway, Allan, Northcote, Sir G. Beaumont, Lawrence, Jackson, Liversege, and James Burnet, painters; of Gibbons, Cibber, Roubiliac, Wilton, Banks, Nollekens, Bacon, Mrs. Damer, and Flaxman, sculptors; and of William of Wykeham, Inigo Jones, Wren, Vanbrugh, Gibbs, Kent, Earl of Burlington, and Sir W. Chambers, architects. The work is popular not on account of the execution of the lives, but on account of the subject; to those however really interested in the subject it is invariably unsatisfactory. The lives are not impartially written, facts are not investigated, statements are made without any reference to authority, anecdotes are recast to suit the author's taste; and, in fact, its chief merit is that of an easy, fluent, and forcible style. The less satisfactory lives are those of West, Blake, Bird, Fuseli, Jamesone, Cosway, Northcote, Wilton, and Bacon: in some of these there is the occasional appearance of a spirit of malevolence, evident enough to force itself into notice: his style is also frequently contemptuous; whether this was his misfortune or his fault those who knew him can best decide. Even his most lauded life, that of Blake, has given little satisfaction to Blake's friends; the editor of a new edition of Blake's 'Songs of Innocence and of Experience,' in 1839, says, in his preface and biographical notice, 'Though we have gladly availed ourselves of Mr. Allan Cunningham's facts, we have been sedulous to exclude from our pages his tone of feeling, and style of thought, in speaking of Blake.' Again, says the writer, 'That Sense and Self are realities; that God, and Nature, and our fellow-men, are current terms,—whence originating or how disposed of it matters not,—has been established, on the basis of Doubt, by David Hume; and has been carried out into some of the details requisite for making it into a 'System of Philosophy,' by Thomas Brown and Dugald Stewart. Behold, then, in the 'Lives of British Painters,' the application of the system to art and the souls of artists. He who has thus applied it possesses eminently the qualifying power of transmuting things into words; and into just such words as imply a negation of the things they stand for.'

Passavant also, in his work on England, 'Kunstreise durch England,' &c., in noticing Allan Cunningham's 'Lives,' observes, 'This work contains several errors, and displays a propensity for relating all sorts of often demeaning and seldom founded anecdotes,' p. 346.

The following few quotations from the work itself will serve in part to justify these censures, though they are a very small portion of the passages that might be adduced. Of West he says, 'He was the first and last President of our Academy who found spelling a difficulty;' of Wilton he says, 'As one eye is enough to make a man king among the blind, Wilton triumphed over all his fellows;' of Bacon he says, 'He was charitable, at least in theory; to resolve to do a benevolent act, indicates a man who can take one step, at least, in the road of mercy; and it may be the fault of the reporters that I have heard oftener of his theory than of his practice.' Of Northcote several such passages might be quoted. His general remarks of the kind are perhaps more numerous than his special ones, as the following in the Life of Owen: 'Art has not yet become with us a fashionable profession for the gentleman and scholar: certain neglect now, and an indifferent memoir hereafter, are no inducements for the polite and the rich to take to the brush or the chisel; and the consequence is, when time thins the ranks of the Academy, the vacancies are supplied by the chance children of genius, who have come from the plough, the manufactory, or the shop, to assert the truth of the great principle of nature, that talent, like sunshine, sheds its light on all conditions. Such is the story of most of our first-rate artists.' This is true of some, but not of 'most of our first-rate artists.'

CUPRESSINITES, a genus of fossil plants, from Sheppey, containing thirteen species. (Bowerbank.)

CUPRESSOCRINITES, a genus of Crinoïdea. (Goldfuss.)

CURCU'LIO, a genus of insects founded by Linnaeus for such tetramerous Coleoptera as have club-shaped antennæ inserted on a prolonged rostrum. In the twelfth edition of the 'Systema Naturae,' ninety-five species are enumerated. The progress of entomology has converted the genus as defined by its founder into a family including several thousand species, though the original name is retained for a few South American beetles, of which *Curculio splendidus* is the type.

The family of *Curculionidae*, as at present constructed, has been made the subject of special research on the Continent by M. Schoenherr, and in England by Mr. Walton. The former entomologist has published a work, as yet incomplete, entitled 'Genera et Species Curculionidum,' in which no fewer than 4089 species, distributed through 404 genera, have been already described, and as many more remain for description.

For notices of the habits of these insects, see WEEVIL, P. C.

CU'RCUMA, a genus of plants belonging to the natural order Zingiberaceæ. It has the tube of the corolla gradually enlarged upwards; the limb 2-lipped, each lip 3-parted; the single filament broad; the anther incumbent, with two spurs at the base; the style capillary; the capsule 3-celled; the seeds numerous, arillate. The species are stemless plants with tuberose roots; the flowers are of a dull yellow colour, surrounded by bracteolæ.

C. Zerumbet, Zedoary, has lateral spikes, the tubers palmate, pale straw-coloured; the leaves from 4 to 6 together, with a long somewhat winged petiole, with a dark purple cloud running down the centre; the flowers shorter than the bracteolæ; the embryo truncate, nearly as long as the seed, the upper half lodged in the vitellus, the lower half in the perisperm. This plant is the *Zedoaria longa* of the shops, and has the same property as the following species. It is a native of the East Indies and Java.

C. Zedoaria, Broad-leaved Turmeric, has the spikes lateral; biennial tubers which are yellow internally; the leaves petioled broad-lanceolate, entire, underneath covered with soft sericeous down. This is the *Zedoaria rotunda* of the shops. Fée has confounded this plant with *Kæmpferia rotunda*, which has no sensible properties resembling the plant in question. The tubers of this plant are aromatic, and are used by the Hindus not only as a stimulating condiment and a medicine, but as a perfume. Its sensible properties are very like those of ginger, but not so powerful. It is employed in the East in cases of disease, as colic, cramp, torpor, &c., where stimulants are indicated. The Zedoary is used under the same circumstances. The roots of both these plants are imported into Europe, but are not used extensively. *C. Zedoaria* is a native of Bengal, China, and various other parts of Asia, and of the Asiatic Islands.

C. rubescens has lateral spikes, the tubers pearl-coloured inside; the leaves bifarious, broad-lanceolate, cuspidate, smooth, strongly marked with parallel veins, of a uniform dark green with the nerves or ribs red, 12 to 24 inches long, 5 or 6 broad; the scapes invested with several dark reddish sheaths. It is a native of Bengal. All the parts of the plant have a pleasant aromatic smell when the plant is bruised. The pendulous tubers of this and several other species of Curcuma yield starch, and are employed by the natives for preparing arrow-root. In Travancore it forms the principal diet of the natives.

C. Amada, Mango Ginger, has few-flowered central spikes; the tubers horizontal, palmate, of a deep orange colour inside; the leaves radical, bifarious, petioled above their sheaths, lanceolate cuspidate, smooth on both sides, from 6 to 18 inches long by 3 to 6 broad. This plant is a native of Bengal, and is called by the Bengalees 'Amada.' It is called mango ginger because the fresh root has the smell of a mango. It is used for the same purposes as ginger.

C. leucorhiza grows in the forests of Bahar, where it is called 'Tikor.' It has remarkably long tubers, often a foot in length, of a pale yellow inside, and they produce an excellent arrow root.

C. angustifolia, with stalked narrow lanceolate leaves, is a native of the forests of India from the banks of the Lona to Nagpore. Its tubers, which are found at the end of fleshy fibres which meet together forming a crown, yield an excellent arrow-root, which is that met with in the markets of Benares.

C. longa, the common Turmeric, is cultivated all over India, and is used as a condiment, and for dyeing. [CURCUMA LONGA, P. C.]

There are several other species of Curcuma, but the above are those which yield aromatic oils and starch in greatest abundance.

(Lindley, *Florica Medica*; Loudon, *Encyclopædia of Plants*.)

CURCUMA LONGA, *Medical Properties of.* This perennial plant, belonging to the tribe Zingiberaceæ, is not ascertained to be native of any particular country in the East; it is occasionally wild, and it is also extensively cultivated in China, Java, Malacca, and in Bengal, prospering in a moist but not swampy soil. The mode of culture is described in P. C. viii. p. 233. The Chinese sort is most esteemed, rather on account of its superior richness in colouring matter than from any other cause. Two varieties are found in commerce, the round turmeric (Curcuma rotunda) and long turmeric (C. longa). These are generally regarded as the produce of the same plant; but even were they yielded by two, it is altogether incorrect to assign the round to Curcuma rotunda, Linn., which is the Kæmpferia ovata, Roscoe, a rare plant, the root of which is destitute of any colouring principle. The name is derived from the Persian kurkum, which means saffron; hence it is sometimes termed Saffran des Indes, but must not be confounded with common saffron, from Crocus sativus. It is likewise called by the French Terra merita (Curcuma, haec Gallis Terra merita male dicitur), see Royle, 'Antiquity of Hindoo Medicine,' p. 87.

Round turmeric occurs in knobs, roundish, ovate, or oval, sometimes pointed, and insensibly running into the long turmeric, and is of a deeper, more camboge-like colour in the interior. The pieces are from one to two inches long, and nearly one in diameter. The long turmeric occurs in pieces about two inches long, either straight, or curved, and doubled up, presenting on the surface more marks whence the rootfibres have sprung. The colour externally is of a brownish yellow, internally lighter than that of the round sort. The fracture has a waxy appearance, and the odour is unctuous. The taste is bitterish, aromatic, and like ginger, but less potent. 'In the fresh state it has a rather unpleasant smell, somewhat resembling cerate, which goes off a good deal on drying.'—Ainslie's Mat. Indica. This article is very liable to be eaten by small beetles. Old, worm-eaten specimens should be rejected. Hard compact pieces, which with difficulty can be powdered, are best. It has been analysed by John, and subsequently by Vogel and Pelletier:—

John's Analysis.		Vogel and Pelletier's.
Yellow volatile oil	1	Acrid volatile oil.
Curcumin	10 to 11	Curcumin.
Yellow extractive	11 to 12	Brown colouring matter.
Gum	14	Gum (a little).
Woody fibre	57	Starch.
Water and loss	7 to 5	Woody fibre.
		Chloride of calcium.
Turmeric	100	

The colouring matter is given out very freely to water, and alcohol, but curcumin in a pure state can only be obtained by digesting the alcoholic extract of turmeric in aether, and evaporating the aetherial tincture to dryness. Its appearance in the mass is brownish yellow, but when powdered a full yellow. It is tasteless, odourless, almost insoluble in water, but readily soluble in alcohol and aether. The alkalies colour it reddish-brown, and readily dissolve it. The alcoholic solution evaporated with boracic acid, becomes red. Hydrochloric acid also reddens it. The alcoholic solution of curcumin produces coloured precipitates, with several salts, such as acetate of lead and nitrate of silver (Pereira). The frequent use of turmeric as a test renders a knowledge of these points necessary. (See Fresenius, 'Chemical Analysis,' by Bullock, p. 31.)

Turmeric has aromatic qualities which render it useful in languid habits, where digestion is difficult, and the circulation slow. The repute it enjoyed as a cure for jaundice and dropsies was founded on the doctrine of signatures (Cullen, 'Mat. Med.,' i. p. 25). It is of some importance as a dye, but it is as a condiment, both in the East and in this country, that it merits notice, as it is an ingredient in all curry powders and *curry pastes*. When in excess the colour is too brown, and one flavour predominates, which is contrary to sound apician law. The same observation applies to Cayenne pepper. 'With us, turmeric and Cayenne pepper prevail in them far too powerfully.'—Acton's 'Modern Cookery,' p. 287. The following table, extracted from the 'Pharmaceutical Journal,' vol. iv. p. 364, supplies an infinite variety of receipts for preparing curry powder. But whichever is preferred should have added to it some *mushroom-powder*. The meat, fish, or whatever article is employed as the basis of the curry should always be so perfectly boiled that it can be eaten with a spoon. This necessarily destroys the natural flavour of the meat. The mushroom-powder contains *osmazome*, the source of flavour in meat, and consequently it restores what the long cooking has dissipated. The curry-powder should not be added to the dish till a few minutes before it is to be served to table. [FOOD, P. C.]

	A.	B.	C.	D.	E.	F.	G.	H.	I.	J.	K.	L.	M.	N.	O.	P.	Q.	R.	S.	T.	U.
Turmeric	4oz.	2oz.	3oz.	5oz.	6oz.	2oz.	8oz.	6oz.	8oz.	3oz.	2oz.	8oz.	6oz.	4lb.	3oz.	8oz.	2½oz.	8oz.	3oz.	4oz.	2oz.
Coriander Seeds	8	6	1	3	1	1	2	13	2	4	2	16	6	4	6½	4	1½	2	12	13	6
Ginger	3	½	1	1	1	2	2	..	..	2	2	..	..	1	1	..	½	2	..	2dr.	..
Cinnamon	½	2dr.	..	..	½	..	..	..	½	..	..	..	..	..	1½	..	..	..	..	..	..
Cassia	..	..	..	..	..	..	..	..	2	..	..	..	..	2oz.	..	..	..	..	2dr.	2	..
Cardamoms	½	..	1	1	..	½	1	..	..	2	½	..	..	4	..	..	½	..	½oz.	2	..
Grains of Paradise	..	..	..	..	..	..	..	..	1	..	..	..	2	..	..	..	..	..	..	..	..
Chillies	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Caraways	..	..	..	..	..	..	..	..	..	..	..	..	4	..	..	..	..	..	..	..	..
Cayenne	..	6	½	1	½	½	1	1	½	2	½	1½	½	1lb.	½	½	½	1	6dr.	½oz.	½
Black Pepper	1½	½oz.	..	1	4	..	2	2	1	1	..	1½	1	..	2½	..	½	..	2oz.	2	3
Mace	..	1dr.	..	½	..	..	..	..	2dr.	..	..	..	..	1oz.	..	..	½	..	..	..	..
Fenugreek	..	1½oz.	½	..	1	..	..	..	..	..	..	2	..	..	1	2	..	1	1	..	1
Cummin	2	..	½	..	1	½	2	3	..	..	½	..	..	..	..	2	..	1	4	3	2
Pimento	..	2dr.	..	..	..	..	..	..	..	..	..	..	..	1lb.	1	..	..	..	2dr.	2dr.	..
Cloves	..	1	..	..	..	..	..	..	½oz.	..	..	..	..	1oz.	2dr.	..	..	½	2	2	..
Nutmeg	..	½oz.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..
White Pepper	..	..	1	..	..	1	..	..	..	..	1	..	..	..	..	..	..	1	..	..	..
Scorched Mustard	..	..	..	2	..	..	..	..	..	3	..	..	..	..	..	..	1	..	..	..	..
Lemon Peel, in powder	..	..	..	..	..	1	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..

CURIA MURIA, or better, KOORYA MOORYA ISLANDS, are situated on the southern coast of Arabia, and afford protection to an open bay called Koorya Moorya Bay, which is extensive, and has good soundings throughout. They lie in the direction of the eastern continuation of Rass Noss, a very elevated headland, and lie between 55° 20′ and 66° 10′ E. long., and near 17° 30′ N. lat. They are five in number, called from west to east Hasik, Soda, Hallanny, Karzawet, and Jebeliya. A long reef is said to extend from Hallanny to Soda, so as to render it very dangerous, if not impossible, for any vessel to pass between them; but between Soda, Hasik, and the main land, the channels are good. Hallany, the only island that is inhabited, contains twenty-three individuals: the anchorage and village are at the northern extremity, where water may be obtained, but it is brackish. Its mountains are high, and apparently of volcanic origin.

(Captain Owen, *Narrative of Voyages to explore the Shores of Africa, Arabia, and Madagascar*; Dr. Hutton's 'Account of the Curia Muria Isles,' in *London Geographical Journal*, vol. xi.)

CURRANT. [RIBES, P. C.]

CURRYING. [LEATHER, P. C. S.]

CURSITOR BARON, an officer of the Court of Exchequer, is appointed by patent under the great seal to be one of the barons of the Exchequer. He attends at Westminster to open the court prior to the commencement of each of the four terms, and on the seal day after each term to close the court. He administers the oaths to all high-sheriffs and under-sheriffs who are sworn by the court, and to several officers of revenue. Prior to 1833 he had various other duties to perform; but since the passing of the act 3 & 4 Will. IV. c. 99, much of the business of his office has entirely ceased; and the commissioners appointed under the 1 Will. IV. c. 58, in reporting on the consolidation of the offices in the Courts of Queen's Bench and Common Pleas, recommended the abolition of the office of cursitor baron. This recommendation, however, has not been carried into effect. (*Report of Commissioners on Offices of Courts of Justice*, 1822; *Parl. Paper*, No. 125; *Parl. Paper*, 1835, No. 314.)

CURVE. In the article CURVE, P. C., a list of curves is given, for which reference is made to their several articles. As one or two of these have been omitted or misplaced, we insert the present article to supply deficiencies. The numbers at the head of each paragraph refer to the list just mentioned.

5. *Semicubical parabola*. The term *parabola* has been extended to mean any curve having an equation of the form $y=ax^m$, where m is positive. Thus $y=ax^3$ is the cubical parabola, and $y=ax^{\frac{3}{2}}$ is the semicubical parabola. The semicubical parabola is the evolute of the common parabola.

8. *Trisectrix*. See this curve described in TRISECTION, P. C., and figured in TROCHOIDAL CURVES, P. C., page 289.

11 and 12. For the *Companion to the Cycloid*, see CYCLOID, P. C. The harmonic curve, so called because it, or a portion of it, is one of the simplest forms assumed by a vibrating string, has for its equation the relation between x and y implied in

$$x = a\theta \qquad y = b(1-\cos\theta).$$

12 to 17. These curves are all described in TROCHOIDAL CURVES, P. C.

20 to 24. See SPIRAL, P. C.

30. *Ovals of Cassini.* Dominic Cassini (see James Cassini's *Astronomy*, vol. i. p. 149) proposed, as a better representation of the planetary motions than the ellipse, a curve in which the rectangle of the distances from any point in it to two fixed foci is constant. This curve is of the fourth order, and may be one oval, a lemniscate form, or two separate ovals, according to the ratio of the given rectangle to the square on the distance between the foci. It is hardly necessary to say that Cassini was wrong in his application of this curve: but the celebrity of his name has kept his oval or ovals among the curves which serve for exercise to beginners.

31. *Watt's Parallel Motion Curve.* The end of the beam of a steam-engine describes an arc of a circle; but it is required that the end of the piston-rod, which must be in some way attached to it, should describe a straight line, or a curve which is very nearly a straight line. Now at and near a point of contrary flexure the arc of a curve is very nearly straight. If two rods revolve round fixed pivots, their ends being connected by a third rod, the middle point of that third rod will describe a curve which has a point of contrary flexure; and if the lengths of the rods be properly taken, and if one of the rods be the beam of the steam-engine, the reciprocating rotatory motion of the beam may be made to communicate what is practically a reciprocating rectilinear (improperly called parallel) motion to the middle point of the third rod, on account of the arc described by that middle point containing the point of contrary flexure. A piston therefore may be attached to the middle point of the third rod, and the requisite condition is practically satisfied. The apparatus described in STEAM-ENGINE, P. C., p. 477, and in Lardner's 'Steam-engine,' pp. 195-201, consists in the addition of a pair of rods which with the first and third compose a parallelogram moveable at all its joints. This is intended to furnish the same reciprocating rectilinear motion to a second piston placed at the new joint, which is nothing to our present purpose. Watt's parallel motion curve must be defined as the locus of the middle point of a straight line of given length, the ends of which describe arcs of circles.

The following considerations on the definition of the word *curve* will be useful to the young analyst:—

Geometrically speaking, a curve is described by a point which moves according to one uniform law, and does not describe a straight line. An oval, for instance, formed by arcs of circles in the manner described in books on mensuration, is not a curve, but a junction of several arcs of different curves: and even the two branches of an hyperbola cannot be said, in this primitive view of the subject, to be anything but two curves; accordingly they *were* called opposite hyperbolas.

But, algebraically speaking, the meaning of the word curve is much extended. Every curve, just defined, has one permanent equation connecting the abscissa and ordinate of every point in it. The converse is made true by extension of the definition of the word *curve*. All the points whose co-ordinates satisfy an equation constitute the curve to which the equation is said to belong. Let x and y be the abscissa and ordinate of a point; and $\phi(x, y) = 0$, the equation which is to connect them. If this equation be satisfied when $x=a$ and $y=b$, the point whose co-ordinates are a and b is considered in every case as belonging to the *curve* whose equation is $\phi(x, y)=0$. The consequence is that a curve, or what is so called in algebra, may be either the simple curve of geometry —or a collection of such curves formed under algebraical modifications of one law—or a collection of such curves not even algebraically connected—or an isolated point—or a collection of isolated points at finite distances from one another—or a collection of isolated points infinitely near to one another, but which nevertheless cannot be considered as forming one continuous branch of an ordinary curve. Or it may be any combination of two or more of these. We give some instances, as follows:—

1. The equation $y—m^2x^2 = a^2$ belongs to both the branches of an hyperbola. If a change, m remaining constant, the hyperbola becomes a different hyperbola, with the same asymptotes as before. But if $a=0$, the equation belongs simply to those two asymptotes, that is, to two distinct and independent straight lines. In like manner the equation

$$(x^2+y^2)\ (x+y)=x^2+y^2+x+y-a$$

belongs to a complicated curve, with various branches. But if $a=1$, this curve resolves itself into two distinct curves, the straight line $x+y=1$, and the circle $x^2+y^2=1$. For the equation can then be reduced to

$$(x^2+y^2-1)\ (x+y-1)=0$$

which is satisfied whenever either $x^2+y^2-1=0$ or $x+y-1=0$ is satisfied. If a, instead of being $=1$, is only very near to 1, the curve approaches very near to the circle just mentioned throughout, and, except for great values of x, also to the straight line.

2. The equation

$$(x-a)^2+m(y-b)^2=0$$

belongs to a distinct pair of straight lines when m is negative. But when m is positive, it belongs to nothing but the point whose co-ordinates are a and b.

3. The equation

$$y=ax^2+\sin x . x^4$$

belongs to a branch with an infinite number of intersecting convolutions, when x is positive: but when x is negative, it belongs to nothing but an infinite number of isolated points, situated at finite distances from each other on a parabola.

4. If $y=a^x$, a being positive, there is a continuous branch in which there is a positive ordinate for all values of x. There can be no negative ordinate except for values of x which have, when in their lowest terms, odd numerators and even denominators. But between any two values of x can be interposed an infinite number of such fractions. There is then a branch of the curve which, though it may be said to contain an infinite number of points, infinitely near together, cannot be called continuous. For there is no negative value of y when x is a fraction which has an even numerator and an odd denominator. These *pointed branches*, as they have been called, have only been recently considered. Their admission depends entirely upon definition. Those who would restrict the meaning of the word curve to something like its antient signification, will reject them: but those who wish to look upon a curve as a tabulation in space of every possible value of x and y which will satisfy a given equation, must admit them. The few hints here given on the extension of the word curve are meant to excite the curiosity of those who have not been accustomed to look at geometrical interpretation as subordinate to algebra.

CUSCO-CHINA, *Medical Properties of.* This bark, which was first distinguished from the common cinchona barks by Jobst, comes from Cuzco in Peru, but the tree which yields it is altogether unknown. It is considered by some to be the same bark as the Arica bark, but this also is doubtful. That it is not the same as the Cinchona rubiginosa of Bergen, though so called by Leverköhn, is certain. In general attributes it approaches the yellow (calisaya) barks, but it differs from all heretofore described, in the chemical characters of the alcaloid it contains. This is termed Cusco-cinchonia, or Cusconina, but it is improper to consider Aricina as synonymous with it, since it is by no means certain that Arica bark and the one now described are identical.

The alcaloid is procured by the same process as is used for cinchonia, which it resembles in its physical qualities, but differs in its chemical habitudes. The taste is more bitter, rather heating, and sub-astringent. It is equally insoluble in water, but easily so in alcohol and in sulphuric aether. It forms with acids salts which resemble those of cinchonia, but have a more bitter taste. The sulphate conducts itself singularly. A concentrated watery solution of this salt forms on cooling a tremulous jelly, which on drying becomes horny, but which, by the assistance of boiling water, resumes the jelly-like state. Cinchonia, quinia, and cusconia are supposed to be one base or radical with progressively increasing proportions of oxygen.

The formula of these is

$(\mathrm{C4^{\circ}\ H24\ Az^2}) + \mathrm{O}$ cinchonia.
$(\mathrm{C4^{\circ}\ H24\ Az^2}) + \mathrm{O^2}$ quinia.
$(\mathrm{C4^{\circ}\ H24\ Az^2}) + \mathrm{O^3}$ cusconia.

This composition renders it worthy in the highest degree of the attention of medical men. The warmth which it excites points out the propriety of giving it in cold intermittents, and low typhoid states of the system.

CUSPA'RIA. [GALIPÆA, P. C.]

CUSTOMARY FREEHOLDS. [COPYHOLD, P. C. S.]

CUSTOMS' DUTIES. [TARIFF, P. C. S.]

CUSTOS BRE'VIUM. Officers so called existed until lately both in the Court of Queen's Bench and the Court of Common Pleas. They received and had the custody of all the writs returnable in their respective courts, filed warrants of attorney, and various other documents connected with the business of the courts. By virtue of the act 1 Will. IV. c. 58, these offices (of which the duties were performed by deputy) were abolished in both courts, and compensation granted to their possessors. The office in the Court of Queen's

Bench was held by Lords Kenyon and Ellenborough jointly, and the compensation granted them was 2089*l.* 17*s.* 4*d.* per annum. In the Court of Common Pleas the compensation granted to the custos brevium was 606*l.* 10*s.* 6*d.* per annum. (*Parl. Papers*, 1835, No. 314, 1844, No. 413.)

CUSTOS ROTULO'RUM is the chief civil officer of the county, to whose custody are committed the records or rolls of the sessions. He is always a justice of the peace and quorum in the county for which he is appointed. The lord-lieutenant has the chief military command of the county, and his office is quite distinct from that of custos rotulorum; but it is the invariable practice to appoint the same person to both offices, in whom is united the highest military and civil authority within the county. By statute 37 Hen. VIII. c. 1, and 1 Wm. III. c. 21, he is appointed under the queen's sign manual. As he has the custody of the rolls of the sessions, he should attend there in person or by deputy; and this duty is performed by the clerk of the peace as his deputy. [Clerk of the Peace, P. C. S.]

(Blackstone, *Comm.*; Burn, *Justice of the Peace*; Dickinson, *Guide to Quarter-Sessions.*)

CUTTING AND STABBING. [Maim, P. C.]

CUYP. [Kuyp, P. C.]

CYANOGEN, CHLORIDE OF. [Chemistry, P. C. S.]

CYANOMETER, from the Greek works κυανός (blue) and μέτρον (a measure), is an instrument which was invented by M. de Saussure for the purpose of enabling an observer to ascertain the intensity of colour in the sky.

It is well known that the visible heavens, when free from clouds, appear to have a blue tint which gradually increases in intensity from the horizon towards the zenith, that the blueness is more intense by night than by day, and that on the tops of mountains the colour is sometimes so deep as to be almost black. These appearances depend partly on the different extents of atmosphere which the rays of light have to pass through, and partly on the quantity of water which the air holds in solution. When, as towards the zenith, the atmospheric space traversed by the light is comparatively small, the violet and blue rays are transmitted to the earth in abundance; while, towards the horizon, the spaces passed through being greater and being charged with vapours, the violet, the blue, and even the green rays are intercepted, the remaining colours only of the spectrum being transmitted: it must, however, be added that the colour of the sky is affected by the terrestrial particles which are occasionally raised in the atmosphere; and also by the reflexions of light from terrestrial objects, particularly from naked rocks and from masses of snow or ice. The colour of the sky being thus, in some measure, an indication of the state of the atmosphere with respect to exhalations and the reflexions of light from the earth's surface; it is of importance to ascertain with some precision the intensity of that colour.

The Cyanometer, as formed by the inventor, consists of a circular plate or ring, of metal or pasteboard, on the surface of which, about the circumference, is a band divided by radii into fifty-three equal compartments. One of these is white, and those which follow in succession are coloured with blue of different degrees of intensity from the most faint to the deepest which can be produced; the rest of the compartments are coloured with mixtures of Prussian blue and ivory-black, and gradually increase in darkness to the last division, which is quite black.

In using the instrument, the observer, who should be in the open air, holds it up between himself and that part of the sky at which he intends to ascertain the colour; and this part should be such that, while the face of the instrument is strongly enlightened, the direct rays of the sun may not fall upon it: on turning the plate or ring in its own plane, till there is brought directly before the part of the sky that compartment which, to the eye, appears to be exactly equal to it in intensity of tint; the number of the compartment will express the required intensity of the blue colour in that part of the sky.

In order to form a scale of numbers for the tints M. de Saussure placed against a wall a piece of white paper, on which was a circular black spot, about one-seventh of an inch in diameter, and receded from it till the spot ceased to be visible: he then laid on paper a tint produced by Prussian blue, so diluted that, at a distance from it equal to that at which the black spot became invisible, the tint could not be distinguished from a perfect white. This tint was marked No. 1. The next deeper colour was produced by diluting the Prussian blue till, at an equal distance, the tint ceased to be distinguished from that of No. 1, the latter being near the eye: this was marked No. 2; and each of the succeeding numbers up to No. 53 was determined in like manner by a comparison of the corresponding tint with that which preceded it on the plate.

CYANURIC ACID. [Chemistry, P. C. S.]

CYA'THEA, a genus of plants belonging to the natural order of Ferns. The sori are globose, situated upon a vein or veinlet, or in the axil of a fork of the vein; the receptacle elevated, globose, or columnar; the involucre globose, inferior, membranaceous, or somewhat horny, at first entire and covering the whole sorus, afterwards bursting from the top with a nearly circular opening, becoming cup-shaped, more or less entire, or laciniated, or lobed; the veins pinnate, simple, or forked, free. (Hooker.) The species are arborescent, and the trunks are often beautifully marked with the scars of the fallen fronds. The fronds are simple or pinnate, or decompoundly pinnate. The stipes is frequently aculeated. The species of this extensive genus of Ferns are found most highly developed in tropical climates. They give a peculiar feature to the vegetation of many districts of South America, and specimens have been brought from the forests of Brazils, the mountains of Mexico and Peru, from the islands of the Eastern, Western, and Southern Oceans, and from the South of Africa, and the interior of India and China. Sir William Hooker, in the 'Species Filicum,' enumerates about forty different species. They are difficult to determine when brought to this country. 'They have,' says Sir William Hooker, 'arborescent trunks whose appearance, and even external form, are only known to travellers who have the privilege of seeing them in their native soils. The fronds, gigantic in most cases, and large in all, seldom reach us in an entire state. We are but little acquainted with the stipes, whether it be unarmed or aculeated, or with any other character which may afford marks of distinction. The shape or outline of the entire frond we have rarely the means of ascertaining: nor do we know what is the exact nature of its composition, nor the value to be put upon the more or less downy or scaly covering of the pinnæ, or the greater or less breadth of the pinnæ, or pinnules, or segments, or the more or less deeply serrated margins. Hence, too, their synonymy becomes inextricable; and without the opportunity of examining authentic specimens of authors, their species in many instances must be looked upon as doubtful. The difficulty is increased by the older authors not considering the nature of the fructification nor the venation, so that in few herbaria do we find the most common, and, we presume, the original species, the one upon which the genus appears to have been mainly founded, *Cyathea arborea*, correctly named.' The following is the definition of the typical species:—

C. arborea, Common Tree Fern, unarmed, or with few distant short prickles on the main rachis, and stipes which are frequently downy; fronds bipinnate, pinnules lanceolate, elongate, much acuminated, deeply pinnatifid, glabrous, or with the rachis and costa hairy, paler beneath; involucre coriaceous, cup-shaped in age, a little contracted upwards, opening with a beautifully even margin. It is a native of Jamaica, Hispaniola, Martinique, St. Vincent, probably the West India Islands generally, and Brazil.

In Hooker's 'Species Filicum' the members of this genus are distributed according to the districts in which they grow. Twenty-one species are natives of the West Indies, Mexico, and South America. Two only are found in South Africa. Eleven are natives of Eastern India and islands, the Pacific Islands, and New Zealand.

Few of these ferns are used by man, and, although very elegant, are seldom cultivated. One of these, *C. medullaris*, a native of New Zealand, produces a starchy matter which is used by the natives as food, and called *Marnaga*. The starch is found in the roots, and these are baked and eaten as food.

(Hooker, *Species Filicum*; Burnett, *Outlines of Botany.*)

CYATHOCRINI'TES, a genus of fossil Crinoidea, confined to the Palæozoic strata. [Encrinites, P. C.]

CYATHOPHY'LLUM, a genus of Madrephylliœa, which occurs fossil in Palæozoic strata, especially in the calcareous beds of the Silurian and carboniferous rocks. In the works of Goldfuss, Murchison, and Phillips many species are recorded from the Eifel, Salop, Devon, Yorkshire, &c. [Madrephylliœa, P. C.]

CY'BIUM, a genus of fossil fishes, from the London clay of Sheppey. (Agassiz.)

CYBO', a Genoese family, said to be of Greek extraction, several individuals of which distinguished themselves in the military service of their country during the middle ages.

Pope Innocent VIII., who was elected in 1485, was of this family; and his grandson Lorenzo Cybò married, about 1520, Ricciarda Malaspina, heiress of the princely fiefs of Massa and Carrara. His son Alberico Cybò Malaspina, after the death of his parents, became lord of Massa and marquis of Carrara in 1553, and his titles were confirmed by a diploma of the Emperor Maximilian, dated August, 1568. Alberico is still remembered both at Massa and at Carrara as a wise and beneficent prince. He died at a very advanced age in 1623, and was succeeded by his grandson Charles, who, dying in 1662, was succeeded by his son Alberico II. Alberico II. obtained of the Emperor Leopold I. the title of principality for his marquisate of Carrara, and he and his successors were thenceforth styled dukes of Massa and princes of Carrara. Alberico II. died in 1690, and was succeeded by his son Charles II. Alberico III., Charles's son, succeeded his father in 1710, and received the investiture of Massa and Carrara by a diploma of the Emperor Charles VI. Alberico III. died childless in 1715, and was succeeded by his younger brother Alderano, who died in 1731, leaving three daughters, the eldest of whom, named Maria Theresa, married Ercole Rinaldo of Este, prince of Modena, in 1741, having obtained for herself from the Emperor Francis I. the investiture of her maternal inheritance. Maria Theresa died in 1790, before her husband, and was succeeded in her dominions of Massa and Carrara by her only child Maria Beatrice, who remained after the death of her father the heiress of the two houses of Este and Cybò Malaspina. She had married, in 1771, the Archduke Ferdinand of Austria, by whom she had the present Duke Francis IV. of Modena and other children. Maria Beatrice continued to administer her principalities of Massa and Carrara till the French revolutionary invasion. [Baciocchi, P. C. S.] The treaty of Vienna of 1815 restored Maria Beatrice to her dominions of Massa and Carrara. Maria Beatrice died in 1829, and her dominions reverted to her son Francis IV. of Modena, who has assumed the title of duke of Massa and Carrara.

(Repetti, *Dizionario Geografico Storico della Toscana*, art. 'Massa;' Viani, *Memorie Storiche della Famiglia Cybò*.)

CYCADEOÏDEA. The fossil stems proved by Dr. R. Brown to be of the Cycadeous family, which occur in the Isle of Portland, were thus named by Dr. Buckland. Brongniart called them Mantellia, and they are ranked by Presl as Zamites.

CYCADI'TES. Fossil remains of plants allied to the natural group of the Cycadeæ are thus named by various authors, but the species are now usually ranked under Pterophyllum, Zamites, Otopteris, &c.

CYCLA'MEN, a genus of plants belonging to the natural order Primulaceæ. It has a bell-shaped half 5-cleft calyx; the corolla with a short bell-shaped tube, and 5-partite reflexed limb; 5 stamens inserted at the bottom, on the tube of the corolla, included; the capsule many-seeded, opening with 5 teeth. The species are herbaceous humble plants with very handsome flowers.

C. hederifolium, has cordate angular crenate leaves, and the throat of the corolla with 5 teeth. The root consists of a large depressed tuber; the flowers are nearly white, seated upon long flower-stalks, which roll up after blossoming and bury the germen. This plant has been found in Great Britain, at Sandhurst, and near Cranbrook in Kent. It is rare, and difficult of cultivation. Its flowers exhale a pleasant fragrance.

C. Europæum common Cyclamen, has the leaves orbicular, cordate, crenate or toothed, the segments of the corolla lanceolate. This species is found in the South of Europe. It has been recorded as a native of Great Britain, but, if found, has probably been an escape from gardens. It is often confounded with the former species. This plant is abundant in Sicily, where the wild boars prefer it to any other kind of food. Hence it is called sow-bread. It has been used medicinally; it acts upon the system as a cathartic, and was formerly esteemed emmenagogue. The acrid principle of the root has been separated under the name of *arthanatine*.

Several other species have been described. Most of them are hardy plants and may be grown on an open border. They are peculiarly adapted for pots and for chamber decoration in spring. One of the peculiarities of the genus is, that the flowers are seated on a twisted pedicel, which, when the flowers fade, turn round and round till they bury the capsule which they bear in the earth. In this position the seeds ripen and germinate, and produce other plants.

(Loudon, *Encyclopædia of Plants*; Babington, *Manual of Botany*; Burnett, *Outlines of Botany*; Koch, *Flora Germanica*.)

CY'CLICA, a family of Tetramerous Coleopterous insects established by Latreille. It is composed of three tribes, of which the genera *Cassida*, *Chrysomela*, and *Galleruca* are the types. The larvæ of the insects of this family are remarkable for their habits. Some cover themselves up in their excrements; others, as the *Cryptocephali*, form tubes of fragments of wood, which they drag about with them; and others bury themselves in the interior of leaves, and live on the parenchyma. The larvæ of the Chrysomelidæ are naked.

CYCLA'RTHRUS, a genus of fossil fishes from the lias of Lyme Regis. (Agassiz.)

CYCLOGRAPH, or ARCOGRAPH, an instrument for drawing arcs of circles without centres, used in architectural and engineering drawing, when the centres are too distant to be conveniently accessible. One such contrivance, which however does not produce perfectly circular arcs, is described under Compasses, P. C., p. 421. Bricklayers and masons, when they wish to strike an arc upon the face of a wall, have recourse to a very simple but perfect mode of accomplishing the object, by driving a nail into the wall at each extremity of the intended arc, and then nailing two straight laths or rods together at such an angle that while their external sides or edges are in contact with the nails driven in the wall, their apex or meeting point shall touch the crown of the required arc or arch. When secured to each other at the required angle, the laths are so moved that while they remain in contact with the nails, the apex may traverse the whole distance from one nail to another, in doing which it will describe the required curve, which may be marked on the wall by a piece of chalk carried round with it. The same plan may be adopted in drawing on paper, substituting pins for the nails, and a piece of stout cardboard, cut to the required angle, for the laths. Mr. Rotch's Arcograph, described in the 'Transactions' of the Society of Arts, vol. xxxix.' pp. 49-51, is an instrument consisting of two rules connected together by a joint which forms a socket for a pencil, and furnished with two quadrant-shaped pieces of brass, sliding upon one another, by which the rules may be set to any required angle, and secured by clasps. This instrument is used in the same way as the laths above described, and it affords the means of measuring, by the graduation of one of the quadrants, the degrees contained in the arcs described by it. Mr. Alderson's Curvilinead, described in the forty-fourth volume of the same work, pp. 151-156, is another instrument on the same principle, but of more perfect construction, in which the pencil may be projected beyond the apex of the angle for the purpose of drawing a second arc parallel with the first. This second arc is not mathematically correct, but, when on a small scale, it is sufficiently so for all ordinary purposes. Most satisfactory testimonials of the convenience and perfect action of this machine are appended to the description in the Society's 'Transactions.'

The Centrolinead of Mr. Peter Nicholson, described in the thirty-second and thirty-third volumes of the 'Transactions' of the above Society, pp. 67-70 and 69-81, is an instrument acting on the same principle, although its chief use is, not as a cyclograph, but as an instrument for drawing lines converging to a distant and inaccessible point. It may be compared to a T-rule in which the transom consists of two pieces adjustable to any required angle with each other, and the centre of which, answering to the apex of the cyclographs above described, is precisely on a line with the fiducial or drawing edge of the stem or long limb of the rule. The instrument being once adjusted to the required angles, and having its angular transom laid against two fixed pins, just like the angle of a cyclograph, any number of converging lines may be drawn by it as readily as parallel lines drawn by a common T-rule, with its transom sliding against the edge of the drawing-board.

Another instrument rewarded by the Society of Arts, and described in the thirty-fifth volume of their 'Transactions,' pp. 109-112, under the name of a Curvograph, was contrived by Mr. Warcup for copying or transferring curved lines, or describing them originally, of any required curvature, by means similar to those adopted in the instrument represented under Bevel, P. C. S., p. 192. The adjustable ruler itself consists of a thin pliable slip of whalebone, and the adjusting ribs, answering to the screws *f*, *f*, in the figure above referred to, instead of being screwed, are merely secured in any required position by the pressure of wedges acting upon small pieces of cork inserted in the ruler or stock through which they pass.

CYCLOID FISHES. One great division of fishes is thus termed by Agassiz, from the concentric striation apparent in their scales, of which the substance is horny, not bony nor enamelled. They are rare as fossils in all except the more recent strata, but abound in the actual creation.

CYCLOLITES, a genus of Madrephylliœa, including single-celled species. [Madrephylliœa, P. C.]

CYCLO'POMA, a genus of fossil fishes from Sheppey. (Agassiz.)

CYCLO'PTERIS, a genus of fossil ferns (Brongniart), remarkable for the size and orbicular or oval shape of the leafits. To the species from the coal-measures (C. orbicularis, C. obliqua, &c.) this remark applies better than to those (C. Beanii, dilatata, &c.) from the oolites, which are really of a different genus.

CYCLO'PTERUS. [Discoboli, P. C. S.]

CYCLO'SIS. [Sap, P. C.]

CYLINDRICAL LENSES are made by grinding each of the opposite surfaces of a plate of glass in the form of the segment obtained on cutting a cylinder by a plane parallel to its axis. Two segments thus obtained being placed with their plane surfaces in contact, and so disposed that straight lines parallel to the axis of the cylinder being drawn on the convex surface of one may be at right angles to lines similarly drawn on the other, would constitute a lens of the kind here indicated.

Lenses of this kind were devised and executed soon after the commencement of the present century by an optician of Paris, who introduced them as eye-glasses in spectacles in place of the usual spherical lenses. This person afterwards, conceiving that in such lenses the chromatic aberration was destroyed, attempted to employ them as simple object glasses for telescopes. But the chromatic aberration is as great in the cylindrical as in the spherical lens; while the aberration arising from the form of the surface, which in spectacles is not always more apparent than the spherical aberration in a common lens, produced, when the image of an object was viewed through the eye-glasses of a telescope, distortions exceeding those of a spherical lens of equal focal length.

In fact, besides the impossibility of executing lenses of cylindrical forms with accuracy, it may be observed that all the sections passing through the optical axis, except two, will be bounded by portions of ellipses of different convexities in each section. Now, if these bounding lines were circular arcs, there would be the same aberration of the marginal rays as in a corresponding spherical lens: but, from the nature of the ellipse, the radii of curvature, instead of being constant, decrease as points are taken more remote from the extremity of the conjugate axis (the vertex of the lens); consequently the cylindrical aberration, as it may be called, will be greater than that which is produced by a spherical surface.

(Thomson's *Annals of Philosophy*, October, 1816.)

CYME. [Inflorescence, P. C.]

CYMI'NUM CYMI'NUM, *Medical Properties of.* This annual umbelliferous plant (the generic name of which is most commonly spelt Cuminum, which mode is correct if it be a mere Latinized form of the Arabian word Qamoùn, but incorrect if it be a reduplication of the Greek *κύμινον*) is native in Egypt, Æthiopia, &c., and was cultivated by the antients in Palestine, as it is by the moderns in Malta and India. The fruit (improperly termed seed) is the officinal part. Externally it is of a greyish yellow colour, and is larger than those of carraway or anise. The seed within more readily separates from the pericarp than happens with most other umbelliferous fruits. It is distinguished from others by having the ridges (juga) prolonged into a point at the summit of the fruit. The primary ridges are five, filiform, and furnished with very fine prickles; the secondary are four, prominent and prickly. Beneath each of these is one vitta. The odour is strong aromatic, and rather unpleasant; the taste is warm, bitter, and disagreeable. The odour and taste are mainly due to a volatile oil which is more abundant in this fruit than in most umbelliferous plants: one pound yields half an ounce of this oil, according to some; while ten pounds yield only three ounces and a half, according to others. Notwithstanding this large quantity of oil, the fruits are frequently eaten by insects. The oil is pale yellow, but speedily becomes brownish, very limpid, of a specific gravity of 0·975. The odour is, like that of the fruit, disagreeable, and the taste is acrid. When old it becomes acid, and according to Chevallier contains succinic acid.

The disagreeable odour of cumin seems to have gradually discarded it from medicine for man, and restricted its use to veterinary medicine. Its employment in this way may be a relic of its antient repute, for the Israelites esteemed it highly as a remedy for cattle after the bites of insects. (Lady Callcott's *Scripture Herbal*, p. 124.)

Still it is a potent carminative, and was esteemed by Cullen the best of this class of remedies, a preference to which the very large portion of essential oil it contains justly entitles it. It was reported also discutient and diuretic. In the former quality it was employed as a plaster. It was reckoned one of the semina 4 calida majora. In the north of Europe it is still much used as an addition to bread and ragouts. It enters into the composition of many curry-powders, but should be introduced into these in very small quantity.

CYNANCHUM (from *κύων*, a dog, and *ἄγχω*, to strangle), a genus of plants belonging to the natural order Asclepiadeæ. It has a 5-parted somewhat rotate corolla; a coronet of appendages consolidated, 5-20-lobed, when 5-lobed with the segments opposite the anthers; the pollen-masses ventricose, pendulous; the stigma usually apiculate, sometimes blunt, very rarely with a beak enclosed below the summit; the follicles smooth. The species are herbs or under-shrubs, with opposite leaves and mostly twining stems.

C. Vincetoxicum has an erect stem, a beardless corolla, a simple umbel with the pedicels three times longer than the peduncle; the corona 5-lobed. This plant is a native of sandy places in most parts of Europe, with the exception of Great Britain. It possesses emetic and purgative properties, and was once celebrated as an antidote for poisons, from which it has derived its specific name.

C. Monspeliacum, Montpellier Cynanchum, is an herbaceous twining glabrous plant, with roundish cordate-stalked leaves, with a semilanceolate contracted point; the segments of the corolla lanceolate, bluntish; the coronet tubular. It is a native of the sea-coast of Italy, of Spain, the South of France, and Greece. The juice of this plant is a drastic cathartic, and when dried it is used as a medicine under the name of Montpellier Scammony.

C. ovalifolium is a smooth twining plant, with oblong oval acuminate leaves; many-flowered cymes; peduncles not longer than the petiole; the coronet 10-cleft, about as long as the corolla; the stigma pointed, emarginate. This plant is a native of Penang, where, according to Dr. Wallich, it is used for the purpose of procuring from its sap caoutchouc, which is of an excellent quality.

C. Argel has erect, pale, round stems; the leaves scarcely stalked, about an inch long, ovate lanceolate, acute, smooth on each side, and rather wrinkled, glaucous on the under side; the corymbs small, axillary, with many smooth alternate branches; the sepals lanceolate; the corolla white, but little longer than the calyx. It is a native of Upper Egypt. The leaves and the whole plant act as a powerful drastic purgative. This plant appears to be a native of the same districts as those from which the Alexandrian Senna is obtained, and all the samples of that senna contain these leaves. They do not however appear to be added for the purposes of adulteration, but are collected with the leaves of the senna through the ignorance of the persons employed in their collection. The leaves of Tinnivelly Senna are not found to contain those of the Cynanchum Argel mixed with them. Much of the unpleasant griping effect of the Alexandrian Senna is attributed by some writers on Materia Medica to the mixture of the leaves of the Argel. Senna leaves are also mixed with those of the *Gomphocarpus fruticosus*, which are in Syria also called Argel or Arghel.

The *Cynanchum Ipecacuanha* of Willdenow, the *Asclepias asthmatica* of Roxburgh, is now referred to the genus Tylophora. [Tylophora, P. C. S.]

CYNARA'CEÆ, one of the primary subdivisions, in the system of Jussieu, of the natural order Compositæ. It is included in the Tubulifloræ of De Candolle. It is characterised by an erect seed, the absence of albumen, a hemispherical involucre, the florets of the ray of the flower tubular, inflated, and regular. Of the three subdivisions this is the smallest. Its type is the genus *Cynara*, to which belongs the common artichoke, *C. scolymus*.

The genera of British plants belonging to this subdivision are as follows:—

Section I.—*Carlineæ.*

Saussurea	1 species.
Carlina	1 species.

Section II.—*Centaureæ.*		
	Centaurea	7 species.
Section III.—*Carduineæ.*		
	Arctium	2 species.
	Onopordum	1 species.
	Carduus	12 species.
Section IV.—*Silybeæ.*		
	Silybum	1 species.
Section V.—*Serratuleæ.*		
	Serratula	1 species.

The Cynaraceæ differ from the Corymbiferæ in their active properties in possessing in a more intense degree the bitter principle of the whole order. None of them seem to possess a tendency to develop the narcotic principle which characterises the Cichoraceæ; nor is the volatile oil which gives to so many of the Corymbiferæ a peculiar aromatic smell developed in these plants. The Carduus nutans (musk thistle) is the only one which possesses any remarkable amount of odour. The prevalence of the bitter principle renders many of them useful stomachic, tonic, and febrifuge medicines. For these purposes, Centaurea, Calcitrapa, Cnicus benedictus, Carduus lanatus, Serratula arvensis, and Silybum marianum, have been used. Some of them are said to be cathartic, and Echinops sphærocephalus, which has this property, is used in Languedoc as a remedy for rheumatism. The seeds of various species of Onopordum yield a fixed oil, which in some parts is expressed and used for domestic purposes. Many of the Cynaraceæ yield colouring matters. The Carthamus tinctorius yields a yellow colour, and is employed to adulterate saffron; the Serratula tinctoria yields a yellow dye of a fine colour. A pigment of a blue colour is obtained from the flowers of Centaurea cyanus. Some of them secrete small quantities of tannin, and are used in consequence as astringents in medicine, as the Onopordum acanthium. Galls also are found on the Cnicus arvensis, which possess astringent properties, owing to the tannin they contain. A number of species yield food. The bracts of the involucre are, in some, very large; and, as they contain starchy and other alimentary secretions, are used as diet by man. The artichoke is a familiar instance. The heads of the Onopordum acanthium are often eaten in the same way. The tender sprouts of the Arctium Lappa are gathered and eaten in the north of Europe. They are cooked in the same manner as asparagus. The tubers of the Cnicus tuberosus are frequently cooked and eaten, and many other species yield starch in their roots. Animals do not generally like the plants belonging to the Compositæ. They seem however occasionally to eat them medicinally, and the ass prefers the thistle to most other kinds of food.

(Burnett, *Outlines of Botany;* Lindley, *Flora Medica;* Babington, *Manual of British Botany.*)

CY'NODON, a genus of grasses belonging to the tribe Chlorideæ. It has a 1-flowered fingered spike, with a superior rudiment; the glumes nearly equal, patent; the paleæ equal, outer boat-shaped, compressed, embracing the inner; the styles long, distinct; the stigmas feathery, protruding below the summit of the floret.

C. Dactylon has 3-5 digitate spikes; smooth paleæ, the leaves downy beneath; the scions prostrate. It is a native of England on the shores of Devon and Cornwall. *C. linearis* is a native of the East, and is known by the name of *Durva-grass.*

(Babington, *Manual of British Botany.*)

CYNOGLOSSUM (from *κύων*, a dog, and *γλῶσσα*, a tongue), a genus of plants belonging to the natural order Boragineæ. It has a 5-cleft calyx; a funnel-shaped corolla with the mouth closed, with prominent blunt scales; the stamens included, filaments very short; the nuts roundish-ovate, depressed, muricated, attached by their inner edge. The species are herbs, with soft leaves.

C. officinale, Common Hound's Tongue, has the leaves downy, acute; the lower leaves elliptical, contracting into a petiole, the upper leaves lanceolate, narrowed below, subcordate, half-clasping. The corollas are of a dull red colour. It is a native of Asia, Africa, North America, and Europe. It is found in Great Britain in waste ground. The whole plant has a disagreeable smell, resembling that from mice. It is said to possess narcotic properties, and was at one time used as a remedy in scrofula, but it is not employed in medicine at the present day.

C. montanum has the leaves slightly hairy, acute, nearly glabrous and shining above, scabrous beneath, inferior, oblong, narrowed into a long petiole, upper leaves lanceolate, slightly narrowed below, clasping. It is found in Great Britain, by roadsides and in hedges in shady situations.

About fifty other species of Cynoglossum have been described, besides the British ones above named. They are all coarse plants, having only small flowers, so that few only are desirable for ornamental cultivation. They are however of the most easy culture, and will grow in almost any situation and soil. The greater number of the species are biennial, and may be propagated by sowing their seed in spring in the open border.

(Babington, *Manual;* Don, *Gardener's Dictionary.*)

CYPE'RUS. [CYPERACEÆ, P. C.]

CYPRIPE'DIUM, a genus of plants belonging to the natural order Orchideæ, and the tribe Cypripedieæ. It has a patent perianth; a ventricose inflated lip; column trifid above; the lateral lobes bearing stamens, the middle lobe sterile, dilated; the two lower sepals combined; the germen straight.

C. calceolus, Lady's Slipper, has a leafy stem; the middle lobe of the column nearly ovate, obtuse, deflexed; the lip slightly compressed, shorter than the calyx. This plant has been found in Great Britain, but is extremely rare.

All the species are exceedingly elegant plants. They are mostly inhabitants of North America and Northern India. Two new species have been lately introduced. In their cultivation they require great care. They will only thrive in a shady border in peat soil. The American species should be covered with some dry straw in very severe frosts, or if there should be too much wet; they are not easily increased, but will perfect seeds in favourable situations, particularly if pains be taken to apply the pollen to the stigma.

(Babington, *Manual;* Loudon, *Encyclopædia of Plants.*)

CYRTO'CERAS, a Nautiloidal genus of fossils, proposed by Goldfuss, which occurs in the Palæozoic strata of Devon, the Eifel, and Ireland principally, and includes many species of great beauty and interest. The septa are pierced by a subdorsal siphon: the last whorl finishes in a straight extension. (*Phil. Pal.*, '*Foss. of Devon.*')

CYSTIPHY'LLUM, a genus of Madrephyllicœa, proposed by Lonsdale, to include species which have a vesicular internal structure, instead of clearly defined horizontal diaphragms and vertical lamellæ. Occurs in the Palæozoic strata of Shropshire, Devon, and the Eifel.

CYSTO'PTERIS, a genus of Ferns belonging to the tribe Aspidieæ. It has the indusium attached by its broad hooded base under the sori, with a lengthened fringed free extremity, at first covering the thecæ.

C. fragilis, Brittle Fern, has bipinnate fronds; the pinnæ ovate-lanceolate; the pinnules ovate or ovate-lanceolate, toothed or pinnatifid. This is a remarkable variable species of fern. Three forms or varieties may be distinguished—*C. f. dentata*, with obtuse ovate pinnules, pointless, bluntly toothed or rarely pinnatifid, not decurrent; *C. f. angustata*, with pinnules linear, lanceolate, deeply and acutely pinnatifid or slightly toothed at the margin; the ultimate subdivisions oblong or linear, not dilated, rounded or ovate; sometimes notched at the end. The other form has the pinnules ovate, acute, pinnatifid, cut and serrated, slightly decurrent. These plants are common in Great Britain, and found on rocks and walls, especially in limestone districts. They are of a diminutive size, and of a remarkably brittle nature, from which circumstance they have obtained their common name.

(Babington, *Manual of British Botany;* Newman, *History of British Ferns.*)

CYTOBLAST. In the development of the tissues of plants from the *Blastema*, or *Cyto-blastema*, which is a fluid consisting of water holding in solution sugar, gum, dextrine, &c., some of the granules assume a definite form, and become darker than the surrounding granules. These dark spots may be seen in the fluids of the growing parts of all plants. It is to these that Schleiden has given the name of Cytoblasts. The cytoblast produces from its surface a cell: when the cell has become fully grown, other cytoblasts are produced in its interior, which, by producing other cells, burst the parent cell and increase the substance of the part in which they are found. [TISSUES, VEGETABLE, P. C.] A growing point of the same nature has been observed in the tissues of the animal kingdom, and it has been thus demonstrated that in the original growth of their tissues there is an identity between the animal and vegetable kingdom. [TISSUES, ANIMAL, P. C. S.]

INDEX TO THE LETTER C.

VOLUME I.

Cab, or Cabriolet [Hackney-Coach, P. C. S.]
Cáccia, Guglielmo, p. 263
Cagnóla, Luigi, 263
Cakile, 264
Caládium, 264
Calamíntha, 264
Cálamis, 265
Calamites, 265
Calamites [Coal-Plants, P. C.]
Calamópora, 265
Calcaire Grossier, 265
Cálceola, 265
Calculating-Machines, 265
Calderári, Ottone, 268
Calendering, 268
Caléndula, 269
Calcott, John Wall, 269
Calcott, Sir Augustus Wall, 270
Callímachus, 270
Callipers [Calibre, P. C.]
Callístratus, 270
Callítriche, 271
Cállitris [Thuja, P. C.]
Callúna, 271
Calogiera, Angelo, 271
Calophyllum, 271
Calotype [Photography, P.C.S.]
Calvert, Denis, 271
Calycophyllum, 272
Caly'mene, 272
Calystégia, 272
Cambiáso, Luca, 272
Cambrian Rocks, 272
Camelína, 273
Campanélla, Tommáso, 273
Campánula, 275
Campbell, Rev. John, 275
Campbell, Thomas, 276
Campi, 276
Campo Basso [Sannio, P. C.]
Canada, 277
Canaria, 280
Cancelliéri, Francesco, 280
Candles and Lamps [Lights, Artificial, P. C. S.]
Candolle, De [De Candolle, P. C. S.]
Canker-Brand [Uredo, P. C.]
Canna, 281
Cáno, Alonso, 281
Canónica, Luigi, 281
Canoppi, Antonio, 282
Cantaríni, Simóne, 282
Cántharus, 282
Cantóni, Simone, 282
Cantonments, 283
Caoutchouc, 283
Capell, Edward, 283
Capital, 284
Capite, Tenants in [Baron, Barony, P. C.; Feudal System, P. C.]
Cápito, Ateius C. [Labeo, P. C. S.]
Caprifólium [Lonicera, P. C. S.]
Caps, Percussion, 287
Capsella, 287
Capstan [Windlas, P. C.]
Caradoc Formation, 288
Caráglio, Giangiácomo, 288
Caravággio, Polidóro da, 288
Carboniferous System, 288
Cardamine, 288
Cardamine Pratensis, 289
Cardi, Ludovico [Cigoli, P. C. S.]
Cardiff [Glamorganshire, P. C.]
Cards, Card-making Machine, 289
Cardúccio, 289
Cárduus [Thistle, P. C.]
Carew, Thomas, 289
Carey, Henry, 290
Carex, 290
Carli, or Carlee [Poonah, P. C.]
Carlína [Thistle, P. C.]
Carlisle, Sir Anthony, 290
Carpenter, Dr. Lant, 291
Carpentry, 292
Carpi, Ugo da, 293
Carpíni (Johannes de Plano), 293
Carr, John, 295
Carrageen Moss [Sea-Weeds, P. C.]
Carrára, Da, 295
Carraway [Carum Carui, P. C. S.]
Carstares, William, 296
Cárthamus Tinctórius [Safflower, P. C.]
Cartridge, 296
Cartwright, William, 297
Carum, 297
Carum Carui, 297
Cary, Rev. Henry Francis, 297
Caryocrinites, 298
Cash Credit [Bank, Banker, Banking, P. C.]
Cashmere, or Cachemere, 298
Cássicus, 298
Cássius, Avídius, 298
Castagno, Andrea del, 299
Castiglíone, Giovanni Benedetto, 299
Castor Oil [Ricinus communis, P. C.]
Casuarína [Casuaraceæ, P. C.]
Cat-Fish [Anarrhicas, P. C. S.]
Catabrósa, 299
Catalpa, 299
Catamaran, 299
Catchfly [Silene, P. C.]
Catechínum, 299
Catenípora, 300
Catgut, and Violin Strings, 300
Cathartocarpus, 300
Catillus, 301
Cato, Dionysius [Dionysius Cato, P. C. S.]
Caúcalis, 301
Caulerpites, 301
Caulópteris [Coal Plants, P. C.]
Cavallíni, Piétro, 301
Cavallo, Tiberius, 301
Cavendish, Margaret, 302
Cavendish, William [Cavendish, Margaret, P. C. S.]
Cean-Bermudez, Juan Augustin, 302
Ceanothus, 303
Cecilians [Siphonops, P. C.]
Cecrópia [Urticaceæ, P. C.]
Cedreláceæ, 303
Celésti, Andréa, 303
Cellulares [Vasculares, P. C.]
Celsia, 303
Celsus, P. Juvéntius, 304
Cemetery [Interment, P. C.]
Cenony'ce [Liverworts, P.C. S.]
Censorínus, 304
Censorship of the Press, 304
Census of 1841, 309
Central Criminal Court, 316
Centranthus, 317
Centúmviri [Judex, Judicium, P. C.]
Centúnculus, 317
Centurion, 317
Cephalanthéra, 317
Cephaláspis, 317
Cephalotáceæ, 317
Céphalus [Gymnodontes, P. C. S.]
Cerámieæ [Water-Plants, P. C.]
Ceramlaut Islands, 318
Cerástium, 318
Ceratophyllum [Ceratophylleæ, P. C.]
Cérebrum [Brain, P. C.]
Cerevísiæ Fermentum, 318
Certiorári, 319
Ceruse, 319
Cervus Elaphus, 319
Césare Giuseppe, 319
Cespedes, Pablo de, 319
Céssio Bonórum, 320
Cestráceæ, or Cestrínæ, 320
Cestui que Trust [Trust and Trustee, P. C.]
Cetiosáurus, 320
Cetrária Islandica, 320
Chærophyllum, 321
Chain Rule, 321
Chalícomys, 321
Chambers, George, 321
Chamisso, Adelbert von, 322
Chamomile [Anthemis nobilis, P. C. S.]
Chancellor of a Church, or a Diocese, or a Cathedral [Chancellor, P. C.]
Chancellor of the Duchy of Lancaster [Chancellor, P. C.]
Chancellor of the Universities of Oxford and Cambridge [Chancellor, P. C.]
Chancellor of the Exchequer [Chancellor, P. C.]
Channing, William Ellery, 322
Chantrey, Sir Francis, 323
Chapman, George, 324
Charge, Rent [Rent, P. C., p. 394]
Charísius, Aurélius Arcádius, 325
Charles X., king of France, 325
Charles XIV., king of Sweden, 327
Charnock, Stephen, 330
Charitable Uses [Uses, Charitable and Superstitious, P. C.]
Charities [Trust and Trustee, P. C., p. 322]
Charter, 330
Charter-Party [Ships, P. C.]
Chartists, 331
Chasing of Metals, 332
Chatham Islands, 333
Chaudet, Antoine Denis, 334
Cheadle [Staffordshire, P. C.]
Cheiracánthus, 334
Cheiránthus [Wall-Flowers, P. C.]
Cheirólepis, 334
Cheirothérium, 334
Chélifer, 334
Chélodus, 334
Chemistry, 334
Chemistry, Organic [Tissues, Organic, P. C. S.]
Chemnitz, Martin, 351
Cheque, 352
Cherémisses [Russia, P. C.]
Cherléria, 352
Cherubíni, Maria-Luigi-Carlo-Zenobi-Salvador, 352
Chettle, Henry, 352
Chief Justice [Courts, P. C.]
Child, Sir Josiah, 353
Child-killing [Infanticide, P.C.]
Child-stealing [Abduction, P. C.]
Chimney, 354
Chimney-piece, 355
China, 356
Chlora, 362
Chloriodic Acid [Chemistry P. C. S.]
Choanítes, 362
Chocolate [Cacao, P. C., p. 96; Theobroma, P. C., p. 313]
Chodowiecki, Daniel, 362
Chomátodus, 363
Chondrítes, 363
Chondrus [Sea-Weeds, P. C.]
Christ's College, Cambridge, 363
Chromatic Thermometer, 363
Chromule [Sap, P. C.]
Chrysocólla, 364
Chrysócoma, 364
Chrysoplénium, 364
Church Discipline Act [Bishop and Bishopric, P. C. S.]
Church Rates, 364
Churn [Butter, P. C., p. 66]
Chusan, 366
Chuvashes [Russia, P. C.]
Chyle [Digestion, P. C.]
Cicendia, 366
Cignaróli, Giambettíno, 367
Cígoli, Ludovico Cardi da, 367
Cília, 367
Cimicífuga, 368
Cincius, 368
Cinerária, 369
Cinque-Cento Style [Renaissance, P C. S.]
Ceóne, Andrea di [Orcagna, P. C. S.]
Circular Polarization, 369
Circumferenter, 370
Cirrhus [Tendril, P. C.]
Cissus [Vitaceæ, P. C.]
Cistópteris [Cystopteris, P.C.S.]
Cistus, 370
Citation, 371
Citizen, 371
Cladium, 372
Cladocóra, 372
Cládodus, 372
Cladónia, 372
Cladyodon, 373
Clairon, Mademoiselle, 373
Clare Hall, Cambridge, 373
Classification of Plants [Endogens, P. C.; Exogens, P. C.; Jussieu, P. C.]
Clathrária, 374
Clathrópteris, 374
Cleanthes, 374
Cleavage, 374
Cleome, 374
Clerc, Le, Sebastian, 374
Clerk of Assize, 374
Clerk in Orders [Clergy, P.C.]
Clerk of the Crown in Chancery, 374
Clerk of the House of Commons, 375
Clerk of the Parliaments, 375
Clerk of the Peace, 375
Clerks and Servants [Servants P. C.]
Cleveland, Cleiveland, or Cleaveland, John, 375
Club-house, 376
Clúsia, 377
Clusius, Carolus, 378
Clutch [Coupling, P. C. S.]
Clyménia, 378
Cly'peus, 378
Cnemídium, 378
Coach-making, 378

INDEX.

VOL. I.

Coal-Mining and Coal-Trade, 380
Cobæáceæ, 382
Cobalt Pyrites [Cobalt (Arseniate of Cobalt), P. C.]
Coccóloba, 382
Cocconeis [Infusoria, Fossil, P. C. S.]
Coccósteus, 382
Cochin, 382
Cochin, Charles Nicolas, 383.
Cochleária, 383
Cochleária Armorácia, 384
Cochliodus, 384
Cochlospermum [Wittelsbachia, P. C.]
Cock, or Stop-cock, 384
Cocoa [Cacao, P. C.; Theobroma, P. C.]
Codex [Code, P. C.]
Coelacánthus, 386
Coello, Claudio, 386
Coeln, Wilhelm von, 387
Coeloptýchium, 317
Cognóvit, 387
Cohesion, Magnetic, 387
Coire, 388
Cokaine, or Cokayn, Sir Aston, 388
Coke, 388
Coke, J. W. [Leicester, Earl of, P. C. S.]
Colebrooke, Henry Thomas, 389
Coleridge, Henry Nelson, 390
Colin, Alexander, 390
Collátio, or Mosaicarum et Romanarum Legum Collatio, 390
Colle, Raffaellino dal, 390
Collision or Percussion of Bodies, 391
Collision of Ships [Ships, P. C. p. 402]
Collómia, 392
Collumpton [Devonshire, P. C.]
Colocynthus [Cucumis, P. C.]
Cologne Cathedral, 392
Colonial Agents, 394
Colonna, Fra Francesco, 394
Colophónia, 394
Colour, Accidental [Accidental Colour, P. C. S.]
Colours, Complementary, 395
Colours of Plates, 395
Colquhoun, Patrick, 397
Columba, 397
Cómarum, 397
Comb, 398
Combination Laws, 398
Combretáceæ [Terminalia, P. C.]
Combustion, 399
Combustion, Spontaneous, Human, 399]
Commia, 400
Commissary, 400
Commission [Agent, P. C.; Broker, P. C.; Factor, P. C.]
Commissioners Lords [Assent, Royal, P. C.; Admiralty, P. C.]
Commissioners of Bankrupts [Bankrupt, P. C.]
Commissioners of Sewers [Sewers, P. C.]

VOL. I.

Committee of a Lunatic [Lunacy, P. C.]
Common Recovery [Recovery, P. C.]
Comocládia, 400
Complementary Colours [Colours, Complementary, P. C. S.]
Compos or Non Compos Mentis [Insanity, P. C.]
Compounding of a Felony [Felony, P. C.]
Compressibility of Water, 401
Compression of the Brain [Head, Injuries of, P. C.]
Comptónia, 401
Computation, 401
Conca, Sebastiano, 404
Concealment of Birth [Infanticide, P. C.]
Concertína, 404
Concussion of the Brain [Head, Injuries of the, P. C.]
Condenser, 405
Condenser of Electricity, 405
Condition of a Bond [Bond, P. C.]
Conductors of Heat, 405
Confections, 405
Conferva [Water-Plants, P. C.]
Confervites, 406
Conflict of Laws [Laws, Conflict of, P. C. S.]
Congleton, Rt. Hon. Henry Brooke Parnell, Lord, 406
Conglomerates, 406
Conóceras, 406
Conscience, 406
Conscience, Courts of [Requests, Courts of, P. C.]
Consideration, 407
Constable, John, 408
Constitutions and Canons Ecclesiastical, 409
Contingent Remainder [Remainder, P. C. and P. C. S.]
Contraction, 409
Conulária, 410
Cónulus, 410
Convallarites, 410
Convention Treaties, 410
Conversion [Trover, P. C.]
Conýza, 411
Cooler, 411
Cooley, Thomas, 411
Cooper, Samuel, 411
Cooper, Sir Astley, 412
Coparceners [Parceners, P. C.]
Cóphinus, 413
Copper, Manufacture of, 413
Coptis, 414
Copyholds, 414
Copying-Machines, 415
Copyright, 416
Coral Fishery, 418
Coral Rag, 418
Corallorhíza, 418
Corbet, Richard, 418
Corénzio, Bellisario, 418
Coriándrum Satívum, 419
Corinna, 419
Corioláno, 419
Cormontaingne, 419
Corn Laws [Corn-Trade, P. C.; Wheat, P. C.]

VOL. I.

Corn-Rent, 420
Corn-Trade, Ancient, 420
Cornbrash, 422
Cornel-Tree [Cornus, P. C. S.]
Cornstone, 422
Cornulites, 422
Cornus, 422
Coroner, 423
Coronilla, 423
Corrádi, Doménico [Ghirlandaio, P. C.]
Correcting-Plate [Sailing, P. C.]
Corrigíola, 424
Cort, Cornelius, 424
Corydális, 424
Corymbíferæ, 424
Corynéphorus, 425
Coscinópora, 425
Cosmas Indicopleustes, 425
Costus [Putchuk, P. C.]
Cosway, Richard, 425
Cotes, Francis, 426
Cotman, John Sell, 426
Cotoneaster, 426
Cottage Architecture, 426
Cotton, Charles, 427
Cotylédon, 427
Council of the Church, 428
Count [Declaration, P. C.; Pleading, P. C.]
Counterpart [Deed, P. C.]
Counterpoise, 431
County Court [Courts, P. C.]
County Rate, 432
Coupling, 433
Court Baron [Manor, P. C.]
Court, Customary [Copyhold, P. C. and P. C. S.]
Court Rolls [Copyhold, P. C. and P. C. S.]
Courtois, Jacques, 425
Courts, Ecclesiastical [Ecclesiastical Courts, P. C. S.]
Cousin, Jean, 435
Couston, 435
Couto, Diogo de [Barros, P.C.]
Cowley, Mrs. Hannah, 436
Coxie, Michael, 436
Coysevox, Antoine, 436
Crab, 436
Cranach, Lucas, 437
Crane, 437
Crank, 438
Cratæva, 439
Crayer, Caspar de, 439
Credi, Lorenzo di, 439
Credit, 440
Credit, Letter of, 441
Creosote [Creasote, P. C.]
Crepidópteris, 441
Crepis, 441
Crescentia, 441
Crespi, Giuseppe Maria, 442
Cricacánthus, 442
Cricópora, 442
Criminal Conversation [Adultery, P. C.]
Criminal Law [Law, Criminal, P. C. S.]
Crinoïdea [Encrinites, P. C.]
Crinum, 442
Crioceratites, 442
Crioceris [Eupoda, P. C. S.]
Crithmum [Samphire, P. C.]
Crocus Satívus, 442

VOL. I.

Crops [Emblements, P. C.]
Cross Bill [Pleading, P. C.]
Cross Remainders [Remainder, P. C.]
Crown Solicitor, 443
Crowne, John, 443
Cryóphorus, 443
Ctenacánthus, 443
Cténodus, 443
Ctenoid Fishes, 443
Cténolepis, 443
Cucking-Stool [Tumbril, P. C.]
Cucúbalus, 443
Cucumites, 443
Culdees, 443
Cumbrian Rocks, 444
Cunégo, Doménico, 444
Cunningham, John, 444
Cunningham, Allan, 444
Cupressinites, 445
Cupressocrinites, 445
Curcúlio, 445
Cúrcuma, 445
Curcuma longa, 445
Curia Muria Islands, 446
Currant [Ribes, P. C.]
Currying [Leather, P. C. S.]
Cursitor Baron, 446
Curve, 446
Cusco-China, 447
Cuspária [Galipæa, P. C.]
Customary Freeholds [Copyhold, P. C. S.]
Customs' Duties [Tariff, P. C. S.]
Custos Brevium, 447
Custos Rotulórum, 448
Cutting and Stabbing [Maim, P. C.]
Cuyp [Kuyp, P. C.]
Cyanogen, Chloride of [Chemistry, P. C. S.]
Cyanometer, 448
Cyanuric Acid [Chemistry, P. C. S.]
Cyáthea, 448
Cyathocrinítes, 448
Cyathophýllum, 448
Cýbium, 448
Cybò, 448
Cycadeoïdea, 449
Cycadítes, 449
Cyclámen, 449
Cýclica, 449
Cyclárthrus, 449
Cyclograph, 449
Cycloid Fishes, 450
Cyclolites, 450
Cyclópoma, 450
Cyclópteris, 450
Cyclópterus [Discoboli, P.C S.]
Cyclósis [Sap, P. C.]
Cylindrical Lenses, 450
Cyme [Inflorescence, P. C.]
Cymínum Cymínum, 450
Cynanchum, 450
Cynaráceæ, 450
Cýnodon, 451
Cynoglossum, 451
Cypérus [Cyperaceæ, P. C.
Cypripédium, 451
Cyrtóceras, 451
Cystiphýllum, 451
Cystópteris, 451
Cytoblast, 451

D.

DABŒCIA (from St. Dabeoc), a genus of plants belonging to the natural order Ericaceæ. It has a 4-parted calyx; the corolla oval, ventricose, the limb 4-toothed; 8 stamens inclosed, the filaments dilated, glabrous; the anther linear, sagittate at the base, the cells of the anthers parallel, loosened at the apex, dehiscing lengthwise; the stigma simple, truncate; the capsule 4-celled with a septicidal dehiscence. There is but one species, the *D. polyfolia*, which is a dwarf bushy evergreen shrub, a native of Ireland and the Pyrenees. This plant is the Andromeda Dabœcia of Linnæus, the Erica Dabœcia of Smith, the Menziesia Dabœcia of De Candolle, and the Menziesia polyfolia of Jussieu. In Ireland, which is its only locality in the British Islands, it is called Irish Whorts, Cantabrian Heath, and St. Dabeoc's Heath. It is a pretty shrub, and well fitted for decorating the fronts of shrubberies or for rockwork. It may be propagated by dividing the whole plant, or by cuttings, or by layers.

(Don, *Edinburgh Philosophical Journal*, vol. 17.)

DÆDALUS. [SCULPTURE, P. C.]

DAFFODIL. [AMARYLLIDEÆ, P. C.; NARCISSUS, P. C.]

DAHL, MICHAEL, a Swedish portrait-painter, who had a very successful career in England, in the reigns of Anne and George I., and was the principal rival of Sir Godfrey Kneller. He was born at Stockholm in 1656, was taught painting by Ernstraen Klocke, and came to England in 1678. He went about a year afterwards to Paris, where he remained a year; and from thence to Italy, where he spent three years in its principal cities. At Rome he painted the portrait of Christina of Sweden, then advanced in years; she terminated her wanderings and her eccentric life at Rome a few years afterwards.

In 1688 Dahl came again to England, 'where,' says Walpole, 'he found Sir Godfrey Kneller rising to the head of the profession, and where he had yet merit enough to distinguish himself as no mean competitor. His colouring was good, and, attempting nothing beyond portraits, he has certainly left many valuable pictures, especially as he did not neglect everything but the head, like Kneller, and he drew the rest of the figure much better than Richardson. Some of Dahl's works are worthy of Riley.'

Walpole mentions, among other works by Dahl, a portrait of his mother, at Houghton, which he says possessed great grace. There is an equestrian portrait by Dahl, at Windsor, of Charles XI. of Sweden, and there are several portraits in the gallery of admirals at Hampton Court, and some whole-lengths of ladies at Petworth.

'Virtuous and esteemed, easy in his circumstances, and fortunate in his health,' says Walpole, 'Dahl reached the long term of eighty-seven years, died in London in 1743, and was buried in St. James's church.'

(Walpole, *Anecdotes of Painting in England*, &c.)

DAISY. [BELLIS, P. C. S.]

DALBY, ISAAC, one of the many self-taught men of this country, who have attained considerable eminence in mathematical science by the mere force of genius, and in defiance of the obstacles opposed by fortune to their progress, was born in Gloucestershire, in the year 1744, and he appears to have been instructed in the rudiments of Latin and Arithmetic at a grammar-school in that county. By his friends he was destined to be a clothworker, but his taste leading him to the study of mathematics, he laboured, by the aid of Stone's Euclid, Simpson's Algebra, and Martin's Trigonometry, to qualify himself to be an usher in a country school; and he actually engaged himself in that unenviable capacity to a Mr. James, who kept a boarding-school at Stoke-Bishop near Bristol. At the end of three years he opened a school on his own account, in another part of the country; but meeting with no success, he came to London in 1772.

Here, in consequence of an advertisement, he offered himself, and was accepted, as an usher, to teach arithmetic in Archbishop Tenison's Grammar-school, near Charing Cross; and while fulfilling the duties of that employment, his name having already appeared in some of the magazines of that time, particularly the Ladies' Diary, among the correspondents who occasionally answered mathematical questions, he became known to many of the most celebrated men of science in town. Among these were Dr. Maskeline, the astronomer royal, Dr. Hutton and Mr. Bonnycastle, both of the Royal Military Academy at Woolwich, the Rev. Messrs. Crakelt and Lawson, and Mr. Landen, Mr. Wales, Mathematical Master of Christ's Hospital, and Mr. Witchel, Master of the Royal Naval Academy at Portsmouth: among them, also, are the names of many persons who, by day, pursued their avocations, one as an attorney, another as a bricklayer, a third as a salesman in Smithfield Market, and who, by night, cultivated mathematical science as a recreation. In a letter written to a friend long afterwards Dalby observed that the greater number of these ingenious men had solved their last problem, and that with them the expression for life had become equal to zero.

Mr. Bayly, who had been employed in making astronomical observations in a building erected near Highgate, by the Hon. Topham Beauclerk, for philosophical purposes, being engaged to sail with Captain Cook, Dalby, after having been about a year at the school above mentioned, was appointed to succeed him. In this situation, besides his duties as observer and librarian, he performed, under Dr. Fordyce, that of experimenter in chemistry; and amidst these employments, he found time to make himself acquainted with the French language, and revive his knowledge of Latin. In 1781 Mr. Beauclerk's establishment being broken up, and the library, instruments, &c. sold, Dalby was engaged to make a catalogue of the library of Lord Beauchamp; and in the following year he was appointed Mathematical Master of the Naval School at Chelsea. This was supported by voluntary contributions, and it succeeded for a time under the management of Mr. Jonas Hanway; but the subscriptions falling off, the Institution was given up.

In 1787 Mr. Ramsden, the distinguished maker of philosophical instruments, to whom for several years Dalby had been known, recommended him, as an assistant, to Major-General Roy, who was then employed in the trigonometrical operations for connecting the meridians of Greenwich and Paris; and during that and the following year he was employed in extending the triangulation through Kent and part of Sussex to the coast opposite France. Dalby was subsequently employed in making the computations preparatory to the publication of the account of the proceedings; and on this occasion he was led to apply a theorem (ascribed to Albert Girard) to the purpose of computing the excess of the three angles of a spherical triangle above two right angles. The account was published in the 'Philosophical Transactions' for 1790; and in the volume for the same year is a paper by Dalby on the figure of the earth, in which it is proved that the 'excess' is, without sensible error, the same whether the earth be a sphere or a spheroid. General Roy died in 1790, and in the following year Dalby was engaged, together with Colonel Williams and Captain (since Major-General) Mudge, to carry on the survey of England. [TRIGONOMETRICAL SURVEY, P. C.]

The operations commenced by a re-measurement of the original base on Hounslow Heath, and before Mr. Dalby quitted that service the triangulation was extended through the southern counties of England to the Land's End. The accounts of the survey were published in the 'Philosophical Transactions;' but in 1798 Dalby, together with Colonel Mudge, made a revision of General Roy's papers, and connected the operations of that officer with those which had subsequently taken place to the end of 1796: these form the subjects of a volume which was published separately.

In the year 1799, on the formation of the Royal Military College at High Wycombe, Dalby, in consequence of an application from Colonel Le Marchant, the Commandant, to Colonel Mudge, was appointed Professor of Mathematics in the senior department of that Institution; at this time, as he observed in a letter to a friend, he was more than fifty years of age, and desirous of securing a retreat from the fatigues of the field. He continued to hold that appointment during the years that the department to which he belonged remained at High Wycombe, and subsequently to its removal to Farnham in Surrey: but in the year 1820, it being then united to the junior department at Sandhurst in Berkshire, his infirmities obliged him to resign. He continued however to reside at

Farnham till his death, which took place October 14, 1824, when he was in the eighty-first year of his age.

His attention to his duties was unremitting; and besides his contributions to the 'Ladies' Diary' and other works, he wrote for the use of the Military College a valuable Course of Mathematics in two volumes, which, with successive improvements, extended to a sixth edition.

(Leybourn's *Mathematical Repository*, vol. v.)

DALTON, JOHN, was born Sept. 5, 1766, at the village of Eaglesfield, near Cockermouth in Cumberland, where his father, Joseph Dalton, was the owner and cultivator of a small copyhold estate, which descended to his eldest son Jonathan Dalton, and is still held by one of the family.

John Dalton attended a school kept by John Fletcher, a Quaker, till he was twelve years of age. In his thirteenth year he himself began to keep a school at Eaglesfield, but he gave occasional assistance to his father in the farming operations. In 1781, when he was fifteen, he removed to Kendal, in order to become an usher in the school of his cousin George Bewley. Dalton, for two or three years before he left Eaglesfield, had been kindly noticed and assisted in his studies by Mr. Robinson, a man of property; and a similar good fortune attended him at Kendal, where he obtained the friendship of Mr. Gough, a blind gentleman who was devoted to the study of natural philosophy, and who, besides the use of his library, afforded Dalton the advantage, which he valued still more highly, of his instruction and conversation.

Dalton continued in his situation of usher till 1793, when Mr. Gough having been asked to name a person fit to become professor of mathematics and natural philosophy in the New College, Mosley Street, Manchester, he recommended Dalton, who was accepted, and immediately removed to Manchester, which became his place of permanent residence during the rest of his life. The college was removed to York in 1799, when Dalton withdrew from it, and began to give lessons in mathematics and natural philosophy at his residence in Manchester, as well as at private seminaries. He afterwards delivered public lectures, of which the first course was given in the rooms of the Literary and Philosophical Society of Manchester, and consisted of twenty lectures on experimental philosophy; he subsequently gave lectures at London, Leeds, Birmingham, and other places in England and Scotland. He had filled for several years the situations of secretary and vice-president of the Manchester Literary and Philosophical Society, of which he had become a member in 1794; in 1817 he was elected president, and was re-elected every year till his death.

In 1822 Dalton paid a visit to Paris, with a single introduction, which was to Brequet, the eminent watchmaker; next day he received an invitation from La Place, by whom he was introduced to the most distinguished scientific and literary men in Paris. Before this time however Dalton had published his most important discoveries in natural philosophy and chemistry; his merits were consequently well known to the French chemists, and they became more and more highly appreciated in England during every succeeding year of his life.

George IV. having, in 1826, given 100 guineas to the Royal Society of London for the purchase of two gold medals to be given to persons who had most distinguished themselves by discoveries in science, the first medal was unanimously awarded by the council to Dalton. He attended, at York in 1831, the first meeting of the British Association for the Advancement of Science, and was the object of general respect and admiration; at the second meeting, at Oxford in 1832, the University conferred on him the title of Doctor of Civil Law; at the third meeting, at Cambridge in 1833, Professor Sedgwick, after pronouncing an eulogium on his character, announced that William IV. had granted him a pension of 150*l.* a year; at the fourth meeting, in Edinburgh in 1834, the University of Edinburgh conferred on him the degree of LL.D., and the Royal Society of Edinburgh elected him a member. In 1836 his pension was raised to 300*l.* a year.

Besides the honours conferred upon Dr. Dalton during the meetings of the British Association, his friends in Manchester, in 1833, subscribed 2000*l.*, and employed Chantrey to execute a statue of him in marble, which is now in the entrance-hall of the Royal Manchester Institution.

On the 10th of April, 1837, Dr. Dalton, then in his seventy-first year, had a severe attack of paralysis, and another slight attack on the 21st; his right side was paralysed, he was deprived of the power of speaking, and his mind appeared to be in some degree affected, but after an illness of some months his body and mind regained their powers, and his voice was restored, but his articulation was less distinct ever afterwards.

On the 3rd of May, 1844, Dr. Dalton had a third paralytic stroke, which affected his right side, and increased the indistinctness of his articulation. He partly recovered from the attack, and on the 19th of July attended a meeting of the council of the Manchester Literary and Philosophical Society, when he received a copy, engrossed on vellum, of a complimentary resolution passed at the annual meeting of the Society. Being unable to articulate distinctly, he delivered a written reply. He died July 27, 1844. He had made his usual entry of meteorological observations, but with some symptoms of indistinctness of memory, before he retired to rest on the previous night. The inhabitants of Manchester expressed their estimation of his character by a public funeral. His body lay in state in the town-hall, and was visited by more than 40,000 persons in a single day. He was buried in the cemetery at Ardwick Green, on the 12th of August. The funeral ceremony was conducted with great magnificence, and was attended by a vast concourse of persons.

Dalton, during his residence at Kendal, had occasionally contributed to 'The Gentleman's and Lady's Diary,' and in 1788 had commenced a series of meteorological records and observations, the first results of which he published soon after he went to Manchester, under the title of 'Meteorological Observations and Essays,' 8vo., 1793. He continued the habit of observing and recording the state of the atmosphere with the greatest regularity till the day before he died, taking several records daily; he had registered altogether upwards of 200,000 independent notices. His first essay in the 'Transactions of the Manchester Literary and Philosophical Society' related to a peculiarity of his own sight, and was entitled 'Extraordinary Facts relating to the Vision of Colours, with Observations, by Mr. John Dalton.' It was read October 31, 1794, and is inserted in the 'Transactions,' vol. 5, part 1. In 1801 he published 'Elements of English Grammar,' London, 8vo., probably in expectation of making a small addition to his limited income, for his tastes and pursuits were by no means philological or literary.

In the Manchester Transactions for 1802, part 2, there are six papers by Dalton, chiefly on subjects of meteorology, of which the most important is one called 'Experimental Essays on the Constitution of Mixed Gases; on the Force of Steam, or Vapour from Water and other Liquids, in different Temperatures, both in a Torricellian Vacuum and in Air; on Evaporation; and on the Expansion of Gases by Heat.' He discusses with great acuteness the difficult problem of the equal diffusion throughout each other of gases of unequal densities; and, besides other facts of importance, he proves that water, when it evaporates, is always converted into an elastic fluid, or vapour, and that the elasticity of this vapour increases as the temperature increases; at 32° of Fahrenheit it balances a column of mercury about half an inch in height; at 212° it balances a column 30 inches high, or is equal to the pressure of the atmosphere. He determines the elasticity of vapour at all temperatures from 32° to 212°, points out the method of determining the quantity of vapour which exists at any time in the atmosphere, and determines the rate of evaporation from the surface of water at all temperatures from 32° to 212°. The principles laid down in these essays have been of the highest importance to chemists in their investigations respecting the specific gravity of gases, and have enabled them to solve many interesting problems.

Dalton began to work out his grand discovery of the atomic theory in 1803; in August, 1804, he explained it distinctly and fully to Dr. Thomas Thomson, who was then on a short visit to Manchester; he touched upon it in a lecture before the Royal Institution of London in 1804, and subsequently in lectures at Manchester, Edinburgh, and Glasgow; but Dr. Thomson was the first to publish a short sketch of it in 1807, in the third edition of his 'System of Chemistry.' Dr. Wollaston became at once aware of its importance, and he and Dr. Thomson endeavoured to make a convert of Davy, but they could not convince him, and he treated the whole matter with ridicule. Mr. Davies Gilbert however soon afterwards made him aware of its truth, and he was ever afterwards a strenuous asserter of its great value; in his last course of lectures at the Royal Institution of London in 1814 he observed, that among the discoveries of modern times one of the greatest was the result of the application of mathematics to chemistry by Dalton.

In 1808 Dr. Dalton published 'A New System of Chemical

Philosophy,' 8vo., vol. 1. In the first chapter he treats of heat; in the second, of the constitution of bodies, in which his chief object is to oppose the peculiar notions respecting elastic fluids which had been advanced by Berthollet and were supported by Dr. Murray of Edinburgh; in the third chapter, which occupies only a few pages, he gives the outline of the atomic theory. In a plate at the end of the volume he gives the symbols and atomic weights of 37 bodies, twenty of which were then considered simple, and the seventeen others compound. In the 2nd volume of his 'New System of Chemical Philosophy,' published in 1810, he treats of the elementary principles, or simple bodies, oxygen, hydrogen, azote, carbon, sulphur, phosphorus, and the metals; next he treats of the oxygen combined with hydrogen, azote, carbon, sulphur, and phosphorus; and of hydrogen combined with azote, carbon, sulphur, and phosphorus; finally, he treats of the fixed alkalies and earths. The table of atomic weights at the end of the volume, though more complete than the one he had given at the end of the first volume, is still very imperfect.

The atomic theory is probably the most important contribution which has ever been made to chemistry, and hardly less important were Dalton's attempts to determine the atomic weights of the different substances, though scarcely a single number was determined correctly. At the time when he made his discovery there was not a single chemical analysis which could properly be considered as correct; there was not a single gas whose specific gravity was known with any approach to accuracy; and Dalton displayed infinite sagacity in coming so near the truth as he did. Since the introduction of the atomic theory, the knowledge of chemical combination has been simplified to an amazing extent, and the processes of analysis, which constitute the essence of chemistry, have assumed a degree of accuracy almost approaching to mathematical precision. Manufactures have been benefited as well as science; the quantity of each constituent of any article can be regulated with perfect accuracy, so that there is no waste, and the result of the combination can be reckoned upon with unfailing certainty.

Dalton represented his atoms by symbols, as, for instance, oxygen by a circle, hydrogen by a circle with a dot, and other elements by similar simple figures. He considers that all bodies are composed of atoms, which, however small, have a definite size and weight. The symbols of oxygen and hydrogen placed together represented water, which he supposed to be composed of an atom of each; and other symbols were used in a similar manner. The atomic weights are the relative or combining weights, not the absolute weights. Assuming hydrogen to be the lightest body, he called it 1; oxygen he determined to be 7, but it has since been ascertained to be 8. Dr. Wollaston has called oxygen 1; hydrogen then becomes ·125. Dalton not only stated the general principle of combination in definite proportions, but he stated the chief laws of combination on which modern chemical analysis is based: 1, that the same compound consists invariably of the same constituents; 2, that the elements of every compound always unite in the same proportion by weight (and Gay-Lussac, in 1809, proved that gases unite in the same proportion by volume as well as by weight); 3, that, when any element combines in more proportions than one, those proportions are multiples—1, 2, 3, 4; 6, 12, 18, 24; 8, 16, 24, 32, and so on; 4, that, if two substances combine in a certain proportion with a third, they combine in exactly the same proportion with each other; 5, that the combining proportion of a compound is the sum of its constituents, as hydrogen 1 + oxygen 8 = water 9. Davy substituted the word proportion for that of atom, and Wollaston that of equivalent, which is now generally used; but, whatever be the term, the meaning is the same; and in proportion as analyses have become more accurate, the laws which Dalton laid down have been more remarkably confirmed. For the details, see Atomic Theory, P. C.

The third volume of Dalton's 'New System of Chemical Philosophy' was not published till 1827, but the greater part of it had been printed nearly ten years before. He treats of the metallic oxides, the sulphurets, phosphurets, carburets, and of the alloys. In the interval between the printing and publication, many of the facts had been anticipated by others, and some of them carried much farther. The most important part of the volume is the appendix, of about ninety pages, in which he discusses with his usual sagacity various important matters connected with heat and vapour. He gives a new table of atomic weights, much more copious than those contained in the two preceding volumes, and in which he introduces the corrections rendered necessary by the numerous correct analyses which had been made since the publication of the second volume.

Dr. Dalton's other works, which are tolerably numerous, are inserted in the 'Manchester Transactions,' 'Nicholson's Journal,' the 'Philosophical Transactions,' and the 'Philosophical Magazine,' and consist of experiments and observations on heat, vapour, evaporation, rain, wind, the aurora borealis, dew, and a variety of other physical subjects.

Dr. Dalton was of middle stature, and strongly made. His face is said to have resembled the portraits of Newton. His power of mind was naturally strong; he was a patient observer, and an independent thinker, with the most perfect self-reliance, and with an extraordinary power of tracing the relations of physical phenomena; his experiments had rarely an insulated character, but were steps in some process of wide generalization. By such a process, comparing the results of numerous experiments and numerous facts which had been established, he elicited order out of seeming confusion, and may truly be said to have become the legislator of chemistry, which before his time was little better than an experimental art—an accumulated mass of unconnected and imperfectly developed facts. Dalton laid down the laws of the combination of substances, and at once advanced chemistry to the rank of a science. His moral character was worthy of his intellectual. He was a man of the strictest truth and honesty; independent, grave, reserved, but not austere; frugal, but not parsimonious. Unassuming, the honours which he received were voluntarily bestowed upon him by those who were best able to estimate the value of his services to science and manufacturing industry; unostentatious, it was some time before his townsmen in Manchester were aware of his merits, but a small circle of friends appreciated him highly, and, long before he received his pension, offered to provide him with an independence, that he might devote the whole of his time to science, but he declined to accept it, observing 'that teaching was a kind of recreation, and that if richer he would probably not spend more time in his investigations than he was accustomed to do.' His mode of life was singularly uniform. He was rarely from home except when he went to some place to lecture; he attended the meeting of the Society of Friends, of which he was a member, twice every Sunday; he went daily to his laboratory, of which the apparatus was of the simplest and indeed rudest kind; he played at bowls on the afternoon of every Thursday; and he paid an annual visit to his friends and the mountains in Cumberland and Westmorland. He was never married. He had left 2000*l*. to endow a chair of chemistry at Oxford, but he revoked the bequest before his death, and is said to have left the money to the relatives of those who had assisted him in his early days.

Dalton was elected a Fellow of the Royal Society about 1821; he was elected a corresponding member of the Institute of France, and a few years later was enrolled a foreign Fellow. He was also a member of the Royal Academies of Science of Berlin and Munich, and of the Natural History Society of Moscow.

(Thomson's *History of Chemistry*, vol. ii.; *Pharmaceutical Journal*, Oct. 1841; *Life and Discoveries of Dalton*, in *British Quarterly Review*, No. 1; *British Association Reports*.)

DAMMAR PINE, DA'MMARA. [Agathis, P. C.]

DANCE. There are two architects of this name, father and son. The elder George Dance was architect to the Corporation of London, and erected the Mansion House, the first stone of which was laid October 25th, 1739. That edifice has been in a manner 'damned' to fame, and by those too who have been exceedingly liberal of their praise towards buildings in not much purer taste—for instance, St. Martin's Church. Ralph, the architectural oracle of London in the last century, says, in regard to it, 'The man pitched upon, and who afterwards carried his plan into execution, was originally a shipwright; and, to do him justice, he appears never to have lost sight of his first profession.' Whether such was really the case, or whether the remark was made in ignorance, if not with malice, we are unable to say; but as to the structure, although certainly not in the happiest or most refined taste, it by no means deserves the obloquy that has been heaped upon it; for if in some respects rather uncouth, it is at all events a stately mass, and has a 'monumental' look. Telford says of it, 'It is grand and impressive as a whole, and reflects credit upon its architect;' and his opinion was expressed of it while the building was as originally designed, with the huge superstructure across the roof at the north end, but that excrescence was taken down in 1840. The elder Dance also built the churches of St. Botolph, Aldgate; St. Luke; and St. Leonard, Shoreditch. He died February 8th, 1768, and was succeeded in his appointment of City Surveyor by his eldest son,

George Dance, Jun. (born in 1740), whose talent acquired for the family name far higher distinction. Not only trained up to architecture, as a pursuit in which a safe and certain career, if not a brilliant one, was opened for him, he had applied himself to the study of it with a diligence exceeding what was required by the routine of that day, and he further possessed both a natural and cultivated taste for the fine arts generally, poetry included. He certainly stamped something of poetry, as well as energetic character, on the very first public work he executed; nor had he long to wait for the opportunity by which he signalized himself, for Newgate, that 'proudest of prisons,' was begun by him in 1770. This structure, one of the few truly monumental pieces of architecture in the metropolis, has been chiefly extolled for its striking degree of character; yet it surely requires no very great ability to make an edifice of so peculiar a class express its purpose so clearly that it cannot possibly be mistaken for any other than what it is. Newgate might have been equally prisonlike in aspect had it been merely a dismal mass, utterly devoid of all æsthetic charm; it was by conferring upon it the latter—by breaking up the monotony of such a mass so as not at all to disturb unity, but enhance it—not to dissipate parts into littleness, but blend and condense them into one impressive whole—that Dance showed himself a great artist —let us say, a great tragic architect. The mode of treatment adopted by him might in less able hands have only weakened the expression aimed at; whereas here it renders it all the more energetic and the more intense. Truly felicitous is the manner in which, by being divided into boldly distinct and well articulated parts, the composition acquires artistic play without losing anything of its severity. Truly felicitous also the effective relief both as to perspective and light and shade thrown into it, not according to the usual practice of bringing parts forward, but of *recessing* them, and placing masses in the rear of others, so that the general line of front is preserved unbroken in its lower part. The great drawback on this otherwise masterly composition is the centre compartment, or 'governor's house.' Well intended as is the kind of contrast between that part and the rest, the contrast actually produced is far from the happiest, the character given to the centre being somewhat prosaic and insignificant—by far too much like that of an ordinary dwelling-house, the windows being so many, in proportion to the space they occupy, as absolutely to crowd it and cut it up, to destroy breadth and repose, and to occasion an air of littleness; whereas, had there been only three windows on a floor, instead of five, the effect would have been incomparably better externally, and probably without the slightest inconvenience as regards internal plan. At all events the attic story is a sad blemish, a most paltry termination to the centre of such a pile; but we believe we may vindicate Dance from the reproach of it, because not only does it look like an addition to the building, but really seems to have been an after and most unlucky alteration, since some prints of it represent the centre of the edifice crowned by a pediment, which gives variety to the whole composition, without any sacrifice of dignity. If it was Dance himself who was afterwards complaisant enough to mar his own work, in order to provide an additional story that might just as well have been concealed within the roof, very little is the pity we have to bestow upon him.

The proximity of Newgate has perhaps deprived Giltspur Street Compter of some of the celebrity it might else have obtained as a piece of architecture; and yet the same proximity is not altogether favourable to the other, the *fenestration* observed in the design of the Compter being decidedly better than that of the governor's residence in Newgate. Resembling the latter in style, this other work of Dance's is of different character from it—of that of the older Florentine palaces, which, unpalatial as it may be to English eyes, has of late years been affected and revived in Germany, both for royal palaces and other buildings, intended for far different purposes than prisons. Dance has derived much more fame from St. Luke's Hospital than from the Compter; in fact more than we can account for. Undoubtedly it looks expressly like what it is, and so generally does an ordinary workhouse; it is a mere horrible reality without any æsthetic beauty infused into it. Whether that building has been overrated or not, there can be but one opinion as to the front of Guildhall, erected by Dance in 1789. Its ugliness we might tolerate, its absurdity we might excuse, but ugliness, absurdity, and excessive paltriness combined together render it quite unendurable. In mitigation of the sentence due to such a monstrosity, it is a very poor plea to urge that Gothic architecture was then scarcely understood at all by any one; for, whether understood or not as style, its character might have been perceived—its expression felt—by any one who had seen any examples of it. If Dance had nothing else to study, there was at least the porch of the building before his eyes just as it now remains; and there was also, what has since been taken down, the small Gothic chapel attached to the east end of the front. So far from being any excuse, his utter ignorance of the style only renders his attempting it all the more unpardonable. For doing so there certainly was no occasion, because, even had it been tolerably satisfactory, the front he added would have still been a mere mask to the hall itself, inasmuch as, instead of indicating a single capacious room in any part of the interior, its physiognomy is that of a building divided into several floors.

Among Dance's minor works are the Shakspere Gallery, Pall Mall, now the British Institution, and the Theatre at Bath, in the front of which last he introduced the tasteless heresy adopted by his pupil Soane [Soane, P. C.], of pilasters without bases or capitals, and having more the character of carpenter's or joiner's work than masonry.

Dance was not only one of the earliest members of the Royal Academy, but held for several years the office of Professor of Architecture; yet he never delivered any lectures, nor does he seem to have exhibited drawings at its exhibitions. Still if he neither lectured nor wrote upon that branch of art which he pursued as a profession, he gave the world evidence of his ability in a department of art wholly unconnected with architecture; we allude to the very interesting series of portraits of the public characters and artists of the day, which appeared in two volumes, folio, 1811-14, and were engraved by Wm. Daniell, R.A., in imitation of the original drawings. All of them have the air of being striking likenesses, far more truthful indeed than always flattering, and they have also the peculiarity of being nearly every one of them represented in profile and looking the same way. Dance held his appointment of City Surveyor till 1816, when he resigned in favour of his pupil, the late W. Montague; but he survived his retirement from practice several years, and died at his house in Gower Street, January 14th, 1825, at the age of eighty-four. He was buried in St. Paul's, near Wren and Rennie.

His younger brother, **Nathaniel Dance**, third son of the elder George Dance, would have ennobled the family name still more as one distinguished in art, had he chosen to pursue the career in which he had begun to display more than ordinary talent. Poetical compliments are not to be received with implicit trust, but we may presume that the artist must have been skilful of whom Hayley has spoken so highly in his second epistle on painting:—

> 'To Dance's pencil, in precision strong,
> Transcendant force and truth of line belong,' &c.

In 1774 he exhibited his Orpheus lamenting Eurydice, and in 1776 his Death of Mark Antony. What more than anything else casts doubt upon Nathaniel Dance's talent for art was the vulgar ambition which led him not only to abandon his pencil when he had no longer any occasion to exercise it for emolument, but even to try to obliterate all record of his works by buying up and destroying as many of them as he could meet with. The fine figure and captivating address of Nathaniel Dance obtained for him the hand of the wealthy Yorkshire heiress, Mrs. Dummer, and from that time he became heartily ashamed of his former profession. On his marriage he had taken the name of Holland in addition to his own, and he was made a baronet in 1800. The income he acquired with his lady was about 18,000*l.* per annum, and as the Dummer estates were entailed, he contrived to amass for himself about 200,000*l.*, for he was one of those of whom it has been said that their 'great aim through life is to secure something to live upon after they are dead.' Sir Nathaniel Dance Holland died very suddenly at Winchester (near which city he resided, at Cranbury House), Oct. 15th, 1811. His money went to his relations, his baronetcy became extinct, and the title for talent which he might have left, he had himself renounced and extinguished.

DANIELL. William Daniell, R.A., painter and engraver, was born in 1769, and at the age of fourteen accompanied his uncle, Thomas Daniell, to India. They commenced their journey at Cape Comorin, and explored and sketched almost everything that was beautiful or interesting in the country between that point and Serinagur in the Himalaya Mountains: this arduous undertaking occupied them ten years. They took an amazing number of sketches, many of which they afterwards engraved and published, in a large form, comprised in one great work entitled 'Oriental Scenery,' in six volumes folio, completed in 1808. Five of these six volumes were engraved by or under the direction of William; the remaining volume, containing the 'Caves of Ellora,' was executed by Thomas, from drawings by James Wales. Besides the above work, William Daniell engraved and published, between 1801 and 1814, the following works:—'A Picturesque Voyage to India;' 'Zoography,' in conjunction with Mr. W. Wood; 'Animated Nature,' 2 vols.; a series of views entitled 'The Docks;' and 'The Hunchback,' after R. Smirke, R.A. Between 1814 and 1825 he was chiefly engaged in a work of extraordinary labour, entitled 'Voyage round Great Britain.' In this arduous undertaking he spent the summer of every year, collecting drawings and making notes. The difficulties he met with in prosecuting this plan were extreme, and had it not been for the cheering influence of the hospitable reception which he occasionally experienced from persons to whom he had letters of introduction, the accomplishment of his task would have been impossible: 'immense fatigue, exposure to weather of all kinds, wretched fare, and still more wretched accommodation, were his constant attendants.'

Besides those works, Daniell painted many large and beautiful oil pictures of remarkable places or scenes in India. In 1832 he painted, in conjunction with Mr. Paris, a panorama of Madras; and, more recently, two others by himself—'The City of Lucknow,' and 'The Elephant-hunt;' and he was a great contributor to the 'Oriental Annual.' His style of colouring was rather hard and red, which arose probably from the climate of India and the peculiar nature of its scenery. He died in 1837.

Thomas Daniell was likewise a member of the Royal Academy, and a very able landscape painter and engraver; he was originally a heraldry painter. He published some works on India besides that already mentioned. He was a fellow of the Royal, of the Asiatic, and of the Antiquarian societies. He died in 1840, aged ninety-one. Another member of this family, **Samuel Daniell**, also distinguished himself by some similar works. He spent three years at the Cape of Good Hope, and published, in 1808, some prints, descriptive of the scenery, habitations, costume, and character of the natives, and an account of the animals of Southern Africa. He published also, in 1808, illustrations of the scenery, animals, and native inhabitants of the island of Ceylon.

(*Literary Gazette*, 1837, 1840.)

DANIELL, JOHN FREDERICK, was born in Essex Street, Strand, March 12, 1790, and was the son of Mr. George Daniell, of West Humble, Surrey, bencher of the Middle Temple. At an early age he became a pupil of Professor Brande, in whose society he made several tours, and of whom he always spoke as one endeared to him by similar tastes and early associations. Mr. Daniell entered originally into business as a sugar-refiner. His fondness for scientific investigations was however manifested at a very early age, and, when a mere lad, he used often to astonish his young companions by exhibiting to them some of the wonders of pneumatic chemistry, a department of physical science on which the labours of Black, Cavendish, Lavoisier, and Priestley had recently thrown a new and unexpected light. He soon relinquished business for pursuits more congenial to his taste. In 1814 he became a fellow of the Royal Society. In 1816, associated with Professor Brande, he commenced the 'Quarterly Journal of Science and Art,' the first twenty volumes of which were published under their joint superintendence. He married in the following year Charlotte, youngest daughter of the late Sir W. Rule, surveyor of the navy. From this time to his death hardly a single year elapsed without the appearance of one or more essays on chemical or meteorological subjects from the pen of Mr. Daniell. In 1820 he published the account of his new hydrometer, an instrument which, for the first time, rendered regular and accurate observations on the dryness and moisture of the air practicable. In this instrument he applied the principle of the cryophorus of Wollaston to obtain the requisite cold for the production of dew upon a ball of dark-coloured glass containing æther. The temperature of the inclosed æther is measured by a delicate thermometer without the bulb, and corresponds with the dew-point. This instrument has been extensively employed in all climates, and has been of the greatest service to meteorology. In 1823 his great work, 'Meteorological Essays,' appeared, which is still the standard work on the science of which it treats. A second edition was published in 1827, and he was engaged in revising proofs of the third edition at the time of his death. This was the first synthetic attempt to explain the general principles of meteorology by the known laws which regulate the temperature and constitution of gases and vapours, and in which the scattered observations and isolated phenomena presented by the earth's atmosphere were considered in their most extensive and general bearings.

One of the most interesting of his theories connected with meteorology was that which he proposed to account for the horary oscillations or periodic daily rise and fall of the barometer, by which he predicted the occurrence of a fall near the poles coincident with the rise at the equator. Actual observations soon confirmed the accuracy of his theory, and the existence of this unsuspected phænomenon was etablished beyond dispute.

In the year 1824 he published an 'Essay on Artificial Climate,' for which he received the silver medal of the Horticultural Society. Dr. Lindley has expressed a strong opinion on the practical value of this paper in completely revolutionizing the methods of horticulture till then adopted.

About this period Mr. Daniell became managing director to the Continental Gas Company, and travelled through most of the principal European cities with Sir W. Congreve and Col. Landmann, making the arrangements by which many of them are lighted at the present day. He also invented a new process for obtaining inflammable gas from resin, by which some of the large towns in America are now lighted.

On the establishment of King's College in 1831 he was appointed Professor of Chemistry, the duties of which office he discharged to the day of his death. About this time he published the account of his new Pyrometer, an instrument still the best for measuring high temperatures, such as those of fusing metals, furnaces, &c. For this simple and perfect invention, the Royal Society, in 1832, awarded him the Rumford Medal, a triennial medal left by Count Rumford to the Royal Society, to be given for the most important discovery or invention relative to the theory of heat or its applications that had been made throughout the known world since the time of its last adjudication. From this time his attention seems to have been principally devoted to voltaic electricity. In 1836 he communicated to the Royal Society a paper in which he described his valuable improvement in the voltaic battery. In this communication he traced the cause of the rapid decline of power in batteries of the ordinary description, and pointed out an arrangement by which a powerful and continuous current of voltaic electricity may be maintained for an unlimited period. The importance of this discovery was recognised immediately by the whole scientific world, and in appreciation of its merit, the Royal Society, in 1837, awarded him the Copley Medal, for the most important scientific discovery made in any part of the world during the previous year. In 1839 he published his 'Introduction to Chemical Philosophy,' an admirable treatise on the action of molecular forces in general, though it modestly professes to give little more than a simple introduction to the discoveries of Faraday, and their applications to chemistry. He continued his researches in the same department of science till the time of his decease, communicating the results of his experiments to the Royal Society. For two of these papers, bearing most essentially on the theory of salts, he received, in 1842, one of the Royal medals.

In 1843 the University of Oxford conferred upon him the honorary degree of D.C.L., and in the same year he published the second edition of his 'Introduction to Chemical Philosophy.' For more than thirty years he was a zealous and active member of the Royal Society, and for the last six years he held the honourable office of foreign secretary to that learned body. Besides his professorship in King's College, he held the post of lecturer to the East India Company's military seminary at Addiscombe, and was examiner in chemistry to the University of London since the opening of that institution.

On the 13th of March, 1845, Mr. Daniell, while attending a meeting of the council of the Royal Society, and having just spoken on a point under consideration, apparently in perfect health, was seized with an apoplectic fit. In five minutes from the commencement of the attack he was dead. A subscription has been entered into at King's College for the purpose of having a bust executed, and for the establishment, in connexion with the college, of a Daniell Scholarship in the science of which he was so distinguished an ornament.

It is worthy of remark, as illustrating the extent and diversity of his attainments, and the importance of his discoveries, that he is the only individual on whom all the three medals in the gift of the Royal Society were ever bestowed. The following is a list of his most important essays, with their dates:—

1816, 'On some Phenomena attending the process of solution,' in 'Quarterly Journal of Science,' vol. i. p. 24.

1817, 'On the mechanical structure of iron, developed by solution, and on the combination of silex in cast-iron,' ditto, vol. ii. p. 278.

1817, 'On a new species of resin from India,' ditto, vol. viii. p. 113.

1818, 'Observations on the theory of spherical atoms, and the relation which it bears to the forms of certain minerals,' ditto, vol. iv. p. 30.

1818, 'On the strata of a remarkable chalk found in the vicinity of Brighton and Nottingham,' ditto, vol. iv. p. 227.

1819, 'On the Formation and Decomposition of Sugar, and the Artificial Production of Crystallized Carbonate of Lime,' ditto, vol. iv. p. 32.

1819, 'On the Acid formed in the slow Combustion of Ether,' ditto, vol. vi. p. 319.

1820, 'On a new Hygrometer,' ditto, vol. viii. p. 298.

1821, 'Description of a new Pyrometer,' ditto, vol. xi. p. 309.

1821, 'Experiments to ascertain the effects of the great Eclipse in September, 1820.' 'On the Gaseous and Aqueous Atmospheres,' ditto, vol. x. p. 123.

1822, 'Inquiry, with Experiments, into the Nature of the Products of the slow Combustion of Ether,' ditto, vol. xii. p. 64.

1822, 'Comparative Remarks (with three tables) on the Weather, and Seasons of the years 1819, 1820, and 1821,' ditto, vol. xii. p. 111.

1822, 'On the Correction to be applied in Barometrical Mensuration for the Effects of Atmospheric Vapours by means of the Hygrometer,' ditto, vol. xiii. p. 76.

1823, 'Meteorological Essays,' first edition.

1824, 'Essay on Climate considered with regard to Horticulture,' in 'Horticultural Transactions,' 1824, p. 1.

1825, 'Observations and Experiments of Evaporation,' in 'Quarterly Journal of Science,' vol. xvii. p. 46.

1825, 'On the Horary Oscillation of the Barometer,' ditto, vol. xvii. p. 189.

1825, 'Observations on the Radiation of Heat in the Atmosphere,' ditto, vol. xvii. p. 305.

1826, 'On the Oscillations of the Barometer,' ditto, vol. xix. p. 82.

1826, Another paper on the Barometer, ditto, vol. xxi. p. 230.

1826, Correspondence concerning the last paper, ditto, vol. xxi. p. 289.

1827, Second edition of 'Meteorological Essays.'

1830, 'On certain Phenomena resulting from the Action of Mercury on different Metals,' in 'Royal Institution Journal,' vol. i. p. 1.

1830, 'On a New Register Pyrometer for measuring the Expansion of Solids, and for determining the higher degrees of Temperature upon the Common Thermometric Scale,' in 'Phil. Trans.,' 1830.

1831, 'On the Relation between the Polyhedral and Spheroidal Theories of Crystallization, and the Connexion of the latter with the Experiments of Professor Mitscherlich,' in 'Royal Institution Journal,' vol. ii. p. 30.

1831, 'Further Experiments on a New Register Pyrometer for measuring the Expansion of Solids,' in 'Phil. Trans.,' 1831, p. 443.

1832, 'On the Water Barometer erected in the Hall of the Royal Society,' in 'Phil. Trans.,' 1832.

1826, 'On Voltaic Combinations (the Constant Battery),' in 'Phil. Trans.,' 1836, p. 107.

1836, 'Additional Observations on Voltaic Combinations,' ditto, 1836, p. 125.

1837, 'Further Observations on Voltaic Combinations,' ditto, 1837, p. 141.

1838, 'Fourth Letter on Voltaic Combinations,' ditto, 1838, p. 41.

1839, 'Introduction to Chemical Philosophy.'

1839, 'Fifth Letter on Voltaic Combinations, with some Account of the Effects of a large Constant Battery,' ditto, 1839, p. 89

1839, 'On the Electrolysis of Secondary Compounds,' ditto, 1839, p. 97.

1840, 'Second Letter on Electrolysis of Secondary Compounds,' ditto, 1840, p. 209.

1841, 'On the Spontaneous Evolution of Sulphuretted Hydrogen in the Waters of the Western Coast of Africa, and of other Localities,' in 'Phil. Mag.,' vol. xix. p. 1.

1842, 'Sixth Letter on Voltaic Combinations,' in 'Phil. Trans.,' 1842, p. 37.

1843, Second Edition of 'Introduction to Chemical Philosophy.'

1844, 'Additional Researches on Electrolysis,' in 'Phil. Trans.,' 1844, p. 1.

DANNECKER, JOHANN HEINRICH, was born at Stuttgart, Oct. 15, 1758. His father was a groom employed in the stables of the Duke Karl of Würtemberg, at Stuttgart, where his particular business was with the mules; and young Dannecker was brought up in a very humble manner. In 1764 his father was removed to Ludwigsburg, and here Dannecker, though then only six years of age, evinced signs of that talent for art for which he was afterwards so eminently distinguished. His first essays were flowers and soldiers, which he drew on any scrap of paper that came into his hands, or he scratched them upon stones. But these amusements of the child were, to his great annoyance, frequently interrupted by his mother, who used to send him occasionally some seven miles to fetch water from the mineral-springs of Cannstat. In 1771 however, in his fourteenth year, Dannecker entered, by the duke's desire, but against his father's wish, the school established at Ludwigsburg for the education of the children of the court-servants. He was first placed in the dancing-school, in which he became acquainted with four fellow-pupils who became the most celebrated of his countrymen in their respective lines—the sculptor Sheffauer, the engraver J. G. Müller, the musician Zumsteeg, and the poet Schiller. He made such progress in drawing in two years as to be removed from the dancing-school and placed in the school of plastic design, under the direction of the sculptors Bauer and Le Jeune, the modeller Sonnenschein, and the painters Harper and Guibal. In this school he remained three years, when, in 1780, in his eighteenth year, he obtained the prize for the best model of Milo of Croton destroyed by the lion; upon which he was appointed sculptor to the duke, with a salary of 300 florins per annum. In 1783 he went with Scheffauer on foot to Paris, and there studied under Pajou; after a two years' stay in Paris, the two friends departed together, again on foot, for Rome, where Dannecker remained until 1790, and contracted a friendship there with Herder, Göthe, and Canova. A Ceres and Bacchus which he executed in Rome were Dannecker's first works in marble: they are now in the palace at Stuttgart.

After 1790 Dannecker lived, with the exception of a few short intervals, wholly at Stuttgart; three of these intervals were occasioned—by a visit to Paris, to view the works of art collected together by Napoleon; by a visit to Zürich to model the bust of Lavater; and by another to Vienna, in the time of the congress in 1815, to model the bust of Metternich. He was professor of sculpture, and director of the School of Art, at Stuttgart; and inspector of the Royal Gallery of Ludwigsburg. He was offered, in 1808, the professorship of sculpture in the academy of Munich, which he declined. He died on the 8th of December, 1841.

Dannecker's works are chiefly executed in the round; there are few bas-reliefs by him, but those few are excellent: a predilection also for representing the female figure is a characteristic of his taste. He was likewise excellent in portraiture; he had a strong perception of individuality of character, and great facility in expressing it. His works however, during the course of his long career, evince the prevalence of a various taste in design in three different periods. At first his works were not marked by any particular originality of thought or excellence of design, but were conceived and executed in the spirit of such works as he had access to in Württemberg or at Paris, and were in the taste of the French school. In Rome other styles were revealed to him, both in the works of Canova and in the antique, and his own works in a few years were characterised by a strong expression of the ideal, especially in the female form. The following works are eminently distinguished in this respect:—'Mourning Friendship,' executed in 1804 for the monument raised by Frederic, king of Würtemberg, to his minister, Count Zeppelin, at Ludwigsburg; the 'Ariadne reclining on a Leopard,' in the garden of M. Bethmann at Frankfort; and 'Cupid and Psyche' in the royal villa of Rosenstein near Stuttgard. His later works were more ideal in character than in form, and his object was to personify religious resignation. Of these his figures of Christ, John the Baptist, and Faith, are the most celebrated. His male figures however are effeminate, and in his Christ, meekness, more peculiarly a female quality, is the predominant sentiment.

Dannecker's greatest excellence was in his busts; he has left many interesting monuments in this branch of art, and foremost among them are the small and colossal busts of Schiller; the busts of Lavater, Gluck, the kings Frederic and William of Würtemberg, and other members of the royal family, and the medallions of Haug and Jung Stilling.

Dannecker ranks as one of the best of the modern sculptors, and his great merit seems to consist in a proper perception and representation of the finer and more gentle qualities of the soul, and of the more delicate characteristics of the human frame. His forms are true to nature, but uniform in character; and the sphere of his art is very circumscribed when compared with the comprehensive range of Canova. Dannecker never attempted, or at least never accomplished, the representation of manly vigour or robust masculine beauty; in the female figure however he was sometimes more natural, equally graceful, and less mannered or affected than Canova; but in his draperies he was frequently untrue. Instead of the natural and elegant folds which loose draperies assume on the human figure, he gave way to the conventional affectation of showing the exact form of the body beneath the draperies, as if they were wet, and adhered to it; producing an effect by no means beautiful, and, except when blown by the wind, unnatural; and in this case the parts not attached to the body must show a corresponding action.

An account of the life and works of Dannecker was published at Hamburg in 1841, with 25 lithographic prints of his principal works, from drawings by his pupil Wagner, likewise a celebrated sculptor. There is also a notice of Dannecker in the first and second numbers of the *Kunstblatt* for 1842.

DAPE'DIUM, changed by Agassiz to Dapedius, one of the first described British genera of fossil Ganoid fishes. To D. politum of De la Beche (*Geol. Trans.*, 2nd series, vol. i. pl. vi.) six others are added by Agassiz, all from the lias.

D'ARBLAY, MADAME, originally Miss *Frances Burney*, was born at Lynn-Regis, 13th June, 1752, and was the second daughter of Charles Burney, Mus. Doc., the author of the 'History of Music,' who was then organist in that town. Her mother, whom she lost when she was about nine years old, was partly of foreign descent, her maternal grandfather having been a French protestant, who left his native country on the revocation of the edict of Nantes. Madame D'Arblay has given her own account of her early life in her Memoirs of her Father. She there assures us that she was so backward when a child, that at the age of eight she was still ignorant of her letters. By the time that she was ten, nevertheless, she had begun of her own accord to exercise her talents in composition, and she was soon incessantly busy in scribbling 'elegies, odes, plays, songs, stories, farces, nay, tragedies and epic poems,'—her confidante at this date being her youngest sister Susannah. At fifteen she burned all her early performances; but one of them, the 'History of Caroline Evelyn,' kept possession of her memory and fancy, and gave rise to her conception of a sequel to it in the story of the daughter of her former heroine. This, we are told, was all 'pent up in the inventor's memory' before she committed any of it to paper; she then wrote down two volumes of it in a feigned hand, and employed her brother to offer them to a publisher. Dodsley declined the work as anonymous; Lowndes, as unfinished. Upon this she completed it by dictating to her brother a third volume; Lowndes gave her twenty pounds for the manuscript; and it was published under the title of 'Evelina; or, the History of a Young Lady's Introduction to the World.' The impression left upon the reader by this detailed account is, that 'Evelina' was written and published no very long time after the burning of the earlier story of 'Caroline Evelyn;' and, indeed, it used to be generally understood, and has been repeatedly stated, that Miss Burney was only about seventeen when this her first novel appeared. The fact is, that it was published in the year 1778, when she was six and twenty. She goes on to inform us that it was written and given to the world without the knowledge of any of her other relations except her sister and her two brothers; that she merely told her father, who used to employ her as his amanuensis (on which account she had employed the disguised hand in writing out the first two volumes), that she was going to print a little book; that the work had been six months published before he knew that it was hers; that she sat as a listener with the rest of the family while it was read through at a friend's house, where she was staying, without her concern in it being suspected; but that after a little time it began to make a great stir, passing from the favourable criticism of the Monthly Reviewers into the hands of the beautiful Mrs. Bunbury, from her to the Hon. Mrs. Cholmoneley, from her to Reynolds, Burke, Johnson, and Mrs. Thrale. By the time however that it reached these last, the authoress was known; and they were her father's intimate friends, and naturally disposed to admire and applaud. They appear, in fact, to have vied with one another in the enthusiasm with which they extolled the work, and hailed the wonderful genius who had suddenly started up among them. And 'Evelina' would, no doubt, have been in some respects a surprising production for a girl in her seventeenth year; but it is still more surprising upon the whole as that of a young woman in her twenty-sixth. Its most striking characteristic is the immaturity of mind which it displays, the girlishness of conception that pervades it, the want of the power of penetrating beyond the outside shows and forms of things, the utter incapacity of appreciating motives and probabilities, the childish absurdity of the whole construction and movement of the story, and of the conduct at every turn of the persons figuring in it. There is fluency indeed, and some occasional vivacity, but the latter is nowhere brilliant, and much of it is made up of mere hoydenish rattle and practical jocularity, and often of insipid vulgar exaggeration and the lowest farce. This addictedness to caricature distinguishes more or less all Miss Burney's novels. Her second, 'Cecilia, or the Memoirs of an Heiress,' appeared in 1782. It is in five volumes, and is a considerable improvement upon 'Evelina.' For more than a dozen years after the publication of 'Cecilia' the fair writer laid aside her pen. In July, 1786, she was appointed one of the Dressers or Keepers of the Robes to Queen Charlotte, and this situation she held for five years. In July, 1793, she married M. Alexandre Piochard D'Arblay, a French emigrant artillery officer; and the same year she published an 8vo. pamphlet, entitled 'Brief Reflections relative to the Emigrant French Clergy.' In 1795 her tragedy of 'Edwy and Elgiva' was brought out at Drury Lane; but it was speedily withdrawn, and was never printed. The next year she produced another five volume novel, 'Camilla, or a Picture of Youth,' which she published by subscription, thereby realising, it is said, above three thousand pounds. It is not rated by her admirers so high as either of its predecessors. After the peace of Amiens, in 1802, her husband and she went to Paris; and M. D'Arblay having given in his adhesion to the existing government, they remained in France. In 1812 however Madame D'Arblay found means to pass over to her own country; and she had thus the satisfaction of again seeing her father, who survived till 1814, when he died at the age of eighty-seven. Her husband, now General D'Arblay, joined her at the peace; and they resided together till his death at Bath in May, 1818. Meanwhile she had, in 1814, published her fourth and last novel, 'The Wanderer, or Female Difficulties,' in 5 vols., for which the bookseller is said to have given her 1500*l.*; but it met with little success, and is considered the poorest of her performances. She lived however for many years after this; and in 1832 once more came before the world through the press with three 8vo. volumes of 'Memoirs' of her father, Dr. Burney. This work was unlike anything she had previously written, as much in manner as in subject; instead of the fluent, familiar style of her novels, she surprised her former readers, and the public in general, by a pompous, indirect, long-winded, drawling diction, apparently intended as an improvement upon Johnson or Gibbon, but having rather the effect of a ludicrous though unintentional caricature. The book however contains many interesting anecdotes. In 1837 Madame D'Arblay lost her son, the only issue of her marriage, the Rev. Alexander Charles Louis D'Arblay; he was a fellow of Christ's College, Cambridge, and perpetual curate of Camden Town Chapel, and he had published several single sermons. Her own death followed at Bath on the 6th of January, 1840. Since then, five volumes have appeared (in 1842) of her 'Diary and Letters, edited by her Niece;' but, although the sixth volume was announced as about to follow in December of the same year, it has not yet been published. It has however been recently announced as in the press. This Diary, though much of it is frivolous enough, is on the whole an extremely curious record, and the account which it presents of some departments of English life and society in the latter part of the last century is the amplest and most distinct that has anywhere been given.

(*Gent. Mag. for Aug.*, 1840; Madame D'Arblay's *Works.*)

DARWAZ is a country in Asia in the valley of the river Oxus, situated north of its course between 37° and 38° N. lat. and between 69° and 71° E. long. Its extent northward is imperfectly known, as it borders there on the almost unknown country of Karategein. On the east of it are Shagnan and Roshan, and on the south Badakshan. It is an Alpine country, consisting of a succession of high mountains and narrow valleys; the mountains are so difficult of access, that the communication between the valleys can only be effected by paths which do not admit of animals of burden of any kind. Cultivation is extremely limited, but cotton is extensively cultivated. It is made into cloth by the inhabitants, and constitutes the principal article of export, for which in return grain and gunpowder are received. A small number of cattle are kept; and sheep and goats are numerous. There are few horses. The natives of this country are Tajiks, and most of them Sooni Mohamedans. Their language is Persian. Though the other small countries in the neighbourhood have been compelled to submit to the authority of Murad Bey in Kunduz, the Shah of Darwaz has been able to maintain his independence, and the intercourse between the two sovereigns is limited to an exchange of presents. The Shah keeps up some show of state, and a large force, large at least when compared with the troops of his weaker neighbours.

(Elphinstone's *Account of the Kingdom of Cabul;* Wood's *Narrative of a Journey to the Source of the River Oxus.*)

DAUCUS CARO'TA, *Medical Properties of.* The carrot has been sufficiently described [CARROT; DAUCUS, P. C.] For medical purposes the root of the cultivated plant, and the fruit (called improperly *seeds*) of the wild plant, are used. The former rasped down into a fine pulp is sometimes applied raw, to chapped nipples, and even cancerous ulcers; but more commonly it is boiled, and beaten into a uniform mass, and applied as a poultice to fetid, sloughing, and other ill-conditioned sores, which it cleanses, and otherwise improves. Upon what its power depends is not well ascertained: the juice of the root, analysed by Wackenroder, gave the following constituents:—

Uncrystallizable sugar, with starch and malic acid	93·71
Albumen	4·35
Fixed oil (along with some volatile oil)	1·00
Carotin	0·34
Ashes containing alumina, lime, and iron	0·60
	100·00

Carotin is a ruby-coloured substance occurring in four-sided plates. It is tasteless, odourless, insoluble in water, soluble in alcohol and æther, also in fatty or fixed oils, which it colours yellow.

The volatile oil is colourless, of a peculiar penetrating odour, and disagreeable taste. Thirty-four pounds of the fresh root yield only half a drachm of oil. Probably the oil of the seeds is similar. (Pereira.) The fruits of the wild carrot are about one line and a half long, oval, flat, and clothed along the ridges with hairs. The odour is peculiar, aromatic; the taste aromatic and bitter. Their primary action is warming and carminative; and in their secondary effects, they are occasionally diuretic. They are seldom used. The root of the wild carrot is said to produce injurious effects, and should be avoided.

The cultivated carrot, particularly the yellow kind, contains in the root a large quantity of starch. This is greatest when it is raised on unmanured ground, exactly as wheat when raised on undunged ground has more starch and less gluten than when manured. The quantity in the carrot seems greatest about the end of September. One hundred pounds (troy weight) of the fresh root then yield four and half ounces of starch. It has been proposed to separate this starch in the same manner as starch from potatoes, to employ it medicinally as a very soothing and demulcent article of food for persons with pulmonary irritation and the cough which remains after the influenza. It is most likely a very digestible form of starch, but not more so than arrow-root. It may be raised at a cheap rate however, as any light soil will answer, and as no manure is needed it cannot be expensive. The refuse after the starch is extracted is good food for cattle, and should not be wasted. The white or Flemish carrot is a valuable food for cattle.

(Rham's *Flemish Farming.*)

D'AVENANT, CHARLES, a writer on politics, political economy, and finance, was born in 1656, and was the eldest son of Sir William D'Avenant, the poet. He studied at Baliol College, Oxford, and first made himself known by a dramatic piece, entitled 'Circe, a Tragedy,' to which Dryden wrote a prologue and Lord Rochester an epilogue, and which was brought out in 1675, but not printed till 1677. It was of an operatic character, like most of his father's productions in the same line, and of very little merit; as indeed Dryden intimates, with slight disguise, in his prologue. D'Avenant however did not pursue poetry, but applied himself to the study of the civil law; and he was some years after this made a Doctor of Laws by the University of Cambridge. Of his public employments, the first that is recorded is his appointment, in 1683, as one of the six commissioners to whom the superintendence of the Excise was delegated at this time, on that part of the revenue, which had for many years been let out to farm, coming again into the hands of the crown. In 1685 he was appointed Inspector of Plays, conjointly with the Master of the Revels; and that year also he was returned to parliament as one of the members for St. Ives. He was afterwards returned for Bedwin in 1698, and again in 1700; and on the 3rd of June, 1703, he was appointed Inspector-general of Exports and Imports, being the second person who had held that office, the first having been William Culliford, originally a custom-house officer in Ireland, who was appointed in 1696, and was now raised to be a commissioner of the customs. (Chalmers's *Historical View of the Domestic Economy of Great Britain and Ireland, Preface*, p. 10, edit. of 1812.) This office D'Avenant retained till his death, 14th November, 1714.

D'Avenant's publications on commerce, finance, and politics range over a period of about eighteen years. We will enumerate the more remarkable of them. 'An Essay upon Ways and Means of Supplying the War,' 1695. This tract immediately gained him considerable reputation for an acquaintance with the subject of the public finances; and for some years all his subsequent publications which he acknowledged were designated on the title-page as being by the author of the 'Essay on Ways and Means;' but he is believed to have been the author of several pieces upon which no such intimation appears. 'Discourses on the Public Revenues, and of the Trade of England,' Part I. 1698; and Part II. containing the Discourses 'which more immediately treat of the Foreign Trade of this Kingdom,' also 1698. To the first part is annexed a translation of Xenophon's 'Discourse on the Revenue of Athens,' by Walter Moyle, which is also printed in Moyle's collected works. The subjects discussed in the 'Discourses' are the use of political arithmetic, credit and the means of restoring it, the management of the king's revenues, the public debts, the general nature of foreign trade, the best way of protecting it, the plantation trade, and the trade with the East Indies. A reply was made to some things in the first part of this work, in 'Remarks upon some wrong computations and conclusions contained in a late tract entitled *Discourses*, &c.; in a letter to Mr. D. S.' 1698. 'A Discourse upon Grants and Resumptions,' 1700. This was written to recommend that certain late grants of crown lands, &c., should be resumed; and it was answered the following year in an elaborate treatise entitled 'Jus Regium; or, the King's Right to grant forfeitures, and other revenues of the crown, fully set forth,' &c. 'Essay upon the Balance of Power; the Right of Making War, Peace, and Alliances; Universal Monarchy,' 1701. This was another attack upon the government of King William, and was answered the same year in 'Animadversions on a late factious book entitled *Essays*,' &c. It was also formally censured by the Upper House of Convocation for a passage in which the author had declared that he could point out several persons whom nothing had recommended to places of the highest trust, and often to rich benefices and dignities, but the open enmity which they had, almost from their cradles, professed to the divinity of Christ. 'Essays upon Peace at home and War abroad,' in two Parts, 1704. To this piece he put his name; and, being now in office, he of course supports the existing government. He still however attached himself to the Tory party; and in 1710, in a work extending to two 8vo. volumes, entitled 'New Dialogues upon the Present Posture of Affairs, by the author of the Essay on Ways and Means,' he renewed an attack upon their opponents, which he is believed to have commenced many years before in an anonymous publication which appeared, in two successive parts, in 1701 and 1702, under the title of 'The True Picture of a Modern Whig.' His last performances were 'Reflections upon the Constitution and Management of the Trade to Africa' (anonymous), in three parts, fol. 1709; and two 'Reports to the Commissioners for putting in execution the Act for examining the Public Accounts of the kingdom,' 8vo. 1712. A selection of the political and commercial works of Dr. D'Avenant was published in 1771, in five vols. 8vo., by Sir Charles Whitworth, M.P., afterwards Earl Whitworth.

D'Avenant's writings are generally of some value for the information contained in them, and on some points he saw rather farther than the generality of his contemporaries; but he is a heavy writer, and was evidently (notwithstanding his poetical descent) a dull man, and as such (though the common notion is different) he was by no means a person to be trusted even in the handling and statement of facts. His notions upon the principles of trade and political economy also were very imperfectly systematised, and in some respects extremely immature; upon no one question perhaps is he more than partially right. He is as much behind his contemporary Sir Dudley North, for example, in the conclusions to which he had come, as if they had been separated by a century.

(*Biographia Britannica*, 2nd edit.; Craik's *History of British Commerce*, ii. 85, &c.; M'Culloch's *Literature of Political Economy*, pp. 351, 352.)

DA'VILA. [Henrico-Caterino Davila, P. C. S.]

DAYS OF GRACE. [Bill of Exchange, P. C.]

DEAN OF GUILD, in the municipal system of Scotland, is, as the title will naturally suggest, an officer of the merchant guilds, or societies of trading persons. An officer with this title used generally to be a member of the town council of every burgh, large or small; but by a clause in the Burgh Reform Act of Scotland (3 & 4 Wm. IV. c. 76, sec. 24), the functions of the dean of guild are appointed to be performed in each of the smaller burghs by some member of the council, chosen by the majority; and an officer chosen by the guildry, and entitled to sit as a member of the council, became peculiar to Edinburgh, Glasgow, Dundee, and Perth. In Edinburgh the dean of guild has by courtesy the title of lord, and there are current many ludicrous anecdotes, arising from the misapprehensions of persons not acquainted with the character of the office on hearing its holder thus addressed. By the act 1593, c. 184, the dean of guild was invested with extensive judicial powers in commercial questions, but this jurisdiction has long been in desuetude. His principal powers are now of an aedile character. They are consuetudinary—not fixed by any general law, but dependent on the local customs of the various towns, so far as these have not been checked in their divergence from a general principle by the decisions of the courts. The dean's authority is generally exercised in a court, of which he is the sole or the principal judge, according to local usage. His proceedings are sometimes conducted with the advice of a professional assessor. The character of his authority is thus defined:—'It belongs to the dean of guild to take care that buildings within burgh be agreeable to law, neither encroaching on private property, nor on the public streets or passages, and that houses in danger of falling be thrown down.' (1 Ersk. *Inst.* 4, 25.) In Edinburgh no building can be taken down or materially altered without the sanction of the Guild Court, which is given after all parties interested have been heard. Proprietors are compelled to repair or remove domestic edifices declared by the Guild Court to be, from disrepair or otherwise, dangerous to the public.

DE CANDOLLE, AUGUSTIN PY'RAMUS, was born at Geneva, where his father was premier syndic, in 1778, the year in which Haller, Linnæus, and Bernard de Jussieu died. His family originally came from Marseille, but had for more than two centuries been settled at Geneva. His earliest tastes were altogether of a literary kind, and from infancy he was distinguished for the ardour with which he pursued his studies. He was remarkable for the facility with which he wrote verses, a taste in which he indulged throughout life. In the year 1792, with his mother and brother, he sought refuge, whilst the French were besieging Geneva, in a village situated at the foot of the Jura. Here he amused himself in collecting wild plants and acquired a taste for botany, which, on subsequently attending the lectures of Professor Vaucher in his native city, became the occupation of his life. In 1796 he went to Paris, and attended the lectures of Vauquelin, Cuvier, and Fourcroy. He also became intimately acquainted with Desfontaines and Lamarck.

The first efforts of De Candolle in botanical science were rather directed to the observation of facts and the accurate distinction of species, than to the theories connected with the physiology or development of plants. His first publication was a description of succulent plants, delineations of which were supplied by Redouté. He also drew up the descriptions for the magnificent work of the same artist on the Liliaceæ, which was published in 1802. After a short withdrawal from Paris on account of the political state of France, he returned again to Paris in 1804, and took his degree of Doctor of Medicine. His thesis on this occasion was on the medical properties of plants. In this masterly essay, which he subsequently republished, much enlarged, he demonstrated satisfactorily the close connexion that exists between the sciences of botany and medicine, and which led to an increasing attention to the structure and secretions of plants, as affording at once the aliment of man in health and his medicine in disease. In the same year he delivered, in the College of France, a course of lectures on the principles of botanical arrangement, of which he gave a sketch in the introduction to the third edition of Lamarck's 'Flora of France, which was published in the following year. This sketch gives an outline of those principles of classification which in after life became the basis of those great works on which his fame as a botanist must principally rest. Although nearly every botanist had yielded to the influence of the artificial system of Linnæus, De Candolle, at this period, correctly estimated its merits. 'The natural method,' he observed, 'endeavours to place each individual object in the midst of those with which it possesses the greatest number of points of resemblance; the artificial has no other end than that of enabling us to recognise each individual plant and to isolate it from the rest of the vegetable kingdom. The former, being truly a science, will serve as an immutable foundation for anatomy and physiology to build upon; whilst the second, being a mere empirical art, may indeed offer some conveniences for practical purposes, but does nothing towards enlarging the boundaries of science, and places before us an indefinite number of arbitrary arrangements. The former, searching merely after truth, has established its foundation on the organs that are of the greatest importance to the existence of plants, without considering whether these organs are easy or difficult of observation; the second, aiming only at facility, bases its distinctions upon those which are most readily examined, and therefore present the greatest facilities for study.'

In the collection of plants De Candolle spared no personal pains, and from the time of his being associated with Lamarck to 1812, travelled over every district of the then extensive possessions of France, for the purpose of examining its native plants. In these excursions also he was frequently employed by the government to report upon the state of agriculture.

In 1807 he was made Professor of Botany in the Faculty of Medicine at the University of Montpellier. In 1810 a chair of Botany being constituted in the Faculty of Sciences of the same place, he was appointed to it. During his residence at Montpellier he devoted much time to the botanic garden; and published a catalogue of the plants contained in it, with descriptions of many new species. Circumstances however occurred which led him to quit Montpellier, and in 1816 he returned to his native city, which was restored to its independence on the re-establishment of the Bourbons on the throne of France. A chair of natural history was established especially for him at Geneva. In the same year he visited England to examine the collections of plants in the British Museum, the Linnean and other societies, for the purpose of aiding him in the publication of his great work on the vegetable kingdom.

In 1818 appeared the first volume of this work intended to comprehend a description of all known plants. He had fully prepared himself for the principles on which this work would be based by the publication of his 'Théorie Elémentaire,' in 1813. In this work he not only carried out the principles of a natural arrangement, of plants, which had been previously developed by Jussieu and Adanson, but by a more extended study of the principles of morphology he was enabled to clear up many of the difficulties which existed in the grouping of plants in previous classifications. Whatever may be the claims of previous writers in this department of botanical inquiry, to De Candolle must be conceded the merit of giving definite expressions for the various causes which act upon the structure of plants, and pointing out the relation between abnormal forms in individual plants and normal forms in particular groups.

The natural system of the vegetable kingdom however was only commenced, a second volume appeared in 1821, but the author was obliged to abandon the design, as a work of too great magnitude. He therefore in 1824 commenced the publication of a Prodromus of the larger work. But even this proved a work too extensive for completion during his lifetime. This work embraced descriptions of all the known species of plants. Commencing with the phanerogamous plants, each order in the natural system was exhausted as far the materials of the author would allow. All the orders belonging to the polypetalous division of Exogens were completed, as well as the orders of the monopetalous division as far as the Compositæ. To this last difficult order De Candolle had paid much attention, and his desire to give it in as perfect a form as possible led him to devote so much time to it, that there can be little doubt that his health suffered severely from this cause alone. Although the work has been left incomplete, yet the materials in the possession of De Candolle still exist, and the work will probably be completed. The importance of this publication to the working botanist can hardly be overrated, as it supplies him with the means of recognising a vast number of species that had before been either undescribed or inaccessible to the student from the places in which they were published. Another point which enhances the value of this work is the care which the author bestowed in drawing up the descriptions of plants, which could not have been done so well by any one who possessed a less extensive herbarium and library than himself.

But although the labour bestowed on this great work, and the judgment with which it was executed, have given it the most prominent position amongst his works, it can only be regarded as the result of an accurate knowledge of the structure and functions of plants. On this subject he lectured for many years, and although frequently producing monographs on various departments of botany, which indicated his knowledge of vegetable anatomy and physiology, it was not till 1827 that he published his ‘Organography of Plants.’ In this work he proceeded on the principle of tracing each organ through all its several modifications of structure in the different plants in which it occurs, and of reducing every part to its organic elements. It is thus not a mere detail of particular structures, but a development of the great doctrine of metamorphosis, which had been explained in his previous work on the principles of classification. This work was followed in 1832 by one on the physiology of plants. This was a comprehensive digest of all that had been done up to the period at which it was written. It was however published at a time when the chemist and the physiologist were both turning their attention to the functions of the vegetable, as affording the means of better understanding the nature of the functions of the animal, and consequently many of the views of the author may be disputed or proved to be erroneous.

For several years previous to his death, De Candolle suffered from ill health. In 1841 he was induced to visit the meeting of naturalists held at Turin, in the hope that change of climate would restore his failing powers, but he derived no benefit from his journey, and died on the 9th of the following September.

As a botanist De Candolle must be placed in the first rank in the century in which he lived. He possessed a quick apprehension, which enabled him to make use of the labours of others, added to a habit of methodical arrangement, by which he could at once refer the various facts that came to his knowledge to their proper position in the departments of the science which he pursued. It was this which, combined with a clear and pleasing delivery, made him a successful lecturer, and which enabled him to produce with rapidity so many works on botany. But he was not only a botanist; he was earnest in his sympathies with mankind, and was an active philanthropist and energetic citizen. In Paris, in the early part of his life, under the auspices of Benjamin Delassert, he took an active part in the formation of the Société Philanthropique of Paris, and the Society for the Encouragement of National Industry was formed under his direction and management. He was for many years a member of the legislative body of Geneva, and also rector of the academy in the same place.

The following is an alphabetical list of his works:—

1, ‘Astragalogia, nempe Astragali, Biserrulæ, et Oxytropedis, necnon Phacæ, Coluteæ, et Lassertiæ Historia, Iconibus illustrata a Redouté,’ fol. Paris, 1802. This work was an account of the Astragalus and some allied genera, and was illustrated by Redouté.

2, ‘Catalogue des Arbres Fruitiers et des Vignes du Jardin Botanique de Genève,’ Geneva, 1820. An account of the fruit-trees and vines in the botanic garden of Geneva.

3, ‘Eloge Historique d'Aug. Broussonet,’ 4to. Montpellier, 1809. A memoir of Broussonet, a distinguished botanist.

4, ‘Essai Elémentaire de Géographie Botanique,’ 8vo. Paris, 1821. This was a reprint of the article on the Geography of Plants in the ‘Dictionnaire des Sciences Naturelles.’

5, ‘Essai sur les Propriétés Médicinales des Plantes, comparées avec leurs Formes extérieures et leur Classification naturelle,’ 1804, 8vo. Paris, 1916. This was his inaugural dissertation on the medical properties of plants in 1804, which he republished in the year 1816.

6, ‘Flore Française, ou Description de toutes les Plantes qui croissent naturellement en France.’ The third edition of this work was edited by De Candolle. It was published at different times from 1803 to 1815, and contained a description of six thousand plants, and was accompanied by a coloured chart, indicating the distribution of plants throughout France.

7, ‘Icones Plantarum Galliæ rariorum,’ 4to. Paris, 1804. Figures of the rarer plants found growing in France.

8, ‘Instructions Pratiques sur les Collections Botaniques,’ 8vo. Geneva, 1820. A little work on the forming of botannical collections.

9, ‘Mémoire sur les différents Espèces, Races, et Variétés de Choux et de Raiforts cultivés en Europe,’ 8vo. Paris, 1822. This is a translation of a memoir which appeared in the ‘Transactions of the Horticultural Society of London.’

10, ‘Mémoires sur la Famille des Légumineuses,’ 4to. Paris, 1825. Up to the time it was written it was by far the best monograph on the Leguminosæ. It was illustrated by seventy plates.

11, ‘Notice sur l'Histoire et l'Administrations des Jardins Botaniques,’ 8vo. Paris, 1822. This was a reprint of an article which appeared on the subject of botanic gardens in the ‘Dictionnaire des Sciences Naturelles.’

12, ‘Organographie Végétale,’ 2 vols. 8vo. Paris, 1827. This work is a description of the organs of plants, and was published with the view of being an introduction to the physiology of plants. It contains sixty plates, representing the structure, normal and abnormal, of the various organs of plants.

13, ‘Plantarum Succulentarum Historia,’ 4 vols. 4to. and fol., Paris, 1799. This was a description of the various kinds of succulent plants, with illustrations by Redouté.

14, ‘Plantes Rares du Jardin de Genève,’ 4to. Geneva, 1825. An account of the rarer plants in the botanic garden of Geneva. It was published in parts, each part containing six plates.

15, ‘Prodromus Systematis Naturalis Regni Vegetabilis,’ 8vo. Paris and London, 1824 to 1845. Of this work seven volumes only are at present published.

16, ‘Regni Vegetabilis Systema Naturale,’ 8vo. Paris, 1818. This work, which was to have contained a full description of all the plants then known, was only commenced by De Candolle, and the Prodromus was published in its place.

17, ‘Projet d'une Flore Géographique du Leman,’ 8vo. Geneva, 1820.

18, ‘Rapport à la Société de Lecture de Genève,’ 8vo. Geneva, 1820.

19, ‘Rapport sur la Fondation du Jardin de Botanique de Genève,’ 8vo. 1819. A second report on the same subject was published in 1821.

20, ‘Rapport sur la Question des Magazins de Subsistance, fait au Conseil Représentant de Genève,’ 8vo. Geneva, 1819.

21, ‘Rapport sur la Pomme de Terre, fait à la Classe d'Agriculture de Genève,’ 8vo. Geneva, 1822. This was followed by two other reports on the culture and uses of the potato.

22, ‘Théorie Elémentaire de la Botanique,’ 8vo. Paris, 1813 and 1816. This was an exposition of the elementary principles of classification, and of the mode of studying and describing plants.

Besides the above works, De Candolle contributed papers to the Transactions of almost every scientific society in Europe, a bare list of which would far exceed the limits of this article.

(Daubeny, Dr., *Sketch of the Writings and Philosophical Character of A. P. De Candolle*; *Proceedings of the Linnean Society*, 1842; Bischoff, *Lehrbuch der Botanik*; Quérard, *La France Littéraire.*)

DECKER, SIR MATTHEW, BART., was born at Amsterdam in the latter part of the seventeenth century, of a Protestant family originally from Flanders, where his ancestors had been engaged in commerce till they were driven out in the Spanish persecution under the Duke of Alva, leaving their estates to their Catholic relations, some of whom long continued to occupy eminent positions in the municipal government at Brussels. Such was the account given by Sir Matthew himself to Collins, the genealogist, in 1727, as recorded by the latter in his 'English Baronetage,' iv. 185 (published in 1741). Decker came over to England in 1702; and he was naturalized the following year by the 28th private Act of the 2nd of Anne. Having settled as a merchant in London, he rose to great commercial eminence, was made a baronet in 1716, and in 1719 was returned to Parliament for Bishop's Castle. He only sat, however, in the House of Commons for four sessions, and his name does not occur in the reported debates. He married Henrietta, daughter of the Rev. Dr. Richard Watkins, rector of Wickford, in Warwickshire; and he died 18th March, 1749, when the baronetcy became extinct, and his estates devolved upon his three daughters. It is said to have been in the gardens of Sir Matthew Decker's country-seat at Richmond, in Surrey, that the pine-apple was first brought to maturity in England.

Decker is believed to be the author of a little work first published in 8vo. at London, in 1743, and entitled in the fourth edition, which appeared in the course of the following year, 'Serious Considerations on the several high duties which the nation in general (as well as its trade in particular) labours under; with a proposal for preventing the running of goods; discharging the trade from any search, and raising all the public supplies by one single tax. By a well-wisher to the good people of Great Britain.' In the seventh edition, which appeared in the same form in 1756, the tract is stated on the title-page to be 'By the late Sir Matthew Decker, Bart.' It consists in both these editions of only 32 pages. The author explains his object in p. 15: 'My proposal,' he says, 'in short, is this: that there be but one single excise duty over all Great Britain, and that upon houses.' He would in this way raise an annual revenue of 6,000,000*l.*, being as much as the ordinary expenses of the government then amounted to; with 1,000,000*l.* over to form a sinking-fund for the discharge of the debt. He calculates that in England, exclusive of Wales, there were then 1,200,000 houses; but of these he would tax only 600,000, counting off 500,000 as inhabited by the working and poorer classes, and 100,000 as uninhabited.

We do not know whether this scheme attracted much notice when it was first proposed, but, from the frequency with which it was reprinted, we may infer that it did. It was, at any rate, elaborately answered, soon after its republication in 1756, in a thick pamphlet of 120 pp., entitled 'The proposal commonly called Sir Matthew Decker's scheme, for one general tax upon houses, laid open, and showed to be a deep concerted project to traduce the wisdom of the Legislature, disquiet the minds of the people, and ruin the trade and manufacturies [sic] of Great Britain; most humbly submitted to the consideration of Parliament,' 8vo., Lond. 1757. The author of this attack is understood to be Mr. Joseph Massie, a fertile mercantile writer of that day. It is, as might be expected from the title, very angry, and even somewhat abusive. If there be any express personal allusion to Decker or recognition of him as the author of the scheme, beyond the mention of his name on the title-page, it has escaped our search. The author of the 'Serious Considerations' is commonly spoken of in some such style as the following:—'Certainly this man must have a front of brass, and a heart of flint' (p. 63).

Decker has also been commonly supposed to be the author of another more considerable work, first published in 4to. at London, in 1744, and reprinted in 12mo. at Edinburgh, in 1756, both editions without a name, under the title of 'An Essay on the Causes of the Decline of the Foreign Trade, consequently of the Value of the Lands of Britain, and on the means to restore both.' Adam Smith notices and comments upon this work as written by Decker, and designates the scheme of taxation advocated in it as 'the well-known proposal of Sir Matthew Decker,' in the fifth book of his 'Wealth of Nations.' It is very evident however that it cannot be by the author of the 'Serious Considerations,' for various reasons. As Mr. M'Culloch has remarked in his late work, 'The Literature of Political Economy,' page 328, 'the *impôt unique*, or single tax, proposed by the author of the "Essay" is quite different from that proposed in the "Considerations;" it is, in his own words, "one tax on the consumers of luxuries," or, as Smith has put it, "that all commodities, even those of which the consumption is either immediate or very speedy, should be taxed in this manner, the dealer advancing nothing, but the consumer paying a certain annual sum for the licence to consume certain goods."' It may be added, that the edition of the 'Essay' published in 1756 is ushered in by a preface, evidently by the author, in which he speaks of this as a second edition, which he had been induced to prepare by the public demand, and in which he had taken an opportunity of correcting some things in the preceding impression. Decker, as we have seen, died in 1749. Mr. M'Culloch states, that in a work by Francis Fauquier, entitled 'An Essay on Ways and Means for raising Money for the support of the present War without increasing the Public Debts,' third edition, 8vo. 1757, it is affirmed that the 'Essay on the Decline of Foreign Trade' was written by a Mr. Richardson.

This 'Essay' is rather a remarkable work. Besides his main project for a single tax, which occupies above 200 of the 228 pages of which the volume (in the 12mo. edition) consists, he advances the four following proposals:—1, To abolish all our monopolies, unite Ireland, and put all our fellow-subjects on the same footing in trade; 2, To withdraw the bounties on exported corn, and to erect public magazines of corn in every county; 3, To discourage idleness by well regulating our poor (he adopts Sir Josiah Child's plan for the management of the poor, and would transport all able-bodied persons who cannot find employment); and 4, To pay off our debts by public bonds, bearing interest, and liquidating part of our debts yearly. The balance of trade theory is assumed, but many of the remarks are both just and ingenious.

DECLARATOR, ACTION OF, a form of procedure peculiar to the Court of Session in Scotland. Its name explains its nature, which is an action to have it judicially declared that a certain right, or a certain character, exists in a particular person or persons. It is not necessary that the party who raises the action should demand any immediate service from the law, or that there should be any adverse party. It may be raised by persons in doubt how they ought to act to avoid the consequence of a breach of the law, and thus it is frequently had recourse to by public officers. A person whose legitimacy is questioned, though no one may be at the moment denying his right to possess any property of which illegitimacy would deprive him, may bring an action of declarator of marriage and legitimacy to have his claim judicially established. The principle of the declaratory conclusion is often admitted into other actions where there are many complex claims. The court lays down certain rules, applicable to the circumstances, by which the claims of individual parties shall in the ultimate decision be tried. In cases of extensive unsettled claims in connection with bankrupt joint-stock companies this has been found a serviceable procedure. The action of declarator has been applied to many useful purposes, but it is likewise, like some similar forms of procedure in chancery in England, capable of abuse. It is sometimes very oppressively applied when a member of a public body claims some particular privilege. An action of declarator is commenced by the body at large, to which he is made a party, for the purpose of ascertaining whether he is entitled to act as he is doing, and he may thus be involved in expensive law proceedings.

DEKKER, THOMAS. [DECKER, THOMAS, P. C.]

DEL CREDERE COMMISSION. [AGENT, P. C.]

DE'LFICO, MELCHIORRE, born of a noble family at Teramo, in the Abruzzo, in 1744, studied at Naples under Genovesi, Mazzocchi, and other learned teachers, and applied himself particularly to the study of the law and of political economy. After his return to his native country he published his first work, an essay in defence of matrimony, against some loose opinions of the time—'Saggio Filosofico nel Matrimonio,' 1774. In 1782 he published a treatise on the advantages of a provincial militia—'Discorso sul Ristabilimento della Milizia Provinciale.' He next wrote a 'Memoria nella Coltivazione del Riso Comune in Provincia di Teramo,' in which he recommended the removal of the unhealthy rice grounds from the neighbourhood of towns and villages, a suggestion which was approved of and acted upon by King Ferdinand. He also wrote several memoirs against the laws restrictive of the trade in provisions—'Memorie sul Tribunale della Grascia e sulle Leggi Economiche nelle Provincie confinanti del Regno.' These memoirs being addressed to the king, had also the effect of removing the obnoxious restrictions on the sale and exportation of rural produce. The government of Naples was at that time disposed to useful reforms, and much was done to improve the condition of the people, until the French revolution broke out, when the Italian governments became suspicious and averse to change. Previous to that however Delfico continued to assist by his suggestions the progress of social improvement. He wrote, in 1787, a memoir against the abuse of the winter transmigration of sheep from the high lands to the maritime districts of the Abruzzo, by which a large tract of fertile land was kept out of cultivation—‘Memoria sú i Regii Stucchi, ossia sulla Servitú dei Pascoli Invernali nelle Provincie Marittime degli Abruzzi,’ and soon after he published another treatise on the like practice in the plain of Apulia [CAPITANATA, P. C.]—‘Discorso sul Tavoliere di Puglia,’ 8vo. 1788. About the same time he wrote a ‘Memoria sú i pesi e le misure del Regno,’ recommending a uniform system of weights and measures throughout the various provinces of the kingdom of Naples. His next work was in favour of the free sale of fiefs which reverted to the crown at the extinction of baronial families—‘Riflessioni sulla Vendita dei Feudi,’ 1790, and ‘Lettera al Duca di Cantalupo sú i feudi devoluti,’ 1795. Here again his recommendation prevailed, and a law was issued for the sale of feudal estates reverted to the crown as allodial property.

Delfico also addressed to the king a ‘Rimostranza,’ or Memorial, by which he obtained the establishment of a ‘Regia Udienza,’ or royal court of justice for the province of Teramo, which till then was dependent on the court of Chieti. King Ferdinand made Delfico a Knight of the Order of Constantine. In 1799 the French invaded the kingdom of Naples, and a few months after they were obliged to evacuate it. In the midst of those blood-stained vicissitudes, Delfico thought it prudent to emigrate, and he repaired to San Marino, where he was inscribed among the citizens of that republic, and where he waited for more peaceful times. In gratitude for the hospitality which he there met with, he wrote the history of that little state from the documents which he found in its archives—‘Memorie storiche della repubblica di San Marino raccolte dal Cavaliere Melchiorre Delfico cittadino della medesima,’ 4to., Milan, 1804. When Joseph Bonaparte became King of Naples, in 1806, Delfico was made Councillor of State, and was also for a time intrusted with the management of the home department. He contributed to the new judiciary organization of the kingdom and other useful measures, among others to the establishment of the house for the insane at Aversa, which has maintained its reputation, for its enlightened philanthropic management, to the present day. On the restoration of King Ferdinand, in 1815, Delfico was made President of the Commission of the Archives. In 1823 he tendered his resignation on account of his great age, and the king allowed him a handsome pension for life. He left Naples, and returned to his native Teramo, where he continued till 1835, when he died at the age of ninety-one. A few years before his death, as the new king, the present Ferdinand II., being on a tour through the provinces, repaired to Teramo, in 1832, Delfico, who in his youth had known his great grandfather King Charles Bourbon, the founder of the Neapolitan dynasty, caused himself to be carried to the presence of his youthful king, who received him with marks of respect, had him seated by his side, and conversed long with him.

Besides the works mentioned in the course of this article, Delfico wrote the following:—1, ‘Ricerche sul vero Carattere della Giurisprudenza Romana, e de suoi Cultori, 8vo. 1791, a work that has been reprinted several times. 2, ‘Pensieri su' la Storia e su' la Incertezza ed Inutilitá della medesima,’ 8vo., Forli, 1806, also reprinted several times. These two works are worthy of notice for a certain boldness and originality of thought which sometimes assumes the form of paradox. The author speaks of the antient Romans and their institutions and manners with great severity; he anticipates Niebuhr in his scepticism concerning the legend of the early ages of Rome, and he repeats the sentence of his countryman Vico, who said that the Roman people, until the second Punic war, knew no other arts but those of digging the ground and cutting the throats of their neighbours. It is worthy of remark, that Neapolitan philosophers and critics have shown less classical veneration for Rome than those of other parts of Italy, and have exhibited more of a Samnite than a Roman feeling in their historical investigations. 3, ‘Dell' Antica Numismatica della Cittá di Atri nel Piceno con alcuni Opuscoli sulle Origini Italiche,’ fol., Naples, 1826, a work of much antiquarian and historical erudition. 4, ‘Memoria sulla Libertá del Commercio, diretta a risolvere il Problema proposto dall' Accademia di Padova sullo stesso Argomento,’ inserted in the thirty-ninth volume of Custodi's great collection of the Italian economists. Delfico was an advocate of free trade. 5, ‘Sugli Antichi Confini del Regno,’ written for the minister of the interior, but as yet inedited, like many other of his treatises and memoirs. 6, ‘Espressioni della particolar Riconoscenza della Cittá e Provincia di Teramo dovuta alla Memoria di Ferdinando I.,’ inserted in the second volume of the ‘Annali Civili del Regno,’ and being a recapitulation of all the improvements effected in that province under the reign of the elder Ferdinand, chiefly at the suggestion of Delfico.

(Tipaldo, *Biografia degli Italiani Illustri*; Mozzetti, *Degli Studii, delle Opere, e delle Virtú di Melchiorre Delfico*, Teramo, 1835.)

DELI'RIUM TREMENS, a disease of the nervous system, to which persons addicted to alcoholic drinks, though not exclusively, are peculiarly liable. As its name indicates, its principal symptoms are delirium and trembling. The delirium is a constant symptom; but the tremor is not always apparent, or does not exist. The delirium is always attended with sleeplessness: the patient is busy, and constantly talking, but is seldom or ever angry or violent. If he is questioned, he answers rationally, but speaks in an agitated and suspicious manner; he mostly does whatever he is told, and is frequently anxious to oblige. His thoughts, however, wander very quickly from objects around him, and he is apparently surrounded by the scenes of his imagination. Here, according to his occupation, he is busily engaged. If he is a master, he will order; if a servant, he will be anxiously obeying his master's commands. The sailor, the soldier, the coachman, all get busily engaged in their occupations. His thoughts are mostly distressful and anxious; he fancies he is in debt, that persons are persecuting him, that reptiles or animals are running after him; he looks suspiciously behind the curtains or door, or under the pillow, and wants to wander about. He seldom meditates harm either to himself or others. When there is tremor, the hands are fidgetty and the patient constantly wants to use them. In addition to these symptoms are others less observed; the tongue is moist and creamy, the pulse though frequent is soft, the skin is perspiring and emits a peculiar odour.

The disease with which this may be confounded is inflammation of the brain; and it is of the greatest importance that it should be distinguished, as the remedies that cure in the one disease will destroy in the other. Although delirium tremens does not invariably present itself in the drunkard, yet, when a person who drinks much alcohol presents many of the above symptoms, there is strong ground for believing it to be delirium tremens.

When the symptoms of this disease are obvious, its treatment is simple. The patient must have a sufficient quantity of opium administered to him to procure sleep; it should first be commenced in small doses, and then continued. A third of a grain of morphia may be given every two hours to begin with, and this may be increased to one or more grains. Generally, after a first sleep the patient becomes refreshed, and not unfrequently wakes up entirely well. Sometimes opium alone is not sufficient; this is the case where the disease has come on as the consequence of a cessation of an accustomed stimulus; in these cases it will frequently be necessary to let the patient have his ordinary beverage in order to prevent that degree of exhaustion which appears to keep up the irritability of the system. This remedy ought not, however, to be continued after the patient has acquired sufficient strength to do without it.

When the disease is about to terminate fatally, the delirium abates, and coma takes its place; the tremor of the limbs becomes subsultus tendinum, the evacuations are passed involuntarily, the face becomes suffused, and the patient dies as though he were in apoplexy. The attacks of delirium tremens are very apt to recur, especially in drunkards who do not, after their first attack, give up the vice to which they are addicted. First attacks seldom prove fatal, but subsequent attacks are not uncommonly attended with fatal symptoms. After death from delirium tremens, the ventricles of the brain are usually found effused with serum. Serum, and even lymph, is also found occasionally under the arachnoid.

(Watson, *Lectures on the Practice of Physic*; Marshall Hall, *Diseases of the Nervous System*.)

DELIVERY. [DEED, P. C.]

DELORME, PHILIBERT, was born in 1518, at Lyon, where his father was a builder or undertaker of public works, in extensive practice. As he himself boasts, he was hardly fifteen when he had upwards of three hundred workmen to receive their directions from him; which probably means that such directions were only transmitted *through* him. Soon afterwards, he had an opportunity of displaying his precocity in a different field, for in 1533 he was sent to Rome, but his professed pursuits there engaged only a subordinate share of his attention, and what he most studied was to ingratiate himself with persons in power. Though in years a mere novice, he was a courtier by intuition, and in a very short time secured a protector in the Cardinal Santa Croce, who took him into his household. The devoutness which he now thought proper to affect far exceeded his application to study, which did not extend to more than making ordinary sketches. Yet if he did not profit much by diligence, he was favoured by accident in making what was then considered an important discovery, namely, that of the mode practised by the antients for tracing the Ionic volute, as described on a capital in Santa Maria Transtevere,—a discovery subsequently claimed for Palladio, although Delorme's prior right to it is neither to be disputed nor suspected, because the other did not visit Rome till 1549, nor begin to publish any of his writings till 1570, whereas the first edition of Delorme's works appeared in 1567.

On his return to his native city in 1536, Delorme, who brought back with him a high character for religious strictness, was employed to erect the portal of the church of St. Nizier, which, as far as it was ever finished, gives no very favourable idea of his architectural talent. The alterations of the Hôtel Billau, in the same city, obtained for him much more credit; but then, nearly the whole of it was due to his brother Jean. That work completed, he was soon afterwards summoned to Paris by Catherine de Médicis, to whom he had been recommended by the Cardinal du Bellay, who had himself been charged by Santa Croce (raised to the papal see in 1555, by the title of Marcellus II., but who wore the tiera only three-and-twenty days) to promote the advancement of his protegé. Catherine perceived in him other merits than those of a mere artist, and rewarded them accordingly. Although he was not in orders, having only received the tonsure when at Rome, several church benefices were conferred upon him, and he was appointed Aumônier du Roi. No wonder therefore, when rewards of that kind were showered upon him so unscrupulously, that he should have obtained much of the most important and lucrative employment in his own profession, without his qualifications being narrowly inquired into; and there is something flippantly extravagant in saying, as Milizia has done, that Delorme's talent was *discovered* by Henri II., and that he was one of the first to strip architecture in France of its Gothic dress, and clothe it in that of antient Greece. Delorme was associated with Primaticcio in the erection of the monument of Francis I., and that of the Valois princes at St. Denys (taken down 1719), but as they were designed by the Italian, he could have only a nominal share in the reputation derived from them as works of art. Among works of a more strictly architectural nature, he built the Château de Meudon for the Cardinal de Lorraine, and completed the Château de Madrid in the Bois de Boulogne at Paris; but his work at the latter building was inferior to that of his predecessors. To these may be added, the Court (*en fer de cheval*) at Fontainebleau, the royal seats of Villers-Cotterêts, de la Muette, and St. Germain-en-Laye, and the celebrated Château d'Anet, built for the Duchess de Valentinois, a lady far less distinguished by her title than by her name of Diane de Poitiers. Of these buildings, such as remain at all have been so altered at different times that their original character is nearly effaced; but of the Château d'Anet the portal or lofty centre compartment is preserved by having been taken down, and re-erected as a restoration, in the court of the Ecole des Beaux Arts at Paris. The reputation, however, obtained by that monument for Philibert is, Callet assures us, in reality due to Jean Delorme, his brother. Neither was Philibert's success altogether unmingled with vexations; there were those who ventured to murmur at Delorme as the creature of court favour, and to hint that he was rewarded more profusely than was altogether becoming even were his talents far greater. On the death of Henri II. (1559) he not only lost his appointment of Royal Aumônier, but fell into disgrace with the new king Francis II. Nevertheless the queen-mother continued her protection, and he was accordingly intrusted by her with the works of her new palace of the Tuilleries (1564). In the history of extensive edifices upon which different architects have been employed, whether nearly at the same time or at considerable intervals, there is generally a great deal of doubt and confusion; and as Bullant [BULLANT, P. C. S.] was also engaged upon the Tuilleries, it is far from certain which of them had the greater share in the original structure, more especially as we have seen that Philibert Delorme was not the man to be particularly scrupulous about taking as much credit as he possibly could to himself. Besides which, the Tuilleries of Catherine de Médicis now hardly exists except in name, and the portion attributed to Delorme (the centre pavilion of the façade) has undergone such changes that it can no longer be recognised as the original. According to Callet, it was Bullant who was the author of the general design of the palace, for Delorme, in the dedication of his works to Catherine (1567), takes credit to himself only for the 'Ionic order' and some other minor parts, but carefully avoids mentioning the name of the other architect. What Delorme's talent and taste really were, may be pretty well judged of by a specimen which no one will envy him the credit of, namely, the house which he erected for himself in the rue de la Cirisaie, and of which Callet exhibits two elevations and a ground-plan; for it is of studied inconvenience as a dwelling, and very far from handsome as a design;—it is certainly no plagiarism from 'antient Greece.' It was there that Philibert died, May 30, 1577, at the age of fifty-nine.

As to his brother JEAN DELORME, no particulars respecting him have come down to us, and no wonder, since Philibert, that 'Jesuite de robe courte,' as Callet calls him, took care that he should be considered a mere nobody, and therefore unworthy of notice. The probability is that Jean died some years before his brother, since otherwise the prudence of the latter might have deterred him from giving the public to understand what it was in the power of another to contradict. Even his writings show Philibert to have been more or less of a charlatan and impostor,—addicted to base and fulsome flattery, and at the same time impudent through over-acted modesty,—of which last one proof is his assuring his readers that all the notes in his work bearing testimony to his own ability were not written by himself, but by good-natured friends, and no doubt quite contrary to his own sincere convictions. Besides other instances of quackery, he goes so far as to pretend not merely to have made improvements in the science of construction and stereotomy, but to have actually discovered it by his own study and his knowledge of geometry. No doubt much useful practical information is to be found in his work entitled 'Nouvelles Inventions pour bien bâtir à petit frais,' Paris, 1551, in regard to the carpentry of roofs and domes, but it is just as likely to have been derived by him from his brother as to have been the fruit of his own unassisted study. Like some of his contemporaries, Philibert Delorme might still be allowed to hold that rank in his art which the courtesy of history concedes to those who have been great in their time and for their time, did he not now stand unmasked to the world as a Tartuffe both in art and in moral character.

(Callet, *Notice Historique sur quelques Architectes Français du Seizième Siècle*, Paris, 1843.)

DELTHY'RIS. Dalman proposed this generic name as a substitute for the Spirifera of Sowerby, but few writers on fossil Brachiopoda have adopted it.

DEMAND AND SUPPLY are terms used in political economy to express the relations between consumption and production between the demand of purchasers and the supply of commodities by those who have them to sell. The relations between the demand for an article and its supply determine its price or exchangeable value [VALUE, P. C.]: the relations between the demand for labour and its supply determine the amount of wages to be earned by the labourer [WAGES, P. C.]. For causes explained elsewhere, the price of an article will rarely vary, for any length of time, very much above or below its cost of production;* nor will the wages of labour, for any length of time, much exceed or fall below the amount necessary to maintain labourers and their families in such comforts as their habits of life have accustomed them to believe necessary for their subsistence; but bearing in mind that, in the prices of commodities and labour, there is a certain point, determined by causes independent of demand or supply, above or below which prices cannot materially vary for any considerable time: all variations of price, if the medium in which they are calculated remains unchanged, may be referred to the proportion which exists between the demand for commodities and the supply of them—between the quantities which purchasers are willing and able to buy, and the quantities which producers are able and willing to sell.

---

* "Cost of production" is used by political economists in a sense different from that of commerce, and includes profits. (See M'Culloch's edition of Adam Smith, c. 7.) It means, in fact, the price below which no man would continue to sell his goods. An ordinary profit is a part of the cost of production in an enlarged sense, as much as the expense of wages and materials.

To have any influence upon prices a demand must be accompanied by the means of purchasing. A demand is not simply a want—a desire to obtain and enjoy the products of other men's labour; for if this were its meaning, there would never be the least proportion between demand and supply: all men would always want everything, and production could not keep pace with consumption. But an 'effective demand,' as it is termed by Adam Smith, exists wherever one man is anxious to exchange the products of his own labour for that of other men. It is, therefore, of an effective demand only that political economists are speaking when they examine the circumstances of demand and supply in connexion with prices.

But although a demand, without the means of purchase, cannot affect prices, the universal desire of mankind to possess articles of comfort and luxury suggests other important considerations. As this desire is natural to man, and too often is so strong as to tempt him even to commit crime, it obviously needs no encouragement: men will always gratify it whenever they have the means, and these means consist in the products of their own labour. Hence all that is required to convert this desire of acquisition into an effective demand is ample employment for industry. Increase the production of all commodities and an increased consumption of them is the certain result; for, men having larger products of their own labour to offer in exchange for the products of other men's labour, are enabled to purchase what they are always eager to acquire. Production, therefore, is the great object to be secured, not only as furnishing a supply of commodities necessary and useful to mankind, but also as creating an effective demand for them. When trade is depressed by a languid demand, it is commonly said that increased consumption is all that is required to restore its prosperity. But how is this consumption to be caused? The desire to consume is invariable, and thus any falling off in consumption must be attributed to a diminished production in some departments of industry which causes an inability to consume. When production is restored, an effective demand for all articles will immediately follow; but until the productive energies of the consumers are in a state of activity it is in vain to expect from them an increased demand.

These considerations lead us to the conclusion that a universal glut of all commodities is impossible. The supply of particular commodities may easily exceed the demand for them, and very often does exceed it; but as the constant desire to obtain commodities needs nothing but the power of offering other commodities in exchange, to become an effective demand, it is evident that a universal increase of production is necessarily accompanied by a proportionate increase of consumption. Men are stimulated by no love of production for its own sake, but they produce in order to consume directly, or because by exchanging their produce with others they are able to enjoy the various comforts and luxuries which they are all desirous of obtaining. Active production, therefore, in all departments of industry causes a general and effective demand for commodities, which will continue to be equal to the supply unless it be checked by war, by restrictions upon commerce, or by other circumstances which prevent a free interchange of commodities.

A country is in the highest prosperity when there is an active and steady demand for commodities and labour, and a sufficient supply of them. Any disturbance of the proportion between one and the other is injurious to the community; and the injury is greater or less according to the extent and duration of such disturbance. When the proportion is well adjusted, the whole community derive benefit from the circumstance, both as producers and consumers; when it is disturbed, they are injured in both capacities.

Having described thus generally the nature and causes of demand, and its intimate connexion with supply, it becomes necessary to examine the influence of demand and supply upon one another, and upon production, consumption, prices, and profits. This influence varies according to the circumstances of the market, and the nature of the commodities to which its laws may be applied. These may be best understood by considering, 1st, the effects of a demand exceeding the supply; and, 2ndly, of a supply exceeding the demand.

1. The first effect of a demand exceeding the supply of a commodity, is to raise its price. As more persons want to buy the commodity than the producers are able or willing to supply, they cannot all obtain what they desire; but must share the supply between them in some manner. But their wants are very much regulated by the cost of gratifying them. One man would purchase an article for a shilling for which he may be unwilling or unable to pay two; while others, rather than forego the purchase, will consent to pay that amount. Those who have commodities to sell, finding that they have more customers than they can satisfy, immediately infer that they are selling them too cheaply, and that they could dispose of all their stock at a higher price. The price is accordingly raised, when the sale becomes limited to those who are not restrained from buying by the increased price. In principle, though not in outward form, the market is in the nature of an auction. The sellers endeavour to obtain the highest price for their goods; the price rises with the eagerness of those who wish to buy, and the highest bidders only secure the prizes. In the market, however, the competition of the buyers is not perceptible amongst themselves except through the prices demanded. Their competition determines the prices, but the sellers judge of its extent and regulate their demands so as to obtain the greatest possible advantage from it.

Some commodities are positively necessary for the support of the people, of which the supply may fall very short of the demand and be incapable of increase. This is the case when there is a bad harvest in a country which is excluded from a foreign supply by war or by fiscal restrictions. Here the price rises in proportion to the deficiency of the crops. The competition for food is universal. Some, indeed, may be driven to the consumption of inferior articles of food, and others to a diminished consumption; but all must eat. The number of consumers is not diminished, while the supply is reduced; and the price must, therefore, rise and continue high until a fresh supply can be obtained. In a siege the competition is still greater. The prices of provisions become enormous: the rich alone can buy; the poor must starve or plunder.

A similar effect is produced if the supply, without being deficient, be confined to the possession of a small number of persons, who limit it to the consumers in order to secure higher prices. However abundant corn might be in a besieged town, if one man were exclusively authorised by law to sell it, it might rise to a famine price, unless the people broke into the granaries, or the government interfered with the monopoly. Less in degree but similar in principle is the effect upon prices of every limitation of the market by fiscal restrictions. When any sellers are excluded, the others are enabled to raise their prices.

These are cases in which the supply cannot be increased to meet the demand, or in which the supply is monopolized. But the greater number of commodities may be increased in quantity, and the supply of them is not artificially limited. The price of these also rises when the demand exceeds the supply; but the increased price raises the profit of the producer and attracts the competition of others in the market. Fresh capital and labour are applied to the production of the profitable article, until the supply is accommodated to the demand, or exceeds it. The prices gradually fall, and at length the profits are reduced to the same level as the profits in other undertakings, or even lower. The encouragement to further production is thus withdrawn, and prices are adjusted so as to secure to the producers the ordinary rate of profits, and no more.

But sometimes the demand for a commodity is diminished, if the supply fall short of it for any considerable time. There are various articles useful and agreeable to mankind, but not essential to their existence, which they are eager to enjoy as far as they can, but for which they are not prepared to make great sacrifices. When the price of an article of this description is raised by a deficient supply, continuing for some length of time, it is placed beyond the reach of many persons who learn to regard it with indifference. They would buy it if it were cheap; but as it is dear, they go without it, or are satisfied with a substitute. In this manner the number of consumers is diminished. Others again, who will not be deprived of an accustomed luxury, enjoy it more sparingly, and consume it in less quantities. But so long as the supply is not increased, the price will continue high, because the consumers who still purchase the article, notwithstanding its price, keep up an effective demand equal to the whole supply; while there is still a dormant demand, only awaiting a reduction of price to become effective.

For the same reasons a demand for articles is diminished when their price is artificially raised by taxation. The demand is gradually confined to a smaller number of persons, and many consume more sparingly. [TAX, TAXATION, P. C.]

In these various ways demand and supply become adjusted through the medium of price, whenever the one exceeds the other. This is the result of natural laws, the operation of which is of the highest value to mankind. If the supply be incapable of increase, it economises consumption; if the supply can be increased, it encourages production. In either case it is of great benefit to the consumer. To revert, for a moment, to the example of a bad harvest in a country excluded from all foreign supply. Suppose that prices did not rise, but remained precisely the same as if the harvest had been abundant, what would be the consequence? The whole population would consume as much bread as usual, and use flour in every way that luxury points out, unconscious of any scarcity. Farmers might even feed their cattle with wheat. By reason of this improvidence the whole of the corn would be consumed before the next harvest, and the horrors of famine would burst, without any warning, upon a people living as if they were in the midst of plenty. This evil is prevented by a rise of prices, which is a symptom of scarcity, just as pain is a symptom of disease. By timely precaution the danger is averted. A high price renders economy and providence compulsory, and thus limits consumption. The supply, therefore, instead of being exhausted before the next harvest, is spread over the whole year. In the case of food, it is true that such economy is painful, and presses heavily upon the poor: but this evil is a mercy compared with famine. If no privation had been endured before scarcity became alarming, none but rich men could buy a loaf; for every one who had a loaf to sell would be risking his own life if he sold it.

These observations are also applicable in some measure to cases in which prices are raised by the supply being confined to one or to a few persons, who have contrived to buy up the whole or nearly the whole of any commodity. But such exclusive possession (sometimes improperly called a monopoly) cannot exist, for any length of time, in articles of which the supply is capable of increase. The extreme case has been put of a besieged town in which the whole supply of corn was monopolized by one man. Under those circumstances of course he would demand a high price; but unless his exclusive supply were upheld by law, it does not follow that the inhabitants would suffer on that account. A most provident consumption of food is absolutely necessary for the defence of a town, and no organization could distribute provisions according to the wants of the people so well as a system of purchase restrained by a high price. It must also be recollected that, without any such exclusive possession, the fact of the siege alone must raise prices by cutting off fresh supplies. If the siege continue, provisions are more likely to last out by the instrumentality of prices than by any other means. At the same time the sole possessor of the corn would be restrained from keeping back the supply beyond the actual necessity of the occasion by many considerations. He would know that if a popular tumult arose, if the town were relieved, the siege raised—a capitulation agreed to, or the place suddenly carried by assault—the value of his exclusive property would be destroyed. His own interest, therefore, is coincident with that of the people. It is better for both that the supply should be meted out with parsimony; it is dangerous to both that it should be immoderately stinted.

In circumstances less peculiar than these, very little evil can arise from an exclusive possession of any commodity not protected directly or indirectly by law. If the supply be capable of increase, and the demand be sufficient to enable the owner to secure a high price, for reasons already explained, the market would rapidly be supplied from other quarters. If the supply cannot be increased, that fact alone would raise the price; and it is probable that the supply would not have been so great without the extraordinary activity of the capitalist who had been able to secure for his country the whole accessible supply to be collected from the markets of the world.

A monopoly, properly so called, is of a totally different character: for however abundant the supply of an article may be, it may, nevertheless, be inaccessible to the consumer. [MONOPOLY, P. C.] Such monopolies were properly condemned so far back as the reign of James I. (21 James I. c. 3), although vast monopolies are still indirectly maintained by our fiscal laws. [TAX, TAXATION, P. C.] The legislature of this country however did not observe any distinction between a legal monopoly and the great speculative enterprises of commerce, miscalled monopolies; and severe penalties were inflicted both by the common and statute laws against offences called 'badgering, forestalling, regrating, and engrossing.' The impolicy of such laws was gradually perceived. If prices were occasionally raised by speculations of this kind, yet the restraints upon commerce, which resulted from these laws, were infinitely more injurious to the consumer. Many of the statutes were therefore repealed by act 12 Geo. III. c. 71; but the common law, and all the statutes relating to the offences of forestalling, regrating, and engrossing, were not erased from our commercial code until the year 1844 (act 7 & 8 Vict. c. 24).

When prices are high by reason of the demand exceeding the supply, it is by no means necessary that the profits of those who sell the dear commodities should always be greater than the profits in other branches of trade. It must always be recollected, that where scarcity is the cause of high price, the sellers who demand it have the less to sell. Where scarcity is not the cause, but the demand is great because the supply, notwithstanding the exertions of the producers, cannot keep pace with it, the profits are undoubtedly greater than usual, until the supply has been increased.

2. It is now time to consider the effects of a supply exceeding the demand; and this division of the inquiry will require less elucidation, as the effects of such a condition of the market may be stated to be the very reverse of those which we have just been examining. When there is more of a commodity than people are prepared to buy, its price must fall. Its sellers must offer it for sale at the price at which they can induce people to purchase. All is now in favour of consumers. They are no longer bidding against each other: but the sellers are competing among themselves to get rid of their goods. The price falls generally in proportion to the excess of the quantity, but this result is very much qualified by the nature of the article. If there be an excess of supply in perishable goods, there is nothing to prevent the natural fall of prices. When fish is unusually abundant, it must be cheap, or a great part of it will be destroyed: it must be eaten at once, or not at all; and to induce people to eat it, it must be offered to them at a low price. But with articles which may be held back, in expectation of higher prices, their value may be partially sustained. Production may be reduced, and the stock gradually brought into the market, until the supply has been equalized with the demand; and wherever the article is such as to admit of voluntary increase or diminution, the natural result of an excessive supply is to reduce production, until the balance of supply and demand has been restored. This mutual adjustment is in perpetual operation, and is ordinarily effected with such precision, that it may be said, without exaggeration, that a large city is supplied exactly with everything its inhabitants require—even down to an egg or a pint of milk. There is always enough of everything, and rarely too much.

Whenever there is an excessive production of any commodity, it is an evil almost as great as scarcity. It is true that the consumer derives benefit from it, but the producing classes are most injuriously affected. In order to raise the value of the produce of their labour, they must cease to produce, or must produce in less quantities. The workmen are thus either deprived of employment altogether for a time, or are employed for a portion of their time only, at reduced wages; while their employers are disposing of their goods at low prices, which scarcely repay the outlay of their capital. Nor does the penalty of over-production fall exclusively upon those engaged in the trade in which supply has exceeded the demand. Their distresses extend to other classes. It has been shown already that it is to production we must look as the cause of sustained consumption, and thus the pressure upon any considerable branch of productive industry must be sensibly felt by those who have the produce of their own labour to sell. Production has failed, and consumption must therefore be diminished.

The ruinous consequences of gluts, in particular staples of trade and manufacture, are too well known, especially in this country, to require any further illustration; but their causes are not always agreed upon. Such gluts are often attributed to the facility with which manufactures are produced by machinery; but we have shown that over-production in all branches of industry is impossible, and if that be true, it is evident that when partial gluts are produced by the aid of machinery, that powerful agent must have been misapplied. It is not contended that nothing can be produced in too great abundance. Whether machinery be used or not, production must be governed by the same laws of demand and supply. Those things only must be produced for which there is a demand, and they must not be produced in greater abundance than the demand warrants. But the more generally machinery is used, the more abundant will be the products which men will have to exchange with each other, and therefore the better will be the market. It follows that machinery can only cause a glut when applied excessively to particular objects, precisely in the same manner as an excessive quantity of labour would cause one if applied where it was not needed by the demands of commerce.

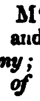
The supply of markets is a very speculative business, and is often conducted with more zeal than discretion. When a particular trade is supposed to be more prosperous than others, capitalists rush into it in order to secure high profits; and in this country the abundance of capital, the perfection of our machinery, and the skill of our workmen, enable them to produce with extraordinary facility. Over-production in that particular trade is the consequence, and all engaged in it suffer from the depreciation in the value of their goods; but if, instead of rushing into the favourite trade, they had distributed their enterprises more widely, their own interest and that of the community would have been promoted. When a ship is wrecked, if all the crew precipitate themselves into one boat, they swamp it; but if they wait till all the boats are lowered, and apportion their numbers to the size of each, they may all reach the shore in safety. And so it is in trade: one trade may easily be glutted, while there is room in other trades for all the capital and industry that need employment.

In proportion to the extent of the market and the variety and abundance of commodities to be exchanged, will be the facility of disposing of the products of capital and labour; and this consideration points out as the most probable antidote to gluts a universal freedom of commerce. When the free interchange of commodities is restricted, not only is a glut caused more easily, but its causes are more uncertain, and dependent upon unforeseen events. With the whole world for a market, the operation of the laws of demand and supply would be more equable, and the universality of the objects of exchange would make gluts of rare occurrence. The market would still be liable to disturbance by bad harvests, by errors in the monetary system, by shocks to public credit, and by war; but apart from these causes of derangement, demand and supply would be adjusted, and the productive energies of all nations called into full activity.

(Adam Smith, *Wealth of Nations*, book i.; M'Culloch, *Principles of Political Economy*, part i. ch. 7, and part ii. ch. 1, 2; Malthus, *Principles of Political Economy*; Ricardo, ch. 30; Mill, *Essays on Unsettled Questions of Political Economy*, Essay ii.)

DEMESNE. [MANOR, P. C.]

DEMISEMIQUAVER, a musical character, formed by adding three hooks to the stem of a crotchet, Ex.—



and in length, or duration, is equal to $\frac{1}{32}$ of a semibreve. [SEMIBREVE, P. C.]

DEMPSTER, THOMAS, was the son of Thomas Dempster, of Muiresk, in Aberdeenshire, where he was born, on the 23rd of August, 1579. His life is a series of strange adventures, where the literary triumphs of the wandering scholar are mingled with fierce controversy and occasional deeds of armed violence. His wild career seems to have commenced in the centre of his domestic circle, of the morality of which he gives a startling picture, telling how one of his brothers had taken to wife his father's concubine, collected a band of ruffians, with whom he surrounded and attacked that father and his attendants; afterwards fled to Orkney, where he headed a band of freebooters, who, among other violences, burned the bishop's palace, and ended his career as a soldier in the Netherlands, where he was put to death as a criminal by being torn limb from limb by wild horses. Thomas Dempster commenced his classical studies at Pembroke Hall, Cambridge, at the age of ten, and completed his education at Paris, Louvain, and Rome. He took the degree of D.C.L., and was made regent in the college of Navarre, in the University of Paris, at a time when, according to his own account, he must have been but seventeen years old. The history of his various wanderings from university to university, his literary contests, and his personal quarrels, is too lengthy to be followed out on this occasion. Being at one time left by the principal of the college of Beauvais, in the University of Paris, as his *locum tenens*, he caused a student of high and powerful connections to be ignominiously flogged. Several relatives took up the student's cause, and made an armed attack upon the college; but Dempster showed that he had resources equal to the occasion: he fortified his college, stood a sort of siege, and concluded the affair by taking some of the belligerents prisoners and confining them in the college belfry. After this affair he fled from France. At the beginning of the year 1616 he was in England, where he married Susanna Waller, a woman whose disposition appears to have been of a no less hardy and reckless character than his own. Some time afterwards, when he was passing through the streets of Paris with this woman, her dazzling beauty and the degree to which she exposed her person, brought on them the dangerous attentions of a mob of followers, and compelled them to seek refuge in an adjoining house. Afterwards, while Dempster was teaching the belles-lettres in the University of Bologna, where he seems to have involved himself in a more than usual number of disputes, he found that his wife had eloped with either one or more of his students. After an ineffectual attempt to overtake the fugitives, he died at Butri, near Bologna, on the 6th of September, 1625, the victim apparently of overwrought energies and a broken spirit. Dempster's works are more celebrated for their profuse miscellaneous learning than their critical accuracy. They are very numerous. Dr. Irving, in his 'Lives of Scottish Writers,' gives a list of fifty, stating that the list is as complete as he has been able to make it. His 'Antiquitatum Romanarum Corpus absolutissimum,' an edition, or rather an enlargement, of the work by Rosinus, bearing that title, published in 1613, is well known. There are many editions of it, and it forms, both in the substance and illustrations, the foundation of Kennet's and other popular books on Roman antiquities. His 'De Etruria Regali,' left in MS., was magnificently edited in 1723-4, in two volumes, folio, by Sir Thomas Coke. His 'Historia Ecclesiastica Gentis Scotorum' was published at Bologna in 1627, and was reprinted for the Bannatyne Club in 1829. It is simply a biographical dictionary of Scottish authors, and as such has been often referred to in this work. In many instances its information may be depended on, but whoever consults the work must bring with him some previous critical knowledge of the subject, as the author is very prone to exaggerate the literary achievements of his countrymen. He not only makes out to be Scotsmen persons whose birth-place is the subject of doubt—*e. g.* Joannes de Sacrobosco, Erigena, &c., but also includes such names as Egleshani, Fust, St. Fiacre, St. Novatus, Pelagius, and Rabanus Maurus, who are well known not to have been natives of Scotland.

DE'NDRODUS, a genus of Placoid fishes, from the old red-sandstone of Elgin, Moray, and Russia. Professor Owen described five species, and Agassiz admits a sixth. (*Reports of British Association for* 1842.)

DENI'NA, CARLO GIOVANNI MARIA, born in 1731, at Revello in Piedmont, studied at Saluzzo and Turin, took priest's orders, and was made professor at Pinerolo. Having discussed rather freely, in a play which he composed, the various systems of education, he incurred the dislike of the Jesuits, who had at that time the monopoly of education, and he was dismissed from his chair. Repairing to Milan, he wrote a work, 'De Studio Theologiæ, et Norma Fidei,' 1758, which was much approved of, and the author was soon after recalled to Piedmont, and was appointed professor of humanities and rhetoric in the High College of Turin. He then began his work on the revolutions of Italy, which is a general history of Italy from the Etruscan times to the beginning of the seventeenth century: 'Istoria delle Rivoluzioni d'Italia,' in 24 books, to which he added afterwards a 25th book, which brings the narrative down to 1792. This was the first general history of Italy, with the exception of the 'Annals' of Muratori, and although it is at times deficient in sound criticism, it is not destitute of merit. The work has been translated into almost all the European languages. In 1777 Denina went to Florence, where he published anonymously his 'Discorso sull' Impiego delle Persone,' which was intended as a reply to certain charges brought against his historical work by ecclesiastical critics, because Denina had censured the abuses of monastic institutions, and had questioned the propriety of binding a vast number of persons to celibacy. There was a law in Piedmont by which any native of that country was forbidden to publish a book, even in a foreign country, without the previous sanction of the Turin censorship. Denina was in consequence deprived of his chair, and banished to his native town. The archbishop of Turin however took up his defence and he was allowed to return to the capital, where some time after he received, through the Prussian envoy, an invitation from Frederic II. to repair to Berlin, for the purpose of writing a work on the revolutions of Germany. Denina accepted the offer, and repaired, in 1782, to Berlin, where he remained many years, and where he composed his 'Rivoluzioni della Germania,' and also 'La Russiade,' being a panegyrical history, in poetical prose, of Peter the Great. He also wrote a work in French on Prussian literature, 'La Prusse Littéraire sous Frederic II., ou histoire abrégée de la plupart des auteurs, des académiciens, et des artistes qui sont nés ou qui ont vécu dans les Etats Prussiens depuis 1740 jusqu'en 1786, par ordre alphabétique,' 4 vols. 8vo., Berlin, 1790-91. He also wrote an 'Essai sur la Vie et le Regne de Frederic II.' In 1792 Denina revisited Italy, and after his return to Berlin he wrote 'Considérations d'un Italien sur l'Italie,' in which he gave an account of the contemporary literature of his native country, for the information of the philologists of Germany. Another and a more important work is his 'Vincende della Letteratura,' 4 vols. 8vo., in which he sketches with concise but clever touches the progress and vicissitudes of the literature of the various nations of Europe. The book displays a vast extent of bibliographical erudition.

In 1804 Denina was introduced to Napoleon at Mainz, to whom he dedicated his 'La Clef des Langues, ou observations sur l'origine et la formation des principales langues de l'Europe.' Soon afterwards he was appointed imperial librarian. He then removed to Paris, where he wrote his 'Istoria dell' Italia Occidentale,' being a sort of supplement or continuation of his 'Rivoluzioni d' Italia.' It is a history of Piedmont and Liguria, and contains much information derived from the local chronicles and documents, which Denina had consulted while he lived in his native country. He also wrote 'Tableau historique, statistique, et moral de la Haute Italie,' which was afterwards translated into Italian. Denina died at Paris, at an advanced age, in December, 1813. Besides the works above mentioned, he wrote many minor ones, among which the following are deserving of notice:—1, 'Guide Littéraire,' being a sketch of the Prussian monarchy, and of its civil and literary institutions. 2, 'Della Lodi di Carlo Emmanuele III., Ré di Sardegna.' 3, 'Elogio storico di Mercurino di Gattinara, Gran Cancelliere dell' Imperatore Carlo V., e Cardinale.' It contains a sketch of the condition of Spain under Charles V. 4, 'Elogio del Cardinale Guala Bicchieri,' who was papal legate in England about A.D. 1222. 5, 'Réponse à la question: que doit on à l'Espagne?' Berlin, 1786, and afterwards translated into Spanish. It is a reply to some harsh judgments upon Spain in the article 'Espagne' in the 'Encyclopédie Méthodique.' Denina shows that Spain has contributed more than is generally supposed to the European stores of sciences, letters, and fine arts. 6, 'Essais sur les traces anciennes du Caractère des Italiens modernes, des Sardes, et des Corses.' Denina was a great supporter of the theory of the influence of climate on the character of nations. 7, 'Bibliopea, essia l'Arte di compor Libri.' 8, 'Istoria politica e letteraria della Grecia libera,' which ends at the death of Philip, father of Alexander.

(Ugoni, *Della Letteratura Italiana nella seconda metà des Secolo XVIII.*; Barbier, *Notice sur la Vie et les principaux ouvrages de Denina*, in the 'Magazin Encyclopédique' for January, 1814.)

DENNER, BALTHASAR, a celebrated German portrait painter, distinguished above all other artists for the elaborate finish of his works; their extraordinary finish however is their chief merit. Of Denner's early life little is known; he was born in Altona in 1685, and lived some time with a painter at Danzig; after having distinguished himself at the courts of several German princes, he came by the invitation of George I. to London. He spent a few years in England, but his success here was not what he had anticipated; he excited more surprise than admiration, and he left this country in 1728. After performing various journeys in the north of Europe, he died rich at Rostock, in Mecklenburg, in 1749, or, according to Van Gool, at Hamburg in 1747. Though Denner bestowed more labour upon his pictures than any painter probably ever did, he still contrived to paint a considerable number; some are however more finished than others, but some are finished with a degree of attention to the minutiæ incredible to those who have not examined them. Yet in a personal inspection, in some cases, recourse to the magnifying glass is said to be necessary, to do justice to his laborious execution. There is the head of an old woman in the gallery of Vienna, for which the Emperor Charles VI. gave him 4700 imperial florins; Denner's own portrait in his forty-second year, in a similar style, is placed near it. There are also two old heads of extraordinarily high finish in the gallery of Munich, said to be the portraits of the artist's father and mother. Denner painted many of the German princes of his day, and three kings, one of whom, Frederic IV. of Denmark, he painted, according to Van Gool, about twenty times; the other two were Peter III. of Russia, and Augustus II. of Poland.

(Van Gool, *Nieuwe Schouburg der Nederlantsche Kunstschilders*, &c.)

DENON, DOMINIQUE VIVANT, BARON, was born of a noble family at Châlons-sur-Saône, in 1747. Though from his early youth his bias was for the arts of design, he for some years devoted himself to them as an amateur only, yet he was early distinguished for his taste and judgment in matters of *virtù*; Louis XV. employed him to make a collection of antique gems for Madame Pompadour. He commenced however his active career in life as a diplomatist, and was first attached to the Russian embassy. Upon the accession of Louis XVI., he found a valuable patron in the minister for foreign affairs, the Comte de Vergennes, who sent Denon on a mission to Switzerland, when he took the opportunity of visiting Voltaire at Ferney, and drew a portrait of him, which was engraved by St. Aubin. He was next sent by his patron to Naples, as secretary to the embassy under the Comte Clermont d'Amboise. He lived seven years at Naples, and devoted much of his time to the study of the arts, especially etching and mezzotint engraving. He also at Naples served two or three days in the capacity of Chargé d'Affaires de France, in the interim between the resignation of M. Clermont d'Amboise, in 1782, and the arrival of his successor, M. de Talleyrand. The death of the Comte de Vergennes however put an end to Denon's diplomatical career, and he thenceforth adopted the arts of design as his profession. He removed from Naples to Rome, and arrived in Paris in 1787. Here, through the influence of his friend Quatremère de Quincy, he was elected a member of the Royal Academy of the Arts; his presentation work was an insignificant etching of the Adoration of the Shepherds after L. Giordano. He returned to Italy, spent five years at Venice, and some time at Florence; he then visited Switzerland, where he learned that his property had been sequestered, and his name enrolled in the list of emigrants. Notwithstanding this threatening state of his affairs, he ventured to make his appearance at Paris, where, but for the assistance of David, he would have been destitute. David contrived to have his name erased from the list of emigrants, and procured him an order from the government to design and engrave a set of republican costumes. He was engaged in this occupation during the horrors of the Revolution.

After the more violent features of the Revolution had subsided, the house of Madame Beauharnois was a centre of attraction where the most distinguished men in politics, art, literature, and science frequently met; and here Denon became acquainted with Bonaparte, whose exploits had already commanded the admiration of all. Denon was a most devoted admirer of the great general, and when Napoleon asked him, in 1798, to accompany him on his expedition to Egypt, Denon, though in his fifty-first year, embraced the opportunity with the utmost enthusiasm. He accompanied General Desaix in his expedition into Upper Egypt, and during the whole stay of Napoleon in the East he was indefatigable in drawing all the most interesting and striking Egyptian monuments. He returned with Napoleon to France, and in the short space of about two years published his great work on Egypt—'Voyage dans la Basse et la Haute Egypt, pendant les Campagnes du Général Bonaparte,' 2 vols. folio, 1802; a second edition in 4to. was published in the same year, and a smaller edition in 1804. A very elegant quarto edition was published in London, in 1802, by M. Peltier, with several appendices by various members of the Egyptian Commission, or 'Institut du Caire,' in addition to Denon's journal, the original text. This work, which, as the production of an individual, is a noble monument of zeal, industry, and ability, is professedly simply descriptive of what Denon saw and what happened to him; he designedly abstained from all hypothesis, whether with reference to origin, object, or principle. About the time of the publication of this work, Denon was appointed by Napoleon directeur-général des Musées, a post of great influence; but he was deprived of it at the Restoration. After his retirement, he occupied himself in preparing a general history of art, for which he prepared, by the assistance of able artists, many lithographic drawings, but he did not live to complete the text. The incomplete work was published by his nephews, in 1829, in 4 vols. folio, under the title 'Monumens des Arts du Dessin, chez les peuples, tant anciens que modernes, recueillis par le Baron de Denon, pour servir à l'Histoire des Arts,' &c. Denon died at Paris in 1825.

Denon's etchings are numerous, amounting to upwards of 300; they are chiefly in imitation of the style of Rembrandt, and consist of portraits, historical and *genre* pieces, from Italian and Flemish masters. Besides his Voyage in Egypt, he is author of the following literary productions:—'Julie, ou Le Bon Père,' a comedy in three acts, 1769; 'Voyage en Sicile et à Malte,' 1788; 'Discours sur les Monumens d'Antiquités arrivés d'Italie,' 1804; several biographical notices of painters in the 'Galerie des Hommes célèbres;' and 'Point de Lendemain,' a tale, 1812.

He was Membre de l'Institut, of the class of fine arts, officer of the Legion d'Honneur, and knight of the Russian order of St. Anne, and of the Bavarian crown. He was created Baron by Napoleon.

(*Kunstblatt*, 1825; *Biographie Universelle Suppl.*)

DENTA'RIA, a genus of plants belonging to the natural order Cruciferæ, the sub-order Siliquosæ, and the tribe Arabideæ. It has a lanceolate compressed pod, flat nerveless valves, a capitate stigma; the seeds in a single row, the funiculus dilated, winged. The Coral-wort, *D. bulbifera*, is the only British species of this genus. It has a simple stem, alternate leaves, the lower leaves pinnate, the upper leaves simple, the axils of the leaves producing bulbs. It has a thick fleshy rhizoma with tooth-like knobs, hence its name. The flowers are rose-coloured or purple. It is a rare plant in England; but it is found in the neighbourhood of Tunbridge Wells. (Babington, *Manual*.)

DENUNCIATION. [Diligence, P. C. S.]

DEODARA. [Abies, P. C., p. 84.]

DEPARTURE. [Pleading, P. C.]

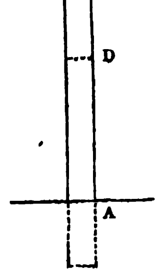
DEPOSIT. The term is applied to the sum of money which under 43 Geo. III. c. 46, a man might deposit with the sheriff after he was arrested, instead of putting in special bail. The amount of the deposit was the sum sworn to on the back of the writ. (Blackstone's *Comm.* iii. 290.)

Deposit is also used for any sum of money which a man puts in the hands of another as a kind of security for the fulfilment of some agreement, or as a part payment in advance.

The Roman word depositum signified anything which a man put in the hands of another to keep till it was asked back, without anything being given to the depositarius for his trouble. The depositor was called deponens or depositor. The depositary was bound to take care of the thing, and to make good any damage that happened to it through fraudulent design (dolus) or gross neglect (lata culpa). The depositor could recover the thing by action; but the depositary was entitled to satisfaction for any loss that he sustained in the matter of the deposit by any default (culpa) on the part of the depositor. The depositary could make no use of the deposit, except with the permission of the depositor, either given in express words or arising from implication. If a man refused to return a deposit, and was condemned in an action of deposit (actio depositi), infamy (infamia) was a consequence of the condemnation.

(*Dig.* 16, tit. 3; Juvenal, *Sat.* xiii. 60.)

DEPRESSION OF MERCURY is intended, here, to signify the diminution of the height of the column of mercury in the tube of a barometer in consequence of a small quantity of air which, from accidents in carriage or otherwise, may get to the upper extremity of the tube and there act, by its elasticity, on the head of the column. When the barometer is to be employed in determining the relative heights of ground, it may not be possible to get this air out of the tube by any means in the power of the observer, and it then becomes necessary to have a formula by which a correction may be applied to the observed height of the mercury at any station, in order to have the height at which the top of the column would stand if the tube were free from air.



For this purpose, before setting out, the height of the column of mercury in the defective instrument must be compared with the height in one which is perfect, in order to obtain the measure of the elasticity of the air which is confined in the upper extremity of the tube. Let AC be the length of the bore of the tube above A, the surface of the mercury in the cistern, AB the height of the column in a barometer free from air, and AB′ the observed height in the defective instrument. It being understood that these heights are read at the same time and place, so that the temperature and density of the air may be the same; and also that both instruments are provided with adjusting screws so that the surfaces of the mercury in the two cisterns may be made to coincide with the zeros of the scales of inches. Then the pressure of the external atmosphere supporting the column AB, and the difference between that pressure and the pressure equivalent to the elasticity of the air in CB′ supporting the column AB′; it follows that the weight of a column of mercury in BB′ measures the pressure last mentioned: let this be represented by ml, in which l is equal to the height BB′.

Now, on removing the instrument to another, suppose a higher, station, let the observed height of the mercury in the imperfect barometer (no more air being supposed to have entered) be AD; then the air which, before, occupied the space CB′, occupies CD, and its elastic force is diminished in the inverse ratio of those spaces or heights; therefore, if CB′ be represented by a, and CD by b,

$$b : a :: ml : m\frac{al}{b};$$

and the last term expresses the pressure of the confined air on D, the top of the column of mercury. This term added to the weight of the column of mercury AD, which may be represented by mh (h being the observed height AD) will be equal to the weight of the column of mercury at the same time and place in a barometer which is free from air. This last being represented by mh'; it follows that $h' = h + \frac{al}{b}$, or $\frac{al}{b}$ is to be added to the observed height in order to obtain the corrected height of the column of mercury at the station.

DERCÆA. [Stenylytra, P. C. S.]

DERME'STIDÆ (from δερμηστής, a moth or worm that eats skins), a tribe of pentamerous coleopterous insects, belonging to the family of *Clavicornes*. It includes the genera *Aspidiphorus*, *Dermestes*, *Megatoma*, *Attagenus*, *Nogoderma*, *Anthrenus*, and *Globulicorne*. The species of the typical genus, *Dermestes*, are harmless insects in their perfect state, living on flowers, but whilst in the condition of larvæ they are most destructive creatures and great pests to the naturalist from the mischief they do among his collections, more especially of skins. They are distributed through Europe, New Holland, Africa, and America.

DERRICK, SAMUEL, whose name occupies an obscure place in the literature of the eighteenth century, was a native of Ireland, and born in 1724. He was first a linen-draper in Dublin, but about 1748 became professionally an author in London, and soon afterwards appeared unsuccessfully as an actor. A life of irregularity and debauchery introduced him to some fashionable acquaintances, whose influence procured his appointment to succeed Beau Nash as master of the ceremonies at Bath and Tunbridge. His extravagant habits remained with him there, and he died very poor, in March, 1769. His avowed literary works are of little importance. His edition of Dryden did more credit to the printer than to the editor. His translation of the third Satire of Juvenal was commended at the time it appeared.

DESIGN, SCHOOLS OF. *English Schools of Design.*—In the year 1835 a committee of the House of Commons was appointed to inquire 'into the best means of extending a knowledge of the arts and of the principles of design among the people (especially the manufacturing population) of this country; also to inquire into the constitution, management, and effects of institutions connected with the arts.' Numerous witnesses, examined before the committee, deposed to the great cost and importance of procuring designs, patterns, and models for manufactured articles, such as should win approval by their elegance and good taste; and there was a general tendency to the opinion that the French, from a better system of instruction in the arts of design, are more successful in patterns and designs generally than our own countrymen.

In the early part of the next year, 1836, another committee was appointed, by whom nearly forty witnesses were examined; and in the Report made by the committee to the House they advert with expressions of regret to the little encouragement which had been given in this country to the cultivation of taste among workmen. 'To us,' the Report states, 'a peculiarly manufacturing nation, the connexion between art and manufactures is most important; and for this merely economical reason (were there no higher motive) it equally imports us to encourage art in its loftier attributes; since it is admitted that the cultivation of the more exalted branches of design tends to advance the humblest pursuits of industry, while the connexion of art with manufacture has often developed the genius of the greatest masters in design.' (p. 3.) The general recommendations of the committee were, that there should be a 'Normal School of Design' established by the government, where both theoretical and practical instruction should be given on the application of art to manufactures; that there should be 'local' or 'branch' schools established at the chief seats of manufacture, such as Manchester, Coventry, the Potteries, Sheffield, &c.; that the government should advance part of the funds for such branch schools, the remainder being provided by those locally interested; that encouragement should in every way be afforded to the establishment of 'Museums of Art' in provincial towns, as a means of diffusing a knowledge and love of art; that easy access should be afforded to Botanical Gardens, wherever practicable, as a medium of obtaining knowledge respecting the forms and colours of flowers; and that the principles of design should form a portion of any permanent system of national education.

These recommendations embraced a wide scope; but that part of them which related to the establishment of a School of Design was at once taken up by the government. In the same year the Board of Trade recommended to the Treasury an application to parliament for a grant of 1500*l.* for the establishment of a School of Design at Somerset House. It was proposed to intrust the management of the scheme to a council of competent persons, guided by such regulations as the government should make for the proper expenditure of the public money. It was further proposed that the officers of the school should consist of a director, two masters, and one or more assistants; that the duty of the director or curator should be to select proper objects for the museum, to submit estimates of the expense to the Board of Trade, and to manage the system of instruction in the school; that the school should be open to all applicants, upon payment of a small fee; that the museum should by degrees be furnished with books, casts, specimens, drawings, and prints; and that exhibitions, premiums, and nominal rewards should be introduced, as incentives to improvement. In partial conformity with this plan, two schools, morning and evening, were opened in 1837. The fee payable was a monthly one, amounting (from the opening of the school to the end of the year 1838) to 16*s.* per month for the morning school, and 4*s.* per month to the evening school; and the number of pupils who paid these monthly rates varied from eight to twenty-five in the morning school, and from eighteen to fifty-eight in the evening school. At the commencement of the year 1839 a reduction was made in the morning school fee from 16*s.* to 4*s.*, and in the evening school fee from 4*s.* to 2*s.* Mr. Papworth was director of the school till August, 1838; after which he was succeeded by Mr. Dyce. In the spring of 1838 Mr. Dyce, who had been sent abroad by the council of the School of Design, made a Report to the Board of Trade, giving the result of certain inquiries which he had instituted on the Continent, the object of which was to determine whether foreign Schools of Design present individually a model which might be proper to follow in organizing the school at Somerset House, or collectively any common character or principle which might serve as a general guide in making out the course of instruction. Mr. Dyce visited France, Belgium, Prussia, and other countries, and gave a full account of the Schools of Design in those countries; from which he drew the inference that, though there was no one school calculated to serve as a model, there was a general spirit or character pervading the whole: this general spirit consisted in making the Schools of Design not mere drawing schools, but institutions for the study of design in connexion with mechanical art.

In February, 1841, a report made by the council of the School of Design to the Board of Trade detailed the chief results obtained from the opening of the school down to that period. At first only a morning school, from ten till four o'clock, was established; but in order to meet the object in view more fully, an evening school meeting from six to nine was afterwards established, and much more fully attended than that held in the morning. Soon after and consequent upon recommendations in this Report the Treasury arranged that the sum of 10,000*l.* should be placed at the disposal of the council, for the establishment of Branch Schools in the more important towns. Applications had been made to the Board from many of the manufacturing towns to this effect; and it was deemed desirable to aid in the object. The terms proposed were as follow: 1st. That 5000*l.* should be expended in making a collection of moulds in the various departments of art, from which casts might be furnished either gratuitously or at a very cheap rate: 2nd. That 5000*l.* should be applied in aid of the contributions of the supporters of Branch Schools of Design, in the outfit and engagement of teachers: 3rd. That each contribution from the public grant should be proportionate to the amount of each provincial subscription: 4th. That conditions for the proper management of the schools should be attached by the council to the acceptance of the grant; the due observance of such conditions being secured by the occasional inspection of the schools by an officer appointed by the council.

During the progress of the school, annual distributions of prizes have taken place, consisting of sums of money of three, four, or five guineas each, presented either by the council, or by individuals who felt an interest in the progress of decorative art. At first these prizes were given for the best designs in certain branches of industry dependent on taste; but it was soon found that elementary skill was wanting; and some of the prizes were therefore given for specimens of drawing, painting, or modelling from fruit and flowers; the others being awarded for designs for particular purposes, such as wall-papers, printed cottons and silks, silver plate, stained glass, and other articles in the decorative arts.

The plan of instruction was modified to the following form:—It was divided into three sections; of which the first comprised drawing, modelling, and colouring, each subdivided into many branches; the second comprised the history, principles, and practice of ornamental art, distinguishing antique, mediæval, and modern styles; while the third comprised the practical application of the above studies to the production of designs for manufactures. Hitherto we believe that little has been done towards an efficient mode of instruction in these two latter branches.

With respect to drawings and casts, the council, during or about the year 1842, put in force the following three plans:—1st, an elementary work on ornamental design was prepared by the director, Mr. Dyce, and published in sheets; 2nd, a collection of ornaments was procured from the *Ecole des Beaux Arts* at Paris, with a view to the production of moulds and casts for general diffusion in this country; 3rd, a purchase was made of copies of Raffaelle's Arabesques at the Loggie of the Vatican, the copies being executed in distemper on canvas screens the same size as the originals.

Another feature was, the establishment of the Female School of Design at Somerset House, in October, 1842. The object was, to instruct females in the arts of design for manufacturing purposes; and the council in reference thereto remarked, that 'The fitness of such an occupation for females; the various branches of ornamental manufacture for which their taste and judgment are adapted; the desirableness of enlarging the field of employment for well-educated women; and the successful precedent of a similar institution on the Continent, appeared to the council to furnish strong grounds for adopting this measure.' The room which had formed the sculpture-room of the Royal Academy at Somerset House was set apart for this school; and Mrs. M‘Ian, a lady whose paintings had often appeared in the public exhibitions, was appointed superintendent of the school.

With respect to the branch schools (of which one had before been established at Spitalfields), the council selected Manchester, York, Coventry, Sheffield, Nottingham, Newcastle, Norwich, and Birmingham, as the recipients of the grants; with a prospective extension to other towns as means offered. In all these cases the grant consisted of a sum as outfit, varying from 300*l.* to 500*l*; and an annual payment for three years, varying from 150*l.* to 350*l.*: the period of three years being fixed upon to test the system. A further stage in the development of the system was the establishment of 'exhibitions.' It was speedily found that there was a deficiency of qualified teachers for the branch schools; and as a means of obviating the difficulty, six exhibitions of 30*l.* each were founded, to be given to those pupils who should be found to advance most rapidly in their studies; such exhibitions to continue for a period not exceeding three years. From among exhibitioners of this class masters were provided for the branch schools at Spitalfields, Nottingham, Sheffield, and York, and afterwards for other schools. It was principally during the years 1841 and 1842 that these various measures were established; and in the next following year a change was made in the directorship by the appointment of Mr. Wilson to that office, Mr. Dyce thereupon assuming the duties of inspector of the provincial schools. And very recently, upon his resignation, Mr. Ambrose Poynter has been appointed the inspector.

In the autumn of 1844 Mr. Townsend, one of the masters, proceeded to Paris, with a view of obtaining information as to the state of the arts of design in Paris. On his return he published a Report to the council, in which he entered with much minuteness into the subject. Mr. Wilson and Mrs. M'Ian also visited Paris; the former with the view of purchasing various articles of manufacture, at the 'Exposition' which took place at Paris last year, for the use of the pupils at Somerset House; and the latter for the purpose of studying porcelain-painting at Sèvres, with a view to the establishment of a class for that purpose in the government School of Design. The Report made by this lady contains much valuable information as to the probability of employing females in the artistic branches of manufacture.

The Report of the Council for the present year, just issued, brings down the details to the end of April, 1845. From this it appears, that the number of students on the books of the Morning School, from May, 1844, to April, 1845, varied from 60 to 113; in the Evening School, from 125 to 226; and, in the Female School, from 43 to 65. The largest number attending at one time was 192, at the Evening School, in January. In almost all the departments an increase in the numbers had taken place as compared with the year 1843-4. The following table gives the relative ages of the students, in the month of February, 1845:—

Ages.	Morning School.	Evening School.
12 to 15	31	0
15 to 20	41	115
20 to 25	21	83
25 to 30	7	17
30 to 35	4	8

The number of schools under the control of the Council, in February, 1845, was 10, and the number of students at that time as follows:—Somerset House, 396; Spitalfields, 190; Manchester, 150; Birmingham, 257; Coventry, 106; Sheffield, 47; Nottingham, 36; York, 76; Newcastle, 140; Glasgow, 360;—total, 1558.

Drawings have been obtained from Italy of arabesques, mosaic pavements, terra-cottas, &c. M. Guizot has presented to the schools casts from the celebrated gates of the Baptistery at Florence. Specimens of paper-hanging, silk, glass, porcelain, bronze, wax ornaments, and other objects, have been purchased or presented for the use of the schools. Books have been purchased or presented, forming a library of reference in matters relating to art and decoration; and some of these books are, under certain regulations, lent out to the students. Books have been sent by the Council to all the provincial schools, in some cases as a gift, and in others on loan, to be tranferred from one school to another in succession. In the Female School, the students are in most cases preparing for one or other of the following employments:—pattern-designers, designers for wood-engraving, for lithography, for children's books, for porcelain, and for ornamental articles generally; or else as teachers: and the specimens produced by them comprise, among others, patterns for lace, for chintz, for wall-paper, for porcelain, &c. On two days in the week, instruction in wood-engraving is given to a small class. The prizes offered to students at Midsummer of the present year are for designs for carpets, silk-damask hangings, table-covers, paper-hangings, furniture and chintz, chandeliers, &c.; as also for arabesques, frescoes, encaustics, drawings, original models, copies from casts, drawings of flowers, &c.: most of these are competed for in the Male Schools only, but some are open also to the Female School.

Several rooms in the Strand front of Somerset House are used for the purposes of the school. The room for the female students is on a different floor, and wholly distinct from the others. The morning and evening students in the male schools have three rooms appropriated to them. In the first, an anteroom, the walls are covered with specimens of fresco, encaustic, distemper, oil, and other kinds of painting, comprising arabesques and ornamental subjects generally; the copies from the arabesques of the Vatican are placed upon revolving quadrangular pillars, for the convenience of the students copying them. Beyond this room is the large room where the greater part of the students assemble; it is provided with long ranges of desks and seats, and conveniences for suspending the drawings or other objects which are to be copied; and there are portfolios at hand for containing a large collection of ornamental designs and drawings. On one side of the room is a bench where the studies in modelling are pursued; and near it are plaster casts conveniently placed for copying. Around the room, at a considerable height from the ground, is a gallery, the walls of which are filled with plaster casts, illustrating various kinds of decorative art. Adjoining this large room is a smaller one containing casts from statues, busts, groups, friezes, bassi-rilievi, and other specimens in plaster, with conveniences for drawing and copying.

Admission to the schools is not obtained without a recommendation from respectable individuals; and the fees payable continue the same in amount as they have been for some time past; viz. 4*s.* per month in the Morning School, and 2*s.* per month in the Evening School and the Female School.

Foreign Schools of Design.—Mr. Dyce ('Parl. Pap.' 1840, vol. xxix. p. 633) states that the present system of Art-education in Prussia consists of Primary or Elementary Instruction; Secondary and Normal Instruction; and Academical Instruction, in the Schools of Fine Art; a division corresponding very closely with the system followed in Prussia for general education (for which see SCHOOLS, P. C.). In Prussia, 'under the term *Fine Art*, every species of decorative design is supposed to be included; no difference in principle being recognised between that kind of art which is applicable to manufacture, and that which has for its object the poetical, the imaginative, or the historical. The immediate result of this opinion is, that, in the matter of education, the difference between a school of design for manufacture and an academy of fine art is made to consist not in the kind of instruction afforded, but in the amount or degree to which it is carried.' The Elementary Schools, of which there is one at Berlin, one at Düsseldorf, and several others in provincial towns, give instruction in 'Drawing from the Antique,' 'Modelling from the Antique,' and 'Geometrical and Architectural Drawing.' They are open to all applicants, on payment of an average fee of about twelve shillings per annum.

The next higher grade includes two schools, the 'Gewerb Institut' and the 'Bau Akademie,' both at Berlin. In the former of these two the studies have reference to all the branches of science or art bearing upon manufactures; comprising drawing of machinery, modelling in clay, elementary geometry, architectural drawing, principles of construction, various branches of mathematics, the physical sciences generally, practical mechanics, mineralogy, original sketching, perspective, sculpture, and studying in workshops belonging to the Institut. Admission to this school is generally contingent on a favourable progress through the elementary schools; and many of the students who leave it become competent overseers and directors of large manufacturing establishments. The education is gratuitous; and rewards are occasionally given to the students. The second of these two schools, the 'Bau Akademie,' is for the education of artists in the branches of manufacture depending on architectural knowledge; architecture being here considered rather as a science than a fine art. All the matters which bear in any way on building, civil engineering, or surveying, come within the scope of this school. The highest class of schools is that which belongs to the Royal Academy of Berlin, and in which the fine arts are embraced in their widest range, without reference to any particular mode of application; all the other schools being subordinate to this as parts of the national system.

In Bavaria (Dyce, p. 645) the education in art is so peculiarly mixed up with education generally, that it is scarcely possible to separate them.

There are six different kinds of education, and four grades. The six are

1. Purely scientific education.
2. Purely popular education.
3. Agricultural combined with scientific education.
4. Agricultural combined with popular education.
5. Technical combined with scientific education.
6. Technical combined with popular education.

The four grades are—

1. Elementary.
2. Gymnasial.
3. Lyceal.
4. University.

Some of the six sections go through all the four grades of study, while others embrace only two or three. In all of the sections the study of art occupies a prominent place; but the one which approaches nearest to the Schools of Design is the Technical or Polytechnic. The earlier stages of this department are taught at the elementary schools scattered about the country; the next stage at the Gymnasia, of which there is one to each large town; and the last stage is at the Lycea, of which there are three. The Lyceum at Munich attends chiefly to architecture and the application of the fine arts to manufactures; that at Nürnberg to metal-casting and wood-carving chiefly; and that at Augsburg to textile manufactures. The regulations of all the schools, and the bearing which they have upon each other, are minutely detailed by Mr. Dyce.

In France (Dyce, p. 657) there are, intermediate between the elementary schools and the royal academies, several others which treat of art in its relation either to manufacture or to science; and which are either supported partly by the state and partly by municipalities, or are private establishments assisted by municipalities. The 'Ecole des Beaux Arts' at Paris, schools of a somewhat similar kind at Lyon, Strasbourg, Dijon, Nancy, Bordeaux, &c., the 'Ecole Royale Gratuite de Dessin,' at Paris, are the principal of these; and in most of them a very extensive system of studies is pursued, bearing in various ways on the science and the fine art of manufactures. The school of art at Lyon, in particular, is an important one in connection with the silk-manufacture carried on in that city; and every endeavour is there made to foster taste in manufactures. Dr. Bowring spoke pointedly upon this subject in his evidence before the committee in 1836; and said that the origin of all the schools of art in France, amounting to about eighty in number, is to be traced to a conviction that the application of the principles of art and science to manufacture is the best means of advancing it. Mr. Dyce illustrates the matter thus: 'At Lyon the commercial value of taste is valued so high, that when a young man displays remarkable powers, a house will admit him to a partnership, in order completely to monopolize his services. Even in general employment, a Lyonese pattern-designer in good practice realises as much as 10,000 francs per annum.' (Report, p 35; or p. 667 of the volume before quoted.)

DESMI'DIUM. [Zoocarpes, P. C.]

DESMOPHY'LLUM, a genus of Zoophyta, fossil in the London clay of Sheppey. (*Geol. Trans.*, N. S., vol. v. t. 8, f. i.)

DETRUSION, FORCE OF. [Materials, Strength of, P. C., p. 11.]

DEVASTA'VIT. [Executor, P. C.]

DEVONIAN SYSTEM. A great portion of the Palæozoic strata of North and South Devon has been thus termed by Sedgwick and Murchison (*Geol. Trans.*), and also referred to as of coeval formation with the old red-sandstone of Herefordshire. Further investigation has shown that a portion of the strata in North Devon belongs to the Carboniferous system, and is equivalent to the lowest shales and sandstones thereof. The old red-sandstone must certainly be admitted to be coeval with some parts of the Devonian strata, which besides contain several red-sandstone members; but there is reason to think that the true place of much of the stratification of South Devon, on the ordinary geological scale, is rather about the upper part of the old red-sandstone; and this mode of viewing these rocks harmonizes with the distribution of organic remains in the Silurian, Devonian, and Carboniferous deposits.

DIA'NCHORA, a fossil genus of Conchifera, allied to Spondylus. Dianchora striata and D. lata are described by Mr. Sowerby from the chalk and greensand (*Min. Conchology of Great Britain*)

DIAPER, a kind of textile fabric, formed of either linen or cotton, or a mixture of the two, upon the face of which a figured pattern is produced by a peculiar mode of twilling, or tweeling. [Weaving, P. C., pp. 177, 178.] Diapers, which, excepting damasks, are the most ornamental kind of twilled cloths, are chiefly used for table-linen, fine towels, &c.

'The word diaper,' observes Mr. Planché, in his 'History of British Costume,' p. 100, 'is derived by some writers from "D'Ipres," i. e. "of Ypres," a town in Flanders, famous for its manufactory of rich stuffs and fine linen before the year 1200.' 'Ducange,' he adds, 'derives it from the Italian "diaspro," the jasper, which it resembles in its shifting lights; but the first is by far the most plausible conjecture; and though we read of diapers of Antioch, it is only because Ypres having given its name to its peculiar manufacture, any similar cloth received the same appellation.'

In decorative painting, and in the ornamenting of glass, the term *diapering* is sometimes applied to a small delicate pattern introduced to diminish the appearance of baldness where a considerable space is covered with one colour, and thus to relieve the eye, without forming any part of the main design. In heraldic painting, especially, it is often resorted to, particularly where the juxtaposition of considerable masses of black and white might prove unsightly; but in all such cases it should be remembered that the diapering forms no part of the heraldic bearing.

DIASTASE. [Chemistry, P. C. S.]

DIATOMA'CEÆ. [Zoocarpes, P. C.]

DIBDIN, THOMAS, one of the sons of Charles Dibdin, was born in 1771. After having spent some time at a school in the north of England, he was apprenticed at the age of sixteen to an upholsterer in London, whom he served for four years. He then joined a company of strolling players in Essex, and for several years wandered through the country in that profession. In 1795 he returned to London, where he wrote a number of very successful pieces for the minor theatres; and in 1797 he was engaged as an actor at Covent Garden theatre, with which, as actor or author, he continued to be connected for fourteen years. The latter part of his life was spent in indigence. At the time of his death he was engaged in compiling an edition of his father's sea-songs, for which he received an allowance from the Lords of the Admiralty. He died at Pentonville on the 16th of September, 1841, leaving children by each of two marriages. Thomas Dibdin's comedies, operas, and farces are numerous enough to fill a long paragraph with their bare names. Many of them were composed for temporary purposes; and many others had little or no success. But there are some which, either through merits of their own or by their adaptation to particular actors and singers, still maintain a place on the stage. Such are the opera of 'The Cabinet,' and the farce of 'Past Ten o'Clock.'

DI'CERAS, a fossil genus of Conchifera, allied in form to Chama. It includes species mostly occurring in the upper part of the oolitic strata, and (D Lonsdalii) the lower part of the greensand. D'Orbigny ranks the latter species as Caprotina.

DICHOBUNE. [Anoplotherium, P. C.]

DICHROISM, from the Greek words *δίς* (double) and *χρόα* (colour), is a term applied to that property of certain crystals by which they exhibit different colours according to the position of their axes with respect to the incident pencil of light.

Some of the phenomena relating to the differences of colour in a crystal were observed by Dr. Wollaston in tourmaline and some other minerals, but Dr. (Sir David) Brewster was the first to discover that they were caused by the different absorptions of the rays of coloured light in their passage through the crystal. In the undulatory theory they depend on some modifications of those functions of the lengths of waves, by which the tints of colour are expressed. Sir David Brewster observed that when common light was transmitted through certain specimens of beryl, the tint, a bluish-green, was the same in every position of the crystal; and the like equality of tint, when common light was transmitted in any direction, was found to exist in yellow carbonate of lime, and in many other minerals: but this was found to be not always the case; in some specimens of tourmaline, for example, the common light transmitted along the axis of the crystal emerges of a deep red colour, and that which passes perpendicularly to the axis is green: also, in some specimens of sapphire the colour seen along the axis is a deep blue, and that which is seen perpendicularly to it is a yellow green.

A pencil of common white light being suffered to fall on a prism of doubly refracting crystal, Sir David Brewster found that the colours of the two images, which were the same when the refracted rays were parallel to the axis, differed from one another when the rays were inclined to the axis, and so much the more as the inclination was greater, the difference becoming greatest when the angle of inclination was a right angle. And Sir John Herschel has represented ('Treatise on Light,' in the 'Encycl. Metrop.') the phenomena of the ordinarily and extraordinarily refracted pencils by algebraic equations of the forms

$$a = x + y \sin.^2 \theta \quad , \quad a' = x' + y' \sin.^2 \theta \, ,$$

of which the terms are functions of the lengths of undulations for the different colours: thus x, x', denote expressions for the tints of the ordinary and extraordinary pencils when the incident rays are parallel to the axis of the crystal; y, y', expressions for the tints of the pencils when the incident rays are at right angles to that axis; θ denotes any inclination of the incident pencil to the same axis; and a, a', are the tints of the ordinary and extraordinary pencils corresponding to the values of θ.

Adding these equations together, there is obtained

$$a + a' = x + x' + (y + y') \sin^2 \theta.$$

Now, when $\theta = 0$, $a + a'$ becomes equal to $x + x'$; and the latter is an expression for the tint arising from the combination of the two pencils in the direction of the axis of the crystal; or it is the tint observed in the crystal when common light is transmitted in the direction of the axis: let therefore $x + x'$ be represented by a. Again, when $\theta = 90°$, $a + a'$ becomes equal to $x + x' + y + y'$, and this is an expression for the tint arising from the combination of the pencils in a direction perpendicular to the axis of the crystal; or it is the tint observed in the crystal, in that direction: therefore let this expression be represented by b; then we shall have $b = y + y' + a$, or $y' + y = a - b$. On substituting these values in the original equation, there arises

$$a + \alpha' = a \cos^2 \theta + b \sin^2 \theta,$$

and the second member is the expression for the tint arising from the union of the two refracted pencils when the incident light makes any angle θ, with the axis of the crystal.

Sir David Brewster also found that there are several crystals on which if a pencil of white light. polarized in any plane, be allowed to fall, the transmitted light will vary in colour according to the angle which the axis of the crystal makes with the plane of polarization: for example, a certain specimen of beryl which transmitted a greenish light only when the axis coincided with such plane, exhibited a blue tint when the axis was at right angles to the plane; the transmitted tints gradually passing from one to the other, by the absorption of some of the light, as the position of the crystal was changed. On cutting the crystals in the form of prisms, in order that the ordinarily and extraordinarily refracted images of a circular aperture in the front might be separated from one another, he found that these were of different colours; one having the tint which would be produced by transmitting through the prism polarized light, in a certain position of the axis; and the other, the tint which would be produced by turning the crystal at right angles to that position. In the 'Philosophical Transactions' for 1819, Sir David Brewster has given lists of crystals, both uniaxal and biaxal, which possess these properties; and Sir John Herschel has given, for the expressions of the tints of the ordinary and extraordinary images in every position of the crystal, the equations

$$\alpha = (x + y \sin^4 \theta) \cos^2 \phi,\ a' = (x' + y' \sin^2 \theta) \sin^2 \phi,$$

in which ϕ is the angle made by the plane passing through the axis of the crystal and the incident pencil with the plane of polarization. From this he deduces, for the tint of the emergent pencil, or $\alpha + a'$, the expression

$$a \cos^2 \theta + (m \cos^2 \phi + n \sin^2 \phi) \sin^2 \theta;$$

in which m and n denote the tints seen when $\phi = 0$ and $\phi = 90°$ respectively: and he finds that $m + n$ is equal to the tint which was before represented by b.

DICTAMNUS. [FRAXINELLA, P. C. S.]

DICTY'OCHA, a genus of fossil Infusoria, from the Polierschiefer of Oran.

DICTYOPHY'LLUM, a genus of fossil plants, proposed by Lindley and Hutton (*Fossil Flora*) to include a large specimen (D. crassinervium) from the new red-sandstone of Liverpool, and a more delicate species (D. rugosum) from the oolitic shales of the Yorkshire coast. The latter is regarded as a fern by later writers. Its nervures are rudely reticulated.

DICYPELLIUM, a genus of plants belonging to the natural order Lauraceæ. It has diœcious flowers, with a deeply 6-parted spread-out calyx, with equal permanent segments. The staminiferous flowers have 3 rows of sterile stamens; the 3 outer being perfectly petaloid, the 3 next petaloideo-unguiculate, inflexed at the point, with 4 pits below the point; the 3 inner compressed sessile truncate, with 2 pits on each side below the point, and 2 glandular protuberances at the back. The fruit is dry, and seated in the enlarged, fleshy, shrivelled calyx, and among the enlarged, hardened, sterile stamens. The inflorescence consists of single few-flowered racemes.

D. caryophyllatum, Bois de Rose, has alternate oblong leaves tapering to a very fine point, which is, nevertheless, bluntish, acute at the base, papery, and smooth-netted on the under side. It is a tree, and a native of the woods of Brazil and Guiana. It is called *Licari Kanali* by the Caribs; and is the *Licaria guianensis* of Aublet. The bark gives out a smell very like cloves, and has a hot, clove-like, peppery taste. It is used as a medicine by the natives in the countries where it grows, and posseses powerful tonic properties.

(Lindley, *Flora Medica.*)

DIE-SINKING. In the preparation of coined money and of medals, the most important feature is the engraving of the 'die' which is to form the stamp. The piece of steel is prepared with the utmost care, and is brought to a soft state when about to be submitted to the hands of the engraver. If the die or stamp is for a medal such as those which are executed by Mr. Pistrucci at the Mint, and of which the relief is great, the metal requires to be cut away to a greater depth than in the dies for coins, such as those intrusted to the hands of Mr. Wyon. By very minute touches, and by the aid of small, fine, hardened steel tools, the engraver cuts away the steel until he has produced, in cavity or 'intaglio,' an exact reverse of the design for the medal or coin. The steel, in a soft state while being engraved, requires hardening before being applied to use. The face of the die is covered with a protecting layer of pounded charcoal mixed with oil, and it is then placed face downwards in a crucible, where it is surrounded with pounded charcoal; after being heated to a 'cherry-red' temperature, it is taken out by means of tongs, and plunged into cold water, the sudden action of which renders the steel extremely hard. When further prepared, so as to be rendered more durable, it obtains the name of the *matrix*, and might be used in that state to stamp coins or medals; but as such a matrix is very costly, and might be spoiled by fracture, arrangements are made for producing multiplied copies of it. A small block of soft steel is, by immense pressure, made to receive an impress, *in relief*, from this matrix; and from this second piece, which obtains the name of the *puncheon*, after being hardened and re-touched by the graver, *dies* or duplications of the original matrix are produced, as briefly noticed in INTAGLIO, P. C. These dies, when intended for coinage, are intrusted to the 'Clerk of the Irons' at the Mint, whose duty it is to superintend the die-press rooms, the purchasing and forging of the steel, and the engraving and hardening of the dies; to receive and transmit all orders respecting the dies, to be present whenever the die-press is used for multiplying the dies, and to exercise general control over all matters relating to them.

In the use of dies by means of the stamping-press, the number of blows required to transfer the device to a blank piece of metal depends upon the depth of the intaglio. Professor Brande states, that in a medal executed by Mr. Wyon, for the Royal Naval College, there was a representation of the head of the king, in such bold relief as to require thirty blows of a very powerful press to complete the impression; and that it was necessary, on account of the hardening produced by the pressure, to anneal each medal after every third blow, so that every medal was placed in the furnace ten times during the process of stamping. In another instance (a large medal struck by Boulton), some of the copies are said to have received three hundred blows each, and to have required heating and annealing after each blow.

A remarkable method is sometimes adopted of producing medals from a die by means of stamping, but upon metal which is in a semi-liquid instead of a cold and solid state: the method is called *en cliché*, and has been much practised in France. The metal of which these medals are formed is one of the various kinds of 'fusible metal,' such as will melt at a low temperature. Type-metal, consisting of five parts of lead to one of antimony, will answer for the purpose, but it is deemed better when a little more lead is added to it; many different alloys of tin, lead, bismuth, and antimony, however, will suffice. The die to be employed is fixed face downwards at the lower end of a stamper, which works within a box or case to prevent the liquid metal from splashing about; at the bottom of the box is a cast-iron plate, on which is placed a small paper tray. The alloy is melted, and allowed to cool down to a pasty state; a little of it is placed in the paper tray; the box is closed on all sides, and the stamper is allowed to fall on the alloy, by which a medallion is produced from the die, rough at the edges, and with an impress only on one side. The contact of the cold die solidifies the alloy, and produces a clear and tolerably sharp impression. The medallions so produced are trimmed at the edge by a lathe, and rendered smooth at the back; sometimes two are fixed together back to back, to form a perfect medallion, and sometimes they are mounted in cases, with only one side visible; the surface being bronzed with metallic sulphates. In some instances, instead of cliché medals being produced from engraved dies, cliché moulds are produced from models made of plaster, wood, sulphur, clay, wax, or metal; thus, the Italian figure-casters often make casts from medallions and small bassi-rilievi by means of moulds which have been made *en cliché* from models.

The process of copying medals by engraving (to which an allusion only, without any description, was given in ENGRAVING, P. C.), depends partly on the same principle as the *Silhouette* or profile machine; that is, a lever of which one end traces over the object to be copied, and the other end over the copy itself; so that the two, though differing perhaps in extent of movement, make movements of the same sied. The object in view, in medal engraving, is to produce an engraving which shall cheat the eye into a belief that the surface is raised like a medal, instead of being flat; and specimens of extraordinary success in this art have been produced within the last few years. We may suppose a medal to be laid down flat, and that placed near it is the copper plate on which the engraving is to be made. A peculiar bent lever touches them both, having a tracer-point at one end and an etching-point at the other; the tracer-point comes down vertically on the medal, whereas the etching-point comes nearly horizontally into contact with the etching-ground of the copper plate. When the tracer-point passes over a flat or level part of the medal, the etching-point marks or engraves a horizontal line on the etching-ground; but when the tracer rises over any of the relief parts of the medal, the etching-point makes a curved line, more or less convex in proportion to the boldness of relief. By passing the tracer-point over every part of the surface of the medal, in parallel lines, the etching-point is made to mark an equal number of lines on the etching-ground of the copper plate; but these latter lines, instead of being straight and parallel, have varying degrees of curvature. In passing over a sloping part of the device on the medal, the lines in the engraving become either more closely placed or more widely separated than in the former case, according to the direction taken by the sloped surface; they thus give the light-and-shade appearance of a surface in relief.

The principle here noticed was the one acted on until within the last twelve or fourteen years; since which time Mr. Bate and M. Collas have introduced several improvements, tending to remove certain distortions of form which necessarily resulted from the older method. Mr. Bate passes the tracer over the medal at an angle of 45°, instead of vertically, an angle which he shows to be better fitted to avoid distortion than any other. A few years ago there was a project before the public, to publish engravings of the large collection of medals contained in the British Museum, as a means of illustrating the history of the times when the medals and coins were struck, and to form the engravings into a work to be called 'Medallic Illustration of British History.' A committee of the House of Commons, appointed to investigate various matters relating to the British Museum, had its attention drawn to this point; and Mr. Brockeden, as an example of the rapidity with which medal-engraving could be effected by Mr. Bate's machine, mentioned the following:—'This large medal of Henry IV., about four inches in diameter, was begun last evening at four o'clock, and finished at two o'clock this morning, that is, finished in the tracing upon the etching-ground: it then went into the hands of an inferior artist, who bit the lines traced through the ground with an acid; and it is now a proof that if an artist had superintended it, it would have united all the beauties of such a work of art.'

DIEFFENBA'CHIA, a genus of plants belonging to the natural order Araceæ, to which the Caladium Seguinum, Dumb Cane, belongs. [Caladium, P. C. S.]

DIEPENBECK, ABRAHAM VAN, a distinguished Dutch historical painter of the Flemish school, was born at Hertogenbosch (Bois-le-Duc) about 1607. He was already a good painter on glass when he entered the school of Rubens at Antwerp, in which he was the fellow-pupil of Vandyck; and he is the scholar who is said to have been pushed against the great picture of the Taking down from the Cross, when wet, the consequent damage to which was so admirably repaired by Vandyck. Diepenbeck lived at two periods with Rubens, before and after a visit to Rome, but in the second period more in the capacity of assistant than scholar. He was one of the best of Rubens's scholars, especially in composition and in colour: in design he was never excellent; he was too hasty in his execution. He had however a great reputation at Antwerp, and in 1641 was elected director of the academy there, an office which he held until his death in 1675.

Diepenbeck came to England in the time of Charles I., and was employed by William Cavendish, duke of Newcastle, to make the pictures for his book on horsemanship, some of which in Walpole's time were still exhibited in the hall at Welbeck.

Diepenbeck's works are very numerous, but they consist chiefly of designs made for booksellers. Heineken has given a long list of the engravings after them in his Dictionary. One of his principal works is a series of fifty-nine designs, published in 1655 at Paris, under the title of 'Tableaux du Temple des Muses,' with illustrated letter-press by the Abbé Marolles: the subjects are from Ovid's 'Metamorphoses,' and the engravings are executed by Bloemart, Matham, and other eminent engravers. There are several later editions and imitations of it.

His oil paintings on canvas are scarce: some pass probably as the works of Rubens; but there are still many of his painted windows in the churches of Antwerp. Houbraken says Diepenbeck was the best painter on glass of his time.

Descamps and others give 1607 as the year of Diepenbeck's birth; but as he was the fellow-pupil of Vandyck with Rubens, had earned a reputation before he entered the school of Rubens, and was elected director of the Academy of Antwerp in 1641, it is very improbable that he was born so late as 1607. D'Argenville gives 1620 as the date of his birth, but this is evidently an error. Houbraken states that he does not know in what year he was born.

(Houbraken, *Groote Schouburg der Nederlandsche Konstschilders*, &c.; D'Argenville, *Abrégé de la Vie des plus fameux Peintres;* Descamps, *Vies des Peintres Flamands*, &c.; Heineken, *Dictionnaire des Artistes*, &c.; Walpole, *Anecdotes of Painting*, &c.)

DIES, ALBERT, a landscape-painter and engraver, born at Hanover in 1755. He learnt the first drudgery of painting under an obscure artist of Hanover, with whom he spent three years: at the expiration of this period he visited Düsseldorf for a year, whence he went to Rome in 1775, with thirty ducats in his pocket, a donation from the royal treasury. At Rome he attracted the notice of the celebrated Piranesi and of the earl of Bristol, who wished to make a second Salvator Rosa of Dies, but the painter preferred sketching from nature to copying or to imitating the works of the gloomy Neapolitan: his favourite retreats were about Albano and Tivoli.

Dies remained several years in Rome, but in the mean while paid a visit to Naples. He also published a set of landscape etchings in Rome, executed in company with some other German artists. He returned with a Roman wife to Germany in 1796, and established himself at Vienna, where he obtained a great reputation, notwithstanding a nervous debility which he had brought on by taking, whilst in Rome, some solution of sugar of lead in mistake for a medicine which he was using. His right side was so much affected by this nervous debility, that he was forced to give up entirely the use of his right hand, and he painted for some years with his left. He was at length forced to give up painting altogether, and his only remaining resource was poetry, for he was a poet. He was also a musical composer, and he performed with skill upon several instruments. Besides several minor pieces upon the arts, he was the author of a comic didactic poem entitled 'Der Genius der Kunst.' Also a few of his musical compositions have been published; and he wrote a biography of Jos. Haydn. He died at Vienna in 1822, after an illness of thirteen years.

(*Archiv für Geschichte*, &c., 1825; Nagler, *Neues Allgemeines Künstler-Lexicon.*)

DIEST is a flourishing town in the province of South Brabant, in the kingdom of Belgium. It is situated in a valley, on the banks of the Demer, which traverses it in several arms, in 51° N. lat. and 5° E. long., and has within its walls many gardens. It has several churches, and a population of 6000 inhabitants. There are manufactures of stockings, woollen-cloth, worsted, some brandy distilleries, and numerous breweries, the beer of which is highly esteemed.

(Hassel, *Erdbeschreibung;* Stein, *Lexicon;* Stein, *Handbuch*, by Hörschelmann; Cannabich, *Lehrbuch.*)

DIETRICH, JOHANN WILHELM ERNST, one of the most distinguished German painters of the eighteenth century, was born at Weimar, in 1712. His father, Johann Georg Dietrich, who was his first instructor, was court painter at Weimar, and painted portraits, battles, and *genre* pictures with considerable success. In his twelfth year his father sent him to Dresden to study under Alexander Thiele, a celebrated landscape painter, and he attended at the same time the Academy of Dresden. Dietrich rapidly distinguished himself; and in 1730, when only eighteen years of age, he was presented at Dresden to August II., king of Poland, who appointed him his court painter. He found, at the same time, a generous and valuable patron in Count Brühl, for whom he painted much in his house at Grochwitz, since destroyed; the Count granted him an annual pension of 400 dollars, or sixty pounds sterling.

In 1741 Dietrich was appointed his court painter by August III., king of Poland; and in 1743 he was sent by the same king to Rome to prosecute his studies there, but he remained there only one year. In 1746 he received an appointment in the picture gallery, with a salary of 400 rix-dollars per annum, or about eighty guineas; and when the Academy of the Arts, of Dresden, was established in 1763, Dietrich was appointed one of the professors, with a salary of 600 rix-dollars, and he was, at the same time, made director of the school of painting in the porcelain manufactory at Meissen. He died at Dresden in 1774, aged sixty-two, and is supposed to have hastened his death by his incessant application to his art; for, notwithstanding an extremely rapid execution he was an indefatigable painter, and laboured at his easel with little intermission till within the last few years of his life, when his weak state of health rendered it physically impossible. Dietrich painted in various styles, and copied any master with surprising exactness. He was most able, however, as a landscape painter; but his views were generally arbitrary compositions, well coloured, transparent, and effectively lighted. He often painted in imitation of the style of some celebrated master, Everdingen, Poelemburg, Berghem, or Claude, and in all occasions the imitations were excellent. He copied also, with equal facility, the style of Raphael, Correggio, Mieris, and Ostade. He also repeatedly imitated the style of Rembrandt, both in paintings and in etchings, especially in religious pieces, but with somewhat less licence as to the costume and the proportions of the human figure: but for this circumstance the most experienced judges might be deceived; yet all his works display something in the handling peculiar to himself.

Dietrich painted also many rustic pieces, and pieces in the style and manner of Watteau. Two collections of etchings by him have been published, which are very scarce, especially the first; the second, consisting of 87 plates, was published after his death, retouched by and under the direction of Zingg. Some of his etchings are signed Dietrich, and others Dietricy; the earlier ones are marked with the former name. There are also many prints after his works by other masters.

There are twenty-seven of Dietrich's pictures in the Royal Gallery at Dresden, and there is a good collection of his drawings and sketches in the collection of prints there.

(Meusel, *Miscellaneen Artistichen Inhalts;* Heineken, *Nachrichten von Künstlern*, &c.; and *Dictionnaire des Artistes*, &c.)

DIFFERENCES, EQUATIONS OF. [Equations of Differences, P. C. S.]

DIFFERENTIAL EQUATIONS. [Equations, Differential, P. C. S.]

DIGBY, GEORGE, EARL OF BRISTOL, was born in 1612 at Madrid, where his father John earl of Bristol was then ambassador. He was educated at Magdalen College, Oxford, travelled in France, and in 1640 entered public life as one of the knights of the shire for Dorsetshire. From this time his career was marked by that uninterrupted series of clever inconsistencies, which make his life like a novel and his character like a riddle. Neither his character nor the incidents of his history can be adequately understood, unless from a full collection of particulars. Such a collection will be found in the very long memoir of him given in the 'Biographia Britannica.' After distinguishing himself in the House of Commons as a member of the opposition, he suddenly joined the court in the middle of Strafford's trial: afterwards he advised the seizure of the six members, and was one of the most violent of the king's imprudent advisers. Compelled to leave England, he served in the French wars of the Fronde, where he gained high reputation, but behaved so intriguingly as to be cashiered: and next, seeking service with the king of Spain, he embraced the Roman Catholic religion, against which he had formerly written a treatise. After the Restoration he returned to England, and sat in the House of Lords, where he, a Roman Catholic, spoke and voted in favour of the Test Act. Another of his most prominent public appearances was his impeachment of Lord Clarendon in 1663. This able but eccentric and useless man died at Chelsea on the 20th of March, 1677. His literary character is not more than respectable. His principal works are several speeches, a good many letters, a translation of the first three books of the French romance of 'Cassandra,' and a lively play called 'Elvira, or the Worst not always True, a Comedy, written by a Person of Quality,' which was licensed and printed in 1667, and is reprinted in Dodsley's 'Old Plays.'

DIGITA'RIA, a genus of grasses belonging to the tribe Paniceæ. It has fingered spikes, the spikelets in two rows on one side of a flattened rachis, unarmed, 1-flowered with an inferior rudiment· the glumes 2, lower very small, upper 3-nerved; the sterile flowers of one 5-7-nerved palea resembling the upper glume and equalling the flower. This genus has obtained its name from the singular form of its heads of flowers, which look like fingers. Two species are described as natives of Great Britain. *D. sanguinalis* was formerly found in Battersea Fields, near London, but is not a true native. It has the leaves and sheaths hairy, the flowers oblong-lanceolate, glabrous with downy margins. It is a common plant in Germany, and has obtained its specific name from an idle trick which the boys in some parts of Germany have of pricking one another's noses with its spikelets till they bleed. It abounds by the roadsides in Poland and Lithuania, in which countries its seeds are collected, and boiled whole like rice with milk, and is esteemed as a pleasant article of diet. The other species is *D. humifusa;* it has leaves and sheaths glabrous, flowers elliptical and downy, with glabrous nerves. This is a rare plant, and grows in sandy fields. It is a true native in many parts of England.

(Babington, *Manual;* Loudon, *Encyclopædia of Plants.*)

DILIGENCE, in the law of Scotland, is an expression nearly equivalent to execution in the law of England. It includes the various means by which the person may be seized and imprisoned, or the property attached and disposed of, to the end of enforcing payment of debt or performance of any civil obligation. It would not give a comprehensive view of the object of this procedure to say that it is for the purpose of carrying out the judgments of the courts of law, because it is a characteristic of Scottish procedure that not only will an agreement properly executed between parties to allow diligence to proceed without a judgment (as in a warrant to allow judgment to be entered up in England) be a sufficient warrant for diligence, but there are certain pecuniary obligations, of which it is the characteristic that summary or the more rapid kind of diligence can proceed on them if they are not in any way vitiated or imperfect. These documents are bills of exchange and promissory notes, and the facility of recovering the debts contained in such documents, by a rapid method of execution, is a marked feature in the mercantile code of Scotland, and one which is believed to have beneficial effects. Before diligence can issue, such a document must be protested and registered in the books of some competent court, and thence the diligence issues, as if it were founded on the decision of the court. The registers being accessible to the public on payment of certain fees, it is believed that this facility for tracing the initial steps of bankruptcy is made use of by members of the mercantile community of Scotland, who have a machinery by which they can inform each other of the persons whose names appear on the register.

Diligence is either against the person, by imprisonment, or against the estate, by attachment and sale. The latter class is divided into two kinds—that against the heritable or real estate [Adjudication, P. C. S.], and that against the moveable. This latter admits of a subdivision into an attachment of property in the debtor's possession, called in the ordinary case Poinding [Poinding, P.C.S.], but where it is by a landlord for rent, Sequestration; and an Attachment, in the hands of a person who is owing money to the debtor or holds property belonging to the debtor in his custody. [Arrestment, P. C. S.] Formerly diligence, in the greater number of cases, proceeded on the clumsy fiction that the debtor, being charged to pay in the king's name and refusing, was to be denounced a rebel by a messenger at arms, who certified that he performed the denunciation by three blasts of a trumpet, and it was nominally as a rebel that his person or estate was seized. A more simple and economical procedure has been substituted for this by 1 & 2 Vict. c. 114.

DILLENIUS. [Sherard, P. C.]

DILUVIAL FORMATION. The superficial deposits of gravel, clay, and sand (sometimes containing shells and bones of land mammalia), which lie far from their original sites on hills, and in other situations to which no forces of water now in action could transport them, are thus termed. The explanations proposed by geologists are various, and as yet unsatisfactorily demonstrated. Violent floods passing over the land; streams flowing formerly at levels and in lines now impossible; the littoral action of the sea during the time of the uplifting of the land; glacier movements; and the flotation of icebergs over the surface while yet it was covered by the ocean, have all been strongly proposed for adoption: but the phenomena are very complicated, and seem to require many partial solutions, involving change of level of sea and land as the fundamental condition. For a statement of many interesting facts on this subject, see Buckland, *Reliquiæ Diluvianæ;* Agassiz, *Etudes sur les Glaciers*; Murchison, *Silurian System*; Hopkins, in *Cambridge Phil. Trans.*

DIMEROCRINI'TES, a genus of Crinoidea, proposed by Phillips (*Sil. System*, t. 17) to include species of Crinoidea inarticulata of Miller, with the finger-joints in double rows. From the Wenlock limestone.

DIODON. [GYMNODONTES, P. C. S.]

DIONY'SIUS CATO. This is the name given to the author of a Latin work in four books entitled 'Dionysii Catonis Disticha de Moribus ad Filium.' But the real name of the author is unknown, and also the time when he lived. It is admitted, however, that he lived before the time of the Emperor Valentinian. These Disticha, which are in verse, are short moral precepts intended for the edification of youth.

There was a work by M. Cato (probably the younger Cato) entitled 'Carmen de Moribus,' from which Aulus Gellius (xi. 2.) has given several extracts; but it was not a poem, as some critics have falsely concluded from the word Carmen: for that word meant something expressed concisely, and did not necessarily imply any metrical arrangement of the words. The work of Cato seems mainly to have consisted of moral precepts, and the existence of such a work may have induced the writer or compiler of these Distichs to attach to it the name of Cato.

The style of these Distichs is simple, and the language generally pure. During the middle ages they were much used in the schools for the purposes of instruction, both on the continent of Europe and in England, and they have been used in some parts of England even to the present century.

The great number of editions shows the popularity which this little work once had. The earliest known edition is without date: a copy of it, apparently the only copy known to exist, is in the library of Earl Spencer. One of the latest and best editions is by Arntzenius, Utrecht, 8vo. 1735. There is a Greek translation of the Distichs by Maximus Planudes, which was published at Paris, 1543, 4to. Weigel. There are translations of the Distichs into many of the languages of Europe. Caxton published an English version of the Distichs, which was made from the French, 1483, folio. There are several English translations from the Latin, the latest of which perhaps is that of N. Bailey, 8vo. London, 1771.

(Bähr, *Geschichte Röm. Lit.*; Schweiger, *Handbuch der Classischen Bibliographie.*)

DIONY'SIUS OF CO'LOPHON, a celebrated Greek painter, who lived in the time of Pericles. His works were known to Aristotle, who, in speaking of imitation, says, that it must be superior, inferior, or equal to its model, which he exemplifies by the works of three painters. Polygnotus, he says, painted men better than they are, Pauson worse than they are, and Dionysius as they are. By which we may infer that Dionysius was a good portrait painter. His style was laboured, as we learn from Plutarch, who states that his works had both force and spirit, yet they appeared to be too much laboured.

Polygnotus and Dionysius were contemporaries, and, according to Aelian, painted similar subjects in a similar style, except that Dionysius painted in small, and Polygnotus in large. Aelian, in the passage alluded to, evidently refers to the styles of the two painters, and not their pictures; he says that Dionysius imitated in every respect, except in size, the art of Polygnotus. Nearly the same might be said of Garofolo with respect to his small works and the art of Raphael, without implying that Garofolo copied in small the pictures of Raphael, which is the interpretation given by Sillig and others to the words of Aelian, namely, that Dionysius copied in small the pictures of Polygnotus.

There was another painter of this name who lived in Rome about the time of the first Roman emperors. Pliny states that his works filled picture galleries; he was probably a portrait painter, and was the same Dionysius who was called, according to Pliny, the Anthropograph, because he painted nothing but men.

(Aristotle, *Poet.* c. 2; Plutarch, *Timol.* 36; Aelian, *Var. Hist.* iv. 3; Pliny, *Hist. Nat.* xxxv. 37, 40.)

DIOSCU'RIDES (Διοσκουρίδης), a very celebrated antient gem engraver who lived at Rome about the time of the Emperor Augustus. Augustus and later emperors were in the habit, according to Suetonius, of using a seal, representing Augustus's portrait, which was engraved by Dioscurides.

There are still several gems extant which bear the name of Dioscurides, but the genuineness of most of them has been questioned; a few of them however are beautifully finished, and are perhaps worthy of the reputation of the greatest gem engraver of antiquity, a reputation which Dioscurides had, according to Pliny.

A Dioscorides of Samos was a worker in mosaic; two of his works have been discovered in Pompeii.

(Suetonius, *Augustus*, 50; Pliny, *Hist. Nat.* xxxvii. 4; Bracci, *Commentaria de Antiquis Scalptoribus*, &c.; Winckelmann, *Geschichte der Kunst des Alterthums.*)

DIOSPYROS. [EBONY, P. C.]

DIO'TIS (double-eared, from δίς, double, and οὖς, ὠτός, an ear), a genus of plants belonging to the natural order Compositæ, the tribe Senecionidæ, and the section Anthemideæ. It has homogamous discoïdal heads; florets hermaphrodite, tubular, the tube compressed, with two auricles at the base; the receptacle convex with concave downy-topped scales; the involucre bell-shaped, imbricated; the fruit compressed, crowned with the persistent auricled tube of the corolla. *D. maritima* is the only British species. The whole plant is densely cottony and white; the stem is about a foot high, recumbent below, densely leafy and corymbose above; the leaves sessile, oblong, obtuse, flat, crenate, persistent; the heads in terminal corymbose tufts; the flowers are yellow. It is found on sandy sea-shores, but is a rare plant. Diotis is adopted by some botanists as the name of a genus of plants belonging to the Chenopodiaceæ, the *Axyris ceratoides* of Linnæus. It is a shrub of no great beauty, and is found wild in Siberia, and some parts of Austria. It thrives well in a light soil, and is easily increased by layers or cuttings under a hand-glass.

(Babington, *Manual*; Koch, *Flora Germanica.*)

DIPLACA'NTHUS, a genus of fossil Placoid fishes, from the old red-sandstone of Scotland. Agassiz admits four species. (*Reports of British Association for* 1842.)

DIPLEU'RA, a genus of Trilobites, proposed by Green.

DIPLOCTE'NIUM, a fossil genus of lamelliferous corals, allied to Turbinolia, from Maastricht.

DI'PLODUS, a genus of fossil Placoid fishes, from the coal formation and mountain limestone. (Agassiz.)

DIPLO'PTERUS, a genus of fossil Placoid fishes, from the old red-sandstone of Scotland, three species; and the coal shale of Leeds, one species. (Agassiz, in *Report to British Association*, 1842.)

DIPLOTAXIS (from διπλοῦς, double, and τάξις, an arrangement, on account of the double rows of seeds in each cell), a genus of plants belonging to the natural order Cruciferæ, and the tribe Brassiceæ. It has a compressed pod and subconvex valves with one straight nerve, and the seeds oval or oblong, in two rows. The species are herbaceous plants, natives of Europe and the temperate parts of Asia and Africa. There are two British species: *D. tenuifolia*, with a leafy branched glabrous stem, shrubby below; and *D. muralis*, with an herbaceous simple hispid stem. The former is a fetid plant with large yellow flowers, and grows on old walls, and is not an uncommon plant in England and Scotland; the latter is a rare plant.

(Babington, *Manual*; Loudon, *Encyclopædia.*)

DIPŒNUS AND SCYLLIS. [SCULPTURE, P.C., p. 126.]

DIPSACUS. [DIPSACEÆ, P. C.; TEAZLE, P. C.]

DI'PTERUS, a genus of fossil fishes, from the old red-sandstone of Caithness and Herefordshire. (Valenciennes and Pentland, *Geol. Trans.*, 2nd series, vol. iii.)

DIRCA, a genus of plants belonging to the natural order Thymeleaceæ. It has a campanulate calyx, with an obsolete unequal limb; 8 capillary projecting filaments inserted into the middle of the tube, alternately longer; the style incurved at the apex. This is an American genus, with a single species, the *D. palustris*. It is remarkable for growing in watery places, and is called *Bois de Plomb* by the French. It is found in the low woods of North America, bearing the severest cold and the greatest heat of the various parts of the United States. It is an irregular shrub, with a tendency to a horizontal direction in its branches. The flowers are yellow, and appear before the leaves, and when young they are enclosed within a small hairy bud, occupying a sheath or cavity in the end of each flowering branch. The fruit is a small, oval, acute, red, 1-seeded berry. This plant is in all its parts very tough, and the twigs are used for making rods, the bark for ropes, baskets, &c. The bark is acrid, and in doses of 6 or 8 grains it produces heat in the stomach, and brings on vomiting. It also acts as a vesicatory when applied to the skin, and in small doses as a cathartic. The fruit possesses narcotic properties, and produces effects upon the system similar to those of Stramonium. Snails are observed to be very fond of this plant, when it is cultivated. In its cultivation, layers require two years before they produce roots. It cannot be propagated in this country either by cuttings or seeds.

(Loudon, *Encyclopædia;* Lindley, *Flora Medica.*)

DISA'STER, a subdivision of Echinodermata, including Spatangus ovalis of Phillips. From the oolite. (Agassiz.)

DISCO'BOLI, the third family of the Malacopterygious osseous fishes in the arrangement of Cuvier. The distinguishing character is the presence, on the under surface of the body, of a disk composed of the united ventral fins. The fishes of this family are popularly known as sucking-fishes. The most common and most remarkable species inhabiting the British seas is the Lump-sucker, *Cyclopterus Lumpus*. It is a large-bodied small-finned fish, bearing on its back an elevated crest or ridge, and having a powerful sucker under its throat formed of the combined pectorals and ventrals. Before the spawning season it is of a brilliant crimson colour mingled with orange, purple, and blue, but afterwards changes to a dull blue or lead colour. When full grown it is rough with tubercles, but when very young is smooth and beautiful, marked with brilliant stripes of various hues. In the seas of the Orkneys, in June, numbers of the young fish, half an inch in length, are seen swimming around floating seaweeds. For a long time they were supposed to belong not only to a different species, but even to a different genus. In the old fish the sucker is so powerful that a pail of water, containing some gallons, has been lifted up by a person holding the tail of a *Cyclopterus* adhering to the bottom. It lives on young fish. It is brought to market, but oftener as a curiosity than as an article of food. The *Cyclopterus Lumpus* ranges from the shores of Greenland to those of the south of England, and westward as far as the coast of North America. Another genus of this family is *Lepadogaster*, consisting of a number of small fishes which have two disks on the under surface of their bodies, the one formed by the pectoral fins and the other by the ventrals. They adhere to stones, rocks, and shells by these disks. They have wedge-shaped defenceless bodies, smooth and without scales, often painted with the most brilliant and defined colours. The Sea-snail, or *Liparis*, is a third genus of this family, the species of which resemble gobies in form. They are found under stones at low-water mark, and are not so brilliantly coloured as others of the tribe. They are furnished with a single sucker formed by the united ventrals and pectorals.

DISCOI'DEA, a genus of Echinodermata, in which are ranked, by Gray and Agassiz, several species generally referred to in works on organic remains under the title of Galerites. They belong to the chalk, greensand, and oolite.

DISCOVERY. [INVENTION AND DISCOVERY, P. C. S.]

DISPART. This word is defined under DISPART, P. C., and it is intended here merely to observe that the Dispart subtends, at the base of the gun, an angle equal to that which, in a vertical plane passing through the axis of the bore, would be contained between that axis and a line (called the *line of metal*) drawn from the circumference of the base to that of the muzzle. In a 24-pounder gun, nine feet long, for example, the dispart is equal to 2·735 inches, and the angle subtended by it is equal to 27′ nearly; allowance must consequently be made for this value in pointing the gun by the line of metal.

In order to place the axis of the bore at any angle with a horizontal plane, a 'tangent scale' is employed [ORDNANCE, P. C.]; and in determining the graduations of this scale, it is manifest that the length of the part raised out of the groove in the base of the gun should (the length of the gun being considered as the radius) be equal to the tangent of the difference between the number of degrees in the proposed angle of elevation and the angle subtended by the dispart; in order that, on lowering the base of the gun till a line joining the top of the scale and the top of the muzzle is parallel to the horizon (which may be determined by a spirit-level on a rod laid from one of those points to the other), the axis of the bore may be correctly elevated. Thus, in the gun above mentioned, for an elevation of one degree, the scale being raised up till the division marked 1° coincides with the top of the base ring, the part raised should be equal to the tangent of 33′ only; for an elevation of two degrees, the part raised should be equal to the tangent of 1° 33′; and so on.

DISPOSITION, in the law of Scotland, is the name given to any unilateral writing, or, as it might be termed in England, deed poll, by which a party solemnly makes over to another a piece of property heritable (viz. real) or moveable. It is but seldom used as a title to moveables alone, and it is in the law of real property that it is of most frequent use and of highest importance. When a new feu or fief is created, it is by charter, but when a fief is transferred from one holder to another it is by Disposition, and notwithstanding the system of subinfeudation in Scotland, the latter is by far the more ordinary transaction. In the disposition, the character of the tenure, and all the conditions on which the property is to change hands, are set forth, and being given to the disponee, it is in his hands a personal obligation by the disponer to give him a full title, and contains the warrants for getting the title made real by infeftment and registration, and by obtaining the superior's sanction to the new investiture. The disposition is not only used for the absolute transference of heritable property, but also for the creation of real securities. The ordinary heritable bond was found insufficient to give the security-holder a prompt and effectual means of realising his debt by taking possession of the subject of the security, and thus there was added to it a disposition or conveyance of the subject, under reversion to the debtor, or with a right of remainder to him on his paying the debt. As heritable property cannot be bequeathed by testament in Scotland [WILL, P. C.], the usual form of family settlements in which such property is disposed of is the disposition.

DISSEN, GEORG LUDOLF, an eminent German scholar, was born on the 17th of December, 1784, at Grossen-Schneen, near Göttingen, where his father was pastor. He lost both his parents at the age of thirteen, and Dissen, with his two brothers, was left almost without the means of subsistence; but a benevolent friend procured for him admission, free of expense, to the celebrated school at Pforta in Saxony, whither the boy was sent in his fourteenth year. He there laid an excellent foundation for his future philological studies; and, notwithstanding his delicate and weakly appearance, he enjoyed excellent health, and displayed the greatest activity. In 1804 he left Pforta and went to the university of Göttingen, where until the year 1808 he devoted himself to the study of philology and philosophy under Heyne and Herbart. His former friend continued to support him in the university; but he was obliged to increase his means by private tuition and reading with such students as had come to the university without being sufficiently prepared. The study of art and poetry, and of the beautiful in general, was his delight, and gave to his mind that tone and tendency which we can trace in all his literary productions. Towards the end of his academical course, in 1808, he spent some time at Dresden with his friends and pupils, and the famous picture gallery of that place made an impression on his mind which was never effaced. On his return to Göttingen he obtained the degree of Doctor in Philosophy, together with permission to deliver lectures in the university. On that occasion he published his first work, a dissertation—'De Temporibus et Modis Verbi Graeci,' Göttingen, 1809, 4to. The principal subjects with which he now occupied himself, and on which he lectured, were Greek grammar and Greek philosophy, especially Plato, the study of whose writings brought about an intimate friendship between him and Boeckh, who then used to visit Göttingen very often. His natural tendency to assemble around him young men of talent and congenial pursuits induced him, towards the end of 1811, to form a Philological Society at Göttingen, of which he was elected president. In 1812 he accepted the offer of an extraordinary professorship of Classical Philology in the University of Marburg. He entered upon his new office with an inaugural dissertation—'De Philosophia Morali in Xenophontis de Socrate Commentariis tradita,' Marburg, 1812. Philological studies were at that time rather neglected at Marburg, but Dissen gave a fresh impulse to them, although he did not remain there more than eighteen months; for in the autumn of 1813 he accepted an invitation as extraordinary professor of Classical Literature in the University of Göttingen, which was always his favourite place, and where in 1817 he was appointed ordinary professor. In his new position he acted in perfect harmony with his philological colleagues Mitscherlich and Wunderlich; and on the death of the latter, in 1816, when F. G. Welcker was appointed his successor, Dissen formed a most intimate friendship with him, which was not disturbed by the removal of Welcker to Bonn in 1819, and lasted till Dissen's death. K. O. Müller, who succeeded Welcker, became equally attached to Dissen. Incessant study and a secluded life had already impaired the health of Dissen, but his activity as a lecturer was still very great. His lecture-room was always filled, and he succeeded in inspiring his audience with an ardent love of the study of antiquity. The zeal with which he devoted himself to his professional duties and the cultivation of his own mind prevented his doing much as an author; and all that was published by him during the period from 1815 to 1825 consists of the part he took in Boeckh's great edition of Pindar, and some reviews which he wrote for the 'Göttinger Gelehrten Anzeigen.' In regard to antient writers, and poets in particular, Dissen directed his attention more particularly to analyzing the connection of the ideas, a point which had been much neglected by previous commentators. With a view to supply this want he prepared a new edition of Pindar, which appeared in 1830, in 2 vols. 8vo.; and of which a second edition, with some improvements, was published by Schneidewin in 1843. In this work Dissen propounded his aesthetical views respecting the artistic construction of the Pindaric odes. The manner in which he has executed his task clearly shows that Dissen was not only no poet, but that he had little conception of the manner in which a poet sets to work. He displays great analytical powers, but they would have been more properly applied to the works of a philosopher than to those of a poet. But his edition of Pindar is nevertheless one of the best that we have.

Dissen's illness was of an asthmatic nature, and about this time had become so much worse, that he was obliged to give up lecturing; but in proportion as his professional occupations decreased, his literary activity increased. Thus he produced in 1835 an edition of Tibullus, with valuable dissertations and a commentary, and in 1837 an edition of Demosthenes's oration 'De Corona.' The great object of these two publications is the same as that of his Pindar, to establish a mode of interpreting the antients which should not merely explain the language and subject matter of a writer, but the artistic construction of his work, and should thus, as it were, trace the secret processes in the author's own mind. This mode of treating an antient author may be very interesting and instructive, but it opens a wide field of speculation, and the results are seldom satisfactory. Immediately after the appearance of his Pindar, Dissen was severely criticised, and among others by his friend Boeckh, which greatly irritated him. His edition of Tibullus is perhaps his best and most satisfactory production; it should not be used without Dissen's 'Supplementum editionis Albii Tibulli Heynio-Wunderlichianae,' which he published in 1819. His edition of the oration of Demosthenes contains many valuable remarks on the style and peculiarities of that orator: it was his last production, and appeared only a few days before his death, which took place about the middle of September, 1837. The last few years of his life were a slow process of dying: he died almost imperceptibly, as if he had gone to sleep.

Dissen was never married; but he supported with paternal care several young men of talent whose fathers had been his friends during their lifetime. He was a man of great sensibility, enthusiastic for everything great and noble, and capable of the most devoted friendship, though in his social intercourse he seldom conversed on any other topics than those relating to the study of antiquity, for his whole mental faculties were absorbed in his pursuits. Besides the works already mentioned, we must not leave unnoticed an excellent little treatise entitled 'Anleitung für Erzieher, die Odyssee mit Knaben zu lesen,' with a preface by the philosopher Herbart, Göttingen, 1809, 8vo. A number of smaller dissertations in Latin and German, together with a selection of the reviews written by Dissen, was published as a collection after his death by his friend K. O. Müller, under the title of 'Kleine Lateinische und Deutsche Schriften, von Ludolf Dissen,' Göttingen, 1839, 8vo. It is preceded by biographical notices written by his friends Fr. Thiersch, F. G. Welcker, and K. O. Müller, from which the above notice is derived.

DISTRIBUTION OF ELECTRICITY. By this is signified the densities of the electric fluid in different bodies placed so as to act electrically upon one another, or in different parts of the same body when the latter has been subject to the electrical influence of another body.

When a body possesses equal quantities of the opposite kinds of electricity, the fluid may be conceived to be uniformly diffused through it; and two such bodies being placed in contact, will produce no effect on each other, because the attractions existing between the particles of the unlike fluids are counteracted by the equal repulsions between the particles of the like fluids. But if a body acquire by any means an excess of either the positive or negative fluid, a mutual action will take place between this body and any other in its vicinity, the fluids in the latter being previously in equilibrio or not.

It was early found that two electrified spheres, equal in magnitude, but of which one was solid and the other a thin shell, acquired precisely equal quantities of the electric fluid; and hence it was inferred that such acquired fluid existed only upon or near the surface of an electrified body. The experiments also of Franklin on a charged Leyden jar with interior and exterior coatings, which could be removed and replaced at pleasure; and those of Coulomb, in which, by a proper apparatus, electricity was drawn from the surface of a charged body when none could be obtained from the bottoms or sides of holes sunk in it to certain depths, sufficiently prove that the electric fluid exists in a stratum on the surface or rather within the body at an infinitely small distance from the surface.

If a sphere have uniformly diffused over its surface a charge of either kind of electricity, and there be placed in contact with it a sphere of equal magnitude in which the electric fluids are in equilibrio, a mutual action between the spheres will take place; the effect of which will be that the fluid particles of opposite kinds in both spheres will have their equilibrium disturbed, and equal quantities of both kinds will flow to the surface of each: the density of the fluid or the thickness of the stratum at either surface being different in the circumferences of circles at different distances from the point of contact.

The investigation, by mathematical analysis, of the laws of the distribution of electricity being too extensive for this place, it must suffice to state the results of some of the experiments made by Coulomb on that subject.

When a sphere, charged as above supposed, is placed in contact with another in which the fluids are in equilibrio, whatever be the ratio between the diameters of the spheres, the density or the thickness of the stratum of fluid on each is, at the point of contact, equal to zero; and, at the opposite extremity of the diameter passing through that point, the density is the greatest. Representing the density opposite to the point of contact by unity, the results of the experiments with two equal spheres show that, in an indefinitely narrow zone at thirty degrees from the point of contact on each, the density may be represented by 0·2; at sixty degrees from that point, by 0·76; and at ninety degrees, by 0·95: it is found also that the mean density on each sphere is represented by 0·79.

When two spheres, in the circumstances just mentioned, but having the diameter of one double the diameter of the other, are placed in contact, the experiments of Coulomb show that, on the smaller sphere, the density opposite to the point of contact is, to the density at ninety degrees from that point, as 1 to 0·75; and at sixty degrees, as 1 to 0·44: they also show that, at ninety degrees from the point of contact, the density on the smaller sphere is to the density on the larger as 1 to 0·8; and that the greatest density on the smaller sphere is to the mean density on the greater as 1 to 0·64. When the diameters of the spheres were to one another as 4 to 1, it was found that the greatest density on the smaller sphere was to the mean density on the greater as 1 to 0·43.

If two spheres which have been placed in contact are subsequently removed beyond each other's influence, the density of the fluid at the surface of each becomes uniform; but on the larger sphere the density is always greater than on the smaller sphere. From Coulomb's experiments it is found that when the diameters of the spheres are as 2 to 1 the densities are as 1·08 to 1; and when the radii are as 4 to 1 the densities are as 1·3 to 1. That philosopher infers also from his experiments, that in no case can the ratio of the densities on two unequal spheres be greater than that of 2 to 1.

When an electrified globe and a circular disk were placed in contact, Coulomb found that the quantities of fluid on them were directly proportional to their entire surfaces. The distribution of electricity on the surface of a spheriod is noticed under ELECTRICITY, P. C., p. 336.

(See Biot's *Traité de Physique*, and ATTRACTION, ELECTRICAL, P. C. S.)

DITHYROCA'RIS, a fossil genus of Crustaceans, so named by Dr. Scouler. It occurs in Tyrone and Derry. D. Colei and D. orbicularis are described in Portlock's Geological Report on those counties.

DIVIDED EYE-GLASS MICROMETER. An instrument of this kind, which was invented by Mr. Ramsden, and by him called a Dioptric micrometer, is described in the 'Philosophical Transactions' for 1779. It consisted of a convex lens bisected in the direction of a diameter, and placed in the eye-piece of an achromatic telescope, between the third and fourth lenses, reckoning from the end to which the eye is applied. The half lenses were fixed in separate portions of a frame, and, on turning a screw, they could be moved in contrary directions on the plane of section, thus causing a separation of the two images of an object: one of the portions of the frame carried two indices with verniers, and the extent of the movement could be read on a scale of equal divisions graduated on the other portion: thus any small angle, such as that which might be subtended by the diameter of a planet, could, by placing the images of the disk in contact with each other, be measured on opposite sides of the zero of the scale. The whole apparatus had a movement about the axis of the telescope; and thus it might be used as a position micrometer.

It is uncertain whether or not Ramsden executed such an instrument, but one exactly similar to it was made by Mr. Dollond.

An improved micrometer of a like kind is made by Mr. Jones, who divides the third eye-glass of a telescope into equal segments, and causes them to move on the plane of section by means of a screw consisting of two parts, one of which being hollow, and having both exterior and interior threads, the other part turns within it: thus the half lenses move by equal quantities in opposite directions at the same time. The stem of the screw carries a graduated circle, on which, by an index, the movement of the two images of the object is measured.

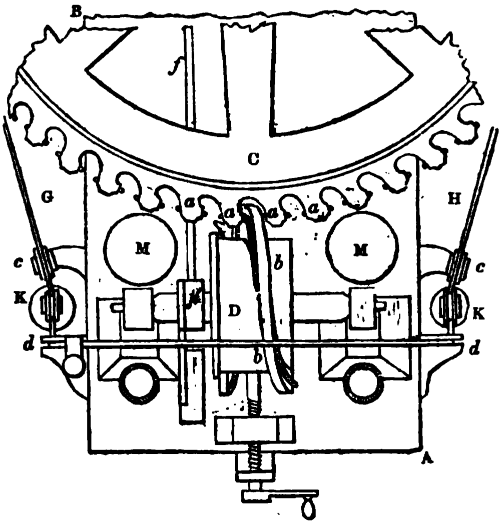
An instrument, which may be considered as a divided eye-glass micrometer, and which is usually called a 'dynameter,' was constructed by Ramsden for the purpose of determining the magnifying power of a telescope by measuring the diameter of the pencil of light at the eye-glass, in order to compare it with the diameter of the object glass. The instrument, which has subsequently been improved by Mr. Dollond, may be used also as a micrometer for measuring any small angular distances. The divided lens is that which is nearest to the eye, and the semi-lenses may have equal quantities of motion in contrary directions communicated to them by means of a double screw on the same stem; the threads on one part of the screw have their distances from one another double the distance of the threads on the other part. On the screw is a graduated circle, by which, on bringing in contact the two images of the pencil of light, the diameter of the latter is measured. (Pearson's *Practical Astronomy*, vol. ii. sec. 11 and 33.)

Mr. Airy, the astronomer royal, has very recently communicated to the Astronomical Society a paper containing investigations of the distances and focal lengths of the eye-lenses of a telescope under the condition that (the third lens from the eye being that which is divided) the prismatic dispersion of light arising from the pencil falling on the segments at parts where their surfaces are inclined to the optical axis may be corrected at the same time that the ordinary achromatism is obtained. This discovery will greatly improve that species of micrometer, particularly since the focal length of the fourth glass, or that which is nearest to the eye, is arbitrary; and consequently the magnifying power of the telescope may be varied by merely changing that eye-glass, the achromatism remaining undisturbed.

DIVIDING ENGINE. Under the word GRADUATION, P. C., is a brief notice of the machine constructed by Ramsden for the purpose of graduating sextants and circles for nautical or astronomical purposes; and it is intended here merely to describe the principal improvement which has since been made in that kind of machine.

In Ramsden's engine the circle carrying the instrument to be graduated was made to turn round by means of a perpetual screw, the teeth of which worked in corresponding notches cut in the edge of the circle: the screw was caused to turn on its axis by a cat-gut band passing several times round a cylinder on the same axis, and made fast below to a treadle which was pressed down by the foot, and allowed to rise, when the foot was removed, by the unbending of a spring connected with the cylinder. In the machine now to be described, which was the invention of Mr. Alexander Ross, and of which an account is given in the 'Transactions of the Society of Arts,' for 1831, the circle has a more steady motion, and it possesses the means of being adjusted, so that the inequalities produced by the wear of the parts may be obviated.

A rectangular cast iron frame, of which AB is a part, carries the circle C, which turns on a vertical axis at its centre; this axis is in the form of two frustums of cones, and its lower extremity rests in a cup which is at one end of a lever; at the other end is applied a counterpoise which, causing a pressure upwards on the axis, diminishes the pressure of the circle on the frame which supports it. Round the circumference of the circle are forty-eight projections *a*, *a*, *a*, &c.; and at one end A of the rectangular frame, a sliding apparatus carries a cylinder D, which turns on a horizontal axis, and has on its convex surface a spiral projection *bb* like a rectangular thread of a screw; this enters between the projections *a*, *a*, &c., and the distance between the two turns of the spiral is rather greater than the breadth of one of those projections.



On the rim of the circle C, and under the projections *a a*, &c., is a groove in which enters an endless cat-gut band GH; on each side of the frame, at the end A of the latter, this band passes over a fixed pulley *c* and under a moveable pulley from which is suspended a weight K: it then passes through a notch at *d*, and above the frame, in the direction *dd*.

Four pillars, of which MM are two, rising from the rectangular frame AB, support a stage which carries the tool for cutting the divisions on the instrument to be graduated. the apparatus by which the cutting-tool is connected with the stage is formed with joints so as to allow the tool to be moved up or down, or in the direction of a radius of the circle C, but neither to the right nor left of that radius; and there is a contrivance for determining the length of the lines of division.

By moving one end of a lever at the opposite extremity of the frame AB, a bar, *ff′*, which is attached at one end to that lever, gives motion to a catch, or click, so as to cause a ratchet-wheel to turn on its axis, and thus give the requisite movement to the cutting tool: the other extremity, *f′*, of the bar, by turning a lever on a horizontal axle containing within it the axle of the cylinder D, allows a catch, or click, to turn a ratchet-wheel on the latter axle, and, with it, the cylinder itself; and thus a side of the spiral projection *b b* is removed a little way from its position when in contact with one side of a projection *a*. Moving then the first-mentioned lever back again, a spring, which had previously pressed against the cat-gut band on the circumference of C, is drawn off; and thus one of the weights, K, by drawing down the band and pulley above it, gives a small movement to the circle C, and consequently brings the side of a projection *a* again in contact with the side of the spiral. According to the place at which the bar *ff′* is applied to the lever on the axle of D, the catch may pass over any required number of the teeth of the ratchet-wheel; and thus the circle C may be turned through any angle consistently with the values of the divisions intended to be cut.

Through each of the projections *a*, *a*, &c., passes a steel screw, whose ends appear in the above cut; and through the spiral thread *b b* pass a number of steel screws, whose ends also appear. The right hand extremity (in the diagram) of each of the former screws is ground quite flat and perpendicular to the length of the screw; while the left hand extremities of the screws in *b b* are turned in the form of hemispheres; and, after every movement of the circle C and of the spiral *b b*, the machine is held in a state of rest by the abutment of the hemispherical end of one screw against the flat end of the other.

The original divisions on the circle C are made on silver studs let into its surface; and the screws passing through *a*, *a*, &c., are so adjusted, by means of their capstan heads, that if he end of a screw in *b b* is in contact with the screw in any one of the projections *a*, one complete revolution of the spiral *bb* may bring the end of the screw in the next projection *a* in contact with the same screw in the spiral. The corresponding movement in the circle is equivalent to the interval between two of the original graduations; and the movement is verified by the primitive divisions coming successively to a wire in a microscope.

DIVISION OF EMPLOYMENTS, in political economy, is an important agent in increasing the productiveness of labour. It is by labour alone that wealth is produced. It is a law of man's nature that 'by the sweat of his face he shall eat bread;' and in return for his labour he acquires various sources of enjoyment. The ingenuity with which he has been endowed, and the hard necessities of his condition, lead him to discover the most effective means of applying his labour to whatever objects he may be seeking to attain. He desires, first, to work no more than is necessary, and, secondly, to obtain the largest return—the most abundant enjoyment, for his industry. He soon finds that his own unaided labour will scarcely provide for him the barest necessaries, and that ease or enjoyment is unattainable. Thus, instead of each man labouring separately, and independently of all others, many men combine together for securing the various objects of life, by means of their joint labour; and this combination of labour leads to division of employments. Labour is naturally exerted in these two forms in the very earliest stages of society. The first pair whom God's ordinances and their own instinct united, must have combined for the support of themselves and their common family, and diversity of sex alone must have produced distinct employments. Among savages the man engages in the chace, for which he has a natural predilection, and for which his strength adapts him, while his mate rears their children and executes those functions which are suited to her sex, but which are as conducive to the comfort of both as if both performed them. In this manner a division of employments naturally arises, and each family affords an example of its origin and character.

This combination for a common object, succeeded by a division of employments, pervades every process of human industry, and increases in variety and complexity with the growth of civilization. One of the earliest forms of industry is that of fishing, and none, perhaps, exemplifies more aptly the mode in which labour is necessarily applied to the purposes of life. A man desirous of building a fishing-boat may cut down a tree, without any assistance from others, and may even hew it into shape; but if it be larger than a mere canoe he cannot, by his own strength, remove it from the spot on which the tree had fallen, and launch it upon the sea. To effect this, others must combine their strength with his. To manage a boat the labour of more than one man is ordinarily required, and the larger the boat the greater must be the number who combine to navigate it. If they paddle or row it, their labour is simply combined for one purpose and in one manner, except that one, instead of rowing, may probably steer the boat. As the art of navigation improves and its objects become multiplied, in addition to a more extensive combination of men in pursuit of the same objects, a diversity of employments ensues. In a deep-sea fishery, some attend to the nets, others to the sails; and on their return to land, some arrange the nets to dry and repair them, while others are engaged in disposing of the fish.

From these illustrations it is evident that the cause of a division of employments is to be sought in the nature and circumstances of man. It is not the result of extraordinary foresight, but is suggested by the most common exigencies of life: its convenience is obvious, but the feeling which prompts men to adopt it is spontaneous and as it were intuitive. It is a social necessity, and the very foundation of any social system whatever, yet it is practised almost unconsciously by the greater part of mankind. Its existence, however, lies so open to observation that it is scarcely to be ranked as a discovery of political economy; but that science, having noted the facts of a combination of labour and a division of employments, explains their uses and results; and in pursuing these inquiries it develops some of the most important principles connected with the production and distribution of wealth. To these inquiries we must now devote our attention.

As labour is the lot of man, it is desirable that his labour should be as productive as possible, in order that the sum of his enjoyments should exceed that of his endurance. This result is attained by several men combining their labour for one object, and pursuing different employments for their reciprocal benefit, instead of each man labouring independently for himself and employing himself in the same manner as all other men. A division of employments, therefore, is not only a natural incident of labour, but is an important auxiliary of human enjoyment. The means by which it adds to the efficacy of labour are described by Adam Smith to be—1st, an 'increase of dexterity in every particular workman;' 2ndly, 'the saving of the time which is commonly lost in passing from one species of work to another;' and, 3rdly, 'the invention of a great number of machines which facilitate and abridge labour, and enable one man to do the work of many:' to which may be added, 4thly, the separation which it causes between labour and the direction of labour; 5thly, the power which it gives of using machinery effectually, when invented; 6thly, the opportunities of exchange which it affords, and the means of availing ourselves of the enjoyments arising from the natural capabilities of the soil, climate, situation, or mineral productions of different parts of the world, and of the peculiar aptitude of their inhabitants for various kinds of industry.

1. The superior dexterity of workmen engaged exclusively in one occupation is universally known. 'Use is second nature,' and when a man has been long accustomed to a particular employment, not only has he acquired great dexterity, but his mind appears to be endowed with faculties specially adapted to his business. The jockey seems to have been born for the saddle; the sailor for the ship: both are active, intelligent, dexterous; but fancy their occupations exchanged or combined! the sailor in the saddle, the jockey at the helm; or both alternately riding the favourite horse at Newmarket and furling the top-gallants of a three-decker at Spithead! The constant exercise of the faculties in any art or business gives them an aptitude for it, which to others is a matter of astonishment. The eye and the hand perform their offices with such precision and rapidity, that their work seems spontaneous, as it were, and independent of the will of the workman. Without deliberation, almost without care, the business is done; and done better than others could do it with the greatest pains. All processes of art and manufacture, and the daily experience of all men, confirm this statement as an unquestionable fact. (Babbage, *Economy of Machinery and Manufactures*.) The advantages of peculiar skill are that men can work better and faster, that the products of their labour are more valuable and more abundant, and that their contributions to the general stock of the world's enjoyments are multiplied. By following out these advantages through all their relations, they will be found to be the primary source of wealth; and, in a moral point of view, the main cause of social progress and of the development of the highest faculties of man.

2. 'The saving of time which is commonly lost in passing from one species of work to another' enables a man who is constantly engaged in one process to perform more work than he would have been able to get through in the course of a day, if he had been required to change his employment. For this reason, as well as on account of his skill, a division of employments makes his labour more productive.

3. The invention of tools and machinery is the most effective auxiliary of labour, and it is necessarily promoted by a division of employments. Those who are constantly attending to one business or description of labour must become best acquainted with its requirements—their observation and experience are concentrated upon it—their interest urges them to facilitate their own exertions. How many inventions are due to workmen employed in manual labour the history of the steam-engine and of the cotton manufacture will furnish examples: but it is not in the case of workmen alone that division of employments facilitates invention. Their employers also have their whole minds bent upon improving their business; and amidst the multiplication of trades arise engineers and machinists, whose sole business it is to construct, improve, and invent machinery, aided by all the lights of theoretical science. And this leads us to the fourth advantage of a division of employments.

4. If all men were doing the same thing, and working for themselves unaided by others, their condition would never be improved; but by following particular occupations those who exert most skill and industry produce more than they require for their own subsistence, and reserve a fund for the employment of others. [CAPITAL, P. C. S.] And thus there grows up from the midst of the people a class of employers who direct the labour of others. Until labour is so directed and maintained by the previous accumulation of capital, it is comparatively ineffectual; and while a division of employments is a power-

ful agent in producing capital, the latter, in its turn, facilitates a further subdivision. Without it, indeed, a system of division can only be carried out imperfectly and to a very small extent. The growth of capital also gives to many men the glorious privilege of leisure, exempts them from the necessity of labour, and leaves them free to study, to reflect, to observe, to reason and investigate. From this class arise men of science and of letters—philosophers, statesmen, historians, poets. And even with these the apportionment of a peculiar province gives power to their minds, and expands their knowledge. Their natural talents are developed, and their aptitude for particular pursuits becomes as conspicuous in intellectual industry as that of other men in manual operations.

5. Adam Smith speaks of the importance of a division of employments as leading to the invention of machinery, but passes over its utility in using machinery effectually, when invented. Every part of a large machine requires workmen whose sole business it is to work in unison with its peculiar movement. So distinct are these various processes—so diverse their character—that in all large manufactures there is an extensive vocabulary of names by which operatives working in the very same factory are distinguished.* Without such a subdivision of peculiar employments the most ingenious machinery would be useless: and thus while machinery multiplies distinct operations of labour, these are, in their turn, essential to its efficacy.

6. Adam Smith assigns the origin of a division of employments to the 'trucking disposition' of mankind—to their 'propensity to truck, barter, and exchange one thing for another' (b. i. c. ii.). This love of barter however is only a secondary cause: men have no natural taste for it; but use it as a means of obtaining the various objects which they desire. If they could obtain them without the trouble of barter, they would unquestionably not follow barter as an amusement, any more than they would work if they could get what they wanted without labour. So far, then, from the trucking disposition of men being the cause of a division of employments, it would appear that a division of employments is rather the proximate cause of commerce. For if all men worked in the same manner and produced the same things, there would be nothing to exchange: but as soon as men learn to devote themselves to the production of one commodity, the whole of which they cannot consume, they must exchange the produce of their labour with others, who have been producing objects which they desire to possess. This is an intelligible origin of barter and commerce—consistent with the natural propensities of mankind, and not requiring for its support the strained hypothesis that men have an innate disposition to truck. But a division of employments, like barter, is itself but a secondary cause; and both alike must ultimately be referred to the one original cause of all forms of industry—the desire of mankind to possess various enjoyments which are only to be gained by labour.

This would appear to be the natural course of social progress. First, a man applies himself to a particular business because he has facilities for following it. One man lives by the sea and is a fisherman; another lives near the forest and hunts game. Each could obtain more of this particular food than he requires for his own use, and may desire some little variety. Under these circumstances it is very natural that they should effect exchanges with each other—not for the mere love of barter—but for the love of food. But such an exchange could not be made between two men who both lived by fishing—nor between two others who both lived by hunting; for under such circumstances neither party would have anything to offer but that of which the other already had enough. It is perfectly true that without barter no extensive division of employments can exist; but it is clear that barter is the immediate effect rather than the cause of such division. Of the influence of commerce upon the division of employments we shall have to speak presently; but in this place it is sufficient to show that the production of different commodities beyond the immediate wants of those who produce them enables men to barter, by giving them something to offer in exchange; and that afterwards the advantages derived from barter are an encouragement to further production of the same kind.

When this state of things has been once established, men avail themselves of all the natural advantages of their several positions, and apply themselves to the production of those commodities for which they have peculiar facilities. In one country minerals can be drawn from the bowels of the earth in unlimited abundance; in another the fruits of the earth teem upon its surface—fostered by a genial climate and a fertile soil. The inhabitants of these countries naturally seek to develop the resources of the earth which are within their reach. They labour effectively and produce abundance of their particular commodities, which they give in exchange for other things which they cannot produce themselves, but which they desire to enjoy: and thus a division of employments, by the aid of an extended commerce, distributes over the whole world the advantages of soil, climate, situation, and mineral productions, obtained by the experience and skill of men who have adapted their talents to the circumstances of each country.

Having thus hastily enumerated the several ways in which a division of employments adds to the efficacy of human labour, and increases the enjoyments of men, let us inquire in what manner it is restrained and limited. It may be collected from several of the preceding remarks, that the power of distributing men into particular employments must be limited by the extent of the market in which the produce of their labour may be exchanged. When there are no means of exchanging, men must provide everything for themselves that they require; and there is no further division of employments than that which necessarily takes place in families, and in the most simple forms of industry. So in every degree in which the situation and circumstances of men give facilities of exchange, do particular employments become assigned to individuals. A village draper sells all kinds of drapery, together with hats, shoes, coats, smock-frocks; nay, in some villages there is but one shop, in which nearly every kind of trade is carried on. In a populous city, on the other hand, trades are almost indefinitely subdivided. And why is this? Solely because of the extent of the market. In the one case, if a man sold nothing but hats, he could not gain a livelihood, and therefore he sells coats, smock-frocks, shoes, and all kinds of drapery—everything, in fact, which the people round about him are likely to buy. In the other case, there is so large a demand for hats, that a man can gain a better livelihood by the exclusive sale of them, than by a heterogeneous trade like that of the village shopkeeper.

But while, by means of exchange, employments are thus subdivided, the labour of many men is most efficiently combined in producing particular results. The combinations of industry for one object are often truly wonderful, while the employments of those who are really co-operating with one another are so distinct, that they are wholly unconscious of any combination at all; nor is their combination at once perceptible to others. If you ask a man 'who made his coat?'—he will naturally answer 'his tailor.' But ask him to enumerate the persons who had contributed to its production, and he will pause long before he attempts any answer, however incomplete. He will be reminded of the grazier, the shepherd, the wool-salesman, the various workmen in the cloth factory—the button-makers, the manufacturers of silk, and thread, and needles: but still the catalogue will be imperfect. In producing the raw materials, and in conveying, selling, and manufacturing them, the diversity of occupations is extraordinarily great. Each man attends to his own business, and scarcely thinks of its relations to the business of other people; and yet all are co-operating in the most effectual manner, for the most perfect and economical manufacture of this finished work of varied art.

The general operation of the principles of a combination of labour and division of employments has now been sufficiently explained so far as it relates to the efficiency of human industry. Of its effects upon the distribution of wealth (another important branch of political economy) no more need be said, than that by multiplying the modes in which industry is made productive, it is the main cause of the various grades of society which exist in all civilized countries. The different employments of men determine their social position as labourers or employers of labour; and the wealth arising from the effective employment of labour is distributed, through the several classes, as rent, profits, and wages.

It has been urged as an objection to an extended division of employments, that it unfits men for any change of business which altered circumstances may require; and that, on that account, great misery is caused when the demand for any particular kind of labour is reduced. Of this position the hand-loom weavers of England and Scotland are a familiar example, who are said to have been thrown out of employment by the extension of machinery. That they have been reduced to great distress is certain; but in their employment there was nothing to unfit them from engaging in power-loom weaving. On the contrary, the transition from one employment to the other would have been perfectly natural; but they preferred their independent life to the discipline of a factory, and for that and other reasons persisted in continuing in their old trade. In the mean time thousands of agricultural labourers and their families, whose occupations had been totally dissimilar, flocked into the manufacturing districts, and readily learned their new business. This example, therefore, instead of sustaining the objection, proves that a division of employments does not disable men, so much as might be expected, from transferring their labour to other departments of industry whenever a sufficient inducement attracts them. But any interruption or change in the ordinary course of industry is necessarily productive of temporary suffering to the working classes, from whatever cause it may arise; and an alteration in the forms of applying labour is but one out of many such causes. Yet much as this evil must be deplored, it is a satisfaction to know that it is only occasional, temporary, and partial in its operation, while the permanent welfare of mankind is promoted by all those means which render industry most productive and multiply the sources of human enjoyment.

---

* A curious example will be found in the glossary annexed to the 'Report of the Commission on Frame-work Knitters,' 1845: and numerous others in the Occupation Abstract of the Census Commissioners—counties of Lancaster, Leicester, West Riding of Yorkshire, &c.

Another objection to a minute subdivision of employments is, that it reduces vast masses of men to the condition of organized machines, uses them like tools, and uses them as such merely because machines have not yet been invented to do their work. From these facts, which are, to a certain extent, undeniable, it is inferred that the moral and intellectual character of men is degraded. This inference, however, is not supported by experience. Agricultural employments are less subdivided than trades and manufactures; but no one will contend that the farm labourer is ordinarily more intelligent than the operative, nor that his morals are decidedly superior. In comparing their relative condition, we shall be led into error if we confine our attention to the influence of a division of employments. In the lower departments of labour the work is rarely of a kind to enlarge the understanding, whether it consist of a combination of several occupations or of one only; and in either case the greater part of a man's time is engaged in his daily work. It is therefore to the circumstances by which he is surrounded, rather than to the nature of his work itself, that we must generally refer his condition. In thinly peopled countries there can be comparatively little division of employments, and in populous cities the principle of division, for reasons already explained, is carried very far. In the one case the intercourse of persons with each other is very confined, and is enlivened with scarcely any variety; in the other case persons are crowded together, and brought into continual intercourse. These opposite circumstances produce different results for good and for evil. The intelligence of mankind is unquestionably increased by extended intercourse with one another: their morals, at the same time, are more liable to corruption. In large cities they are exposed to more temptations—they are under less restraint; and above all, they have, almost universally, higher wages, which enable them to indulge their propensities more freely. Much of the intellectual disparity of rural and town populations might be removed by an efficient system of education, by which men would be better qualified to observe and reflect upon the objects by which they may be surrounded; and great would be the moral influence of education in rendering high wages innocuous, by offering liberal sources of recreation to the operative, more attractive than the temptations of vice.

But to all objections it may be answered, that a division of employments is an imperative law of civilization. So overpowering is the necessity of a combination of labour with a distribution of distinct employments, for the production of wealth, that Mr. Wakefield has ingeniously ascribed to it the origin of slavery, in countries where labour has not been accessible by means of wages. (See Note to Adam Smith, book i. ch. 1.) Where land is abundant, families naturally scatter themselves over it, and provide for themselves nearly all that they want. More than they want they do not produce, as there is no market; and the growth of capital, under such circumstances, is impossible. One man has no inducement to offer to another for his labour; and thus the strongest men, with dominant wills, finding the necessity of combined industry for any extensive production, wage war upon their weaker neighbours and compel them to work by force. But where land becomes scarce and dear, men are forced into other employments distinct from agriculture; capital grows, wages are offered as an inducement to work, and the more wealthy and populous a country becomes, the more extensive must be the distribution of separate employments. To object to a division of employments, therefore, is no less than to object to civilization altogether; for the two conditions are inseparable. It is deeply to be lamented that many evils have hitherto clung to the progress of civilization, which are not its necessary accompaniments. Many of them may be referred to the slow growth of political science, and might be corrected by the application of sound principles of government; many may be attributed to the neglect of the religious and moral culture of an *increasing* population: but short indeed must be the sight of any man who would seek to correct them by applying to a civilized state the rude expedients of barbarism.

(Adam Smith's *Wealth of Nations*, book i. chapters 1, 2, 3, with Notes by M'Culloch and Wakefield; M'Culloch's *Principles of Political Economy*, &c.)

DOBERAN is a market-town in the grand-duchy of Mecklenburg-Schwerin, situated in 54° 5′ N. lat. and 12° E. long. It had a chapel so early as the year 1164, and in 1171-73 Prince Pribislav built a church and convent. The convent was peopled by a great number of Cistercian monks from Brunswick; but in seven years it was plundered by the Wends, or Vandals, and seventy-eight monks were massacred. Prince Henry Borowin I. laid the foundation of a new church and convent in 1188, on the spot where Doberan now stands; the church was consecrated in 1232. Extensive landed property was granted to the convent, and though it was totally destroyed by lightning in 1291 and not thoroughly restored till 1368, its wealth and importance increased from year to year. Pilgrims came from distant countries, even from Spain, to see the numerous relics in the church. But the Reformation put an end to the prosperity of the convent. The duke John Albrecht secularised it in 1552, and added its extensive possessions to his domains. Doberan suffered also very much in the Thirty Years' War. Doberan is indebted for its present thriving condition to the foundation of an establishment for sea-bathing in 1793. This was the first of the kind established in Germany, and this little town has become a celebrated and much frequented watering-place. The baths are about three miles from the town. A good road, bordered with trees, leads to the baths, through a fine country and plantations of oak and beech. The bathing-house, as it is called, is only thirty paces from the coast of the Baltic, from which it is supplied with sea-water by pipes and pumps. The building is 166 feet in length, and contains every accommodation for warm and cold bathing, shower-baths, douche, &c. There are likewise bathing-machines in the open sea. Doberan is situated in a pleasant valley, and the surrounding country is very agreeably diversified. The town contains 3000 inhabitants. Among the public buildings the most interesting is the church, unquestionably the finest specimen of antient Gothic architecture in Mecklenburg, next to St. Peter's church at Rostock. It contains many monuments of the dukes of Mecklenburg, and a great number of paintings and statues. The stained-glass windows are much admired. There are two palaces belonging to the grand-duke, a theatre, and various buildings for the accommodation of visitors to the baths, who are generally about 1500 in the season. All the bathing establishments are the private property of the grand-duke, and are managed on his account. The visitors are chiefly from the neighbouring states of the North of Germany and from England.

A singular dam, called the Heiliger Damm, or Holy Dam, extends from the bathing-house to the village of Rehtwisch; it is above three miles long, from 60 to 100 feet broad, and 16 feet high. This has been cast up by the Baltic, some say gradually; but there is a tradition that it was cast up in one night, perhaps by an earthquake. It is entirely composed of boulders of different sizes and of a great variety of beautiful colours.

(G. Hempel, *Mecklenburg*; Brockhaus, *Conversations-Lexicon.*)

DOBSON, WILLIAM, was born in the parish of St. Andrews, Holborn, in 1610. He was a very distinguished painter, and succeeded Vandyck in the favour of Charles I., who used to call him the English Tintoret. Vertue collected some interesting particulars respecting Dobson. His father was of a good family of St. Albans, but being at length in poor circumstances, his son was apprenticed to Mr. Peake, afterwards Sir Robert Peake, painter and picture-dealer, who kept a shop at Holborn Bridge; but he learnt more, according to R. Symonds, of Francis Cleyn, a German, who stood also in great favour with Charles I.

Sir Robert Peake set Dobson to copy pictures for him, and exposed the copies for sale in his shop-window. One of these copies was seen by Vandyck in a shop-window on Snow Hill, and having made inquiries for the artist, he found him at work in a poor garret, whence he took him and introduced him to the king. After the death of Vandyck, Charles I. appointed Dobson sergeant-painter and groom of the privy-chamber, and he accompanied the king to Oxford, where he painted the king, Prince Rupert, and many of the nobility. The Rebellion however, and his own extravagance together, got Dobson into difficulties, and he was thrown into prison for debt, from which he was released by a Mr. Vaughan, whose portrait he painted, and he considered it his best work in that class. He did not long enjoy his liberty: he died in London in 1646, aged only thirty-six, and was buried at St. Martin's-in-the-Fields.

Dobson painted portrait and history equally well, and his portraits are generally considered so excellent, that he has been termed the English Vandyck, to whom he was but little inferior in this branch of art, and his reputation was unrivalled by that of any English painter until the appearance of Sir Joshua Reynolds. There are several excellent historical pictures by Dobson in various parts of England. There is a Beheading of John the Baptist at Wilton, in which the head of John is from Prince Rupert; at Albury, in Surrey, the seat of the earl of Arundel, there was a Woman taken in Adultery, with several figures, the heads being portraits, and among them was the poet Cowley; at Blenheim is Francis Carter, an architect and pupil of Inigo Jones, with his family, a picture, says Walpole, equal to anything he had ever seen by Dobson. Walpole mentions several other family pieces, and many portraits with one or more figures, of which he particularly praises one at Drayton, in Northamptonshire, of Henry Mordaunt, earl of Peterborough, in armour, with a page holding his horse and an angel giving him his helmet. Walpole says further, 'Dobson's wife, by him, is on the stairs of the Ashmolean Museum at Oxford; and his own head is at Earl Paulett's: the hands were added long since by Gibson, as he himself told Vertue.' He also etched his own portrait. Dr. Waagen mentions a few pictures by Dobson which are not noticed by Walpole, all of which he uniformly praises, except in the colouring, which he considers inferior. Considering Dobson's short life and the very unsettled period in which he lived, a great proportion of his works must be still preserved, and it is to be regretted that there is not a single specimen of 'the English Vandyck' in the British National Gallery. Dobson is said by D'Argenville to have been the first artist to adopt the system of requiring half the payment of a portrait at the commencement of it: he did it to reduce the number of his sitters to within a practicable limit.

(Walpole, *Anecdotes of Painting*, &c.; Waagen, *Kunstwerke und Künstler in England*; D'Argenville, *Abrégé de la Vie des plus fameux Peintres*.)

DOCKET. [BANKRUPT, P. C.]

DODD, THE REV. WILLIAM, LL.D., was born in 1729, at Bourn, in Lincolnshire, of which place his father was vicar. In 1745, he was admitted a sizar of Clare Hall, Cambridge, and took his bachelor's degree with reputation in 1750. Soon afterwards he removed to London, where he contracted an imprudent marriage. In 1753, he received priest's orders from the Bishop of London; and from this time he continued to obtain a succession of small preferments in the church, holding, in the latter part of his life, two chapels in London with a rectory and vicarage in the country, and possessing an ecclesiastical income of eight hundred a year. His character as a popular preacher, and as a man of letters, aided by his assiduous courtship of persons of rank, procured for him patronage of a high order. He was one of the king's chaplains till he was displaced for a simoniacal offer; and, in 1763, he was intrusted with the education of Philip Stanhope, afterwards the famous Earl of Chesterfield. During all this time his literary activity was great and varied. In February, 1777, he was arrested on a charge of having forged the signature of his late pupil, Lord Chesterfield, to a bond for four thousand pounds, of which he had obtained payment. He repaid the money, but was brought to trial and convicted. He was executed on the 27th of July, 1777. The writings of this unfortunate person are numerous, and in their matter exceedingly various. There are poems, among which are 'A New Book of the Dunciad,' published anonymously in 1750; and the blank verse poem, called 'Thoughts in Prison,' which was composed in the interval between his conviction and execution. Among the prose works are many sermons, and the well-known 'Reflections on Death,' 1763. A work of another character is his 'Beauties of Shakspere,' in which, besides the extracts which make up the body of the volume, are interspersed many criticisms. These, like Dodd's other works, are fluent and tasteful rather than original or vigorous. Indeed some of them are mere plagiarisms. It is worth while to observe, that just before his apprehension he had entered on negotiations for publishing an expensive edition of Shakspere's works; and that the desire of raising money for the engraving of the plates has been assigned as most probably his reason for committing the forgery.

DODWELL, EDWARD, F.S.A., was a man of fortune, and was educated at Trinity College, Cambridge. He left the University in 1800, and from that time till his death in May, 1832, he mostly resided abroad, and occupied himself in researches connected with the earlier antiquities of Greece and her colonies. The first results of his investigations and studies in this field he gave to the world in 1819, in two quarto volumes entitled 'A Classical and Topographical Tour through Greece during the years 1801, 1805, and 1806.' This learned and accurate work was followed in 1821 by a folio volume of 'Views in Greece, from Drawings by Edward Dodwell, Esq.,' containing thirty coloured prints, accompanied by short descriptions in French and English, from a collection of nearly a thousand drawings which he had made of architectural objects and natural scenery. In the summer of 1830 Mr. Dodwell brought on a severe illness by fatigue and long exposure to the sun while engaged in seeking for the situation of some antient cities in the Sabine Mountains; and from this he never completely recovered. He left on his death a very large collection of drawings; from which a folio volume of lithographic plates was published at London, in 1834, under the title of 'Views and Descriptions of Cyclopian or Pelasgic Remains, in Greece and Italy; with Constructions of a later period; from Drawings by the late Edward Dodwell, Esq., F.S.A., and member of several foreign academies; intended as a Supplement to his Classical and Topographical Tour in Greece,' &c. Of the views, 71 are Grecian, 55 Italian. The subject of the early architecture called Cyclopian (or sometimes Titanic) had been slightly discussed by Dodwell in his 'Tour;' and it had engaged much of his attention in the last years of his life: he had been in correspondence about it with M. Petit Radel of Paris, and other learned persons, and it was his urgent request to the person to whom he bequeathed his drawings, and by whom the last-mentioned volume was afterwards edited, that the collection of views of which it consists should be published. The descriptions by which the plates are accompanied are extremely brief.

(*Editor's Preface to the Views of Cyclopian Remains; Mr. Dodwell's Works.*)

DOG-WOOD. [CORNUS, P. C. S.]

DOLOMITE. This rock, having the aspect and general geological history of limestone, but composed of carbonate of magnesia united to carbonate of lime, usually atom to atom, occurs as a part of the oolitic system of the Alps and Apennines, and of the German Jurakalk; and it is perhaps proper to call by the same name the crystallized magnesian limestone of Nottinghamshire, Derbyshire, Yorkshire, and Durham. The best example of this English dolomite is at Bolsover, in Derbyshire, from whence the stone is taken to build the new Houses of Parliament. From the manner in which this rock occurs along the Lake of Lugano, and other parts on the south side of the Alps, in direct contact, or more frequently in a peculiar relation of propinquity to augitic traps, Von Buch inferred that dolomite was a metamorphic limestone, altered by absorption of magnesian vapours yielded by volcanic action. There is much to recommend this inference. In England we frequently find the mountain limestone *dolomitized*, along lines of fracture and along the sides of mineral veins; and these cases appear to enter into Von Buch's explanation. But the broad magnesian limestones of the North of England are certainly due to original crystallization together of the two carbonates already named. Dolomite is usually very deficient of organic remains. In the Alps and in Franconia its aspect is very picturesque.

DOMAT, or DOUMAT, JEAN, a distinguished French civilian, was born at Clermont in Auvergne, on the 30th of November, 1625. He connected himself with the brilliant circle of literary recluses at the Port Royal among whom hi reputation stood high both for jurisprudence and ethics. He was a very modest man, and little is known of his personal history. He was in the confidence of Pascal, attended him on his death-bed, and was intrusted with many of his papers. His great systematic work on the civil law appears to have long existed and been perused by his friends in MS. before it was published. Rumours of the value of the work coming to Louis XIV., Domat received a pension, and took up his abode in Paris, where he received encouragement from the kindness of D'Aguesseau, then conseiller d'état, through whose patronage many distinguished jurists appear to have found their way to notice. Domat married Mademoiselle Blondel, by whom he had thirteen children—a circumstance deemed worthy of particular commemoration in France. He held the office of Avocat du Roi at Clermont. He died at Paris on the 14th of March, 1695, and, notwithstanding his pension and his office, is said to have ended his days in extreme poverty. In his works he stands pre-eminently above all the jurists of his age, and acquired a reputation throughout Europe that has hardly been subsequently reached by any of his countrymen. His work 'Les Loix Civiles dans leur ordre naturel, suivies du Droit Public' appeared anonymously in 1689, and is said to have been for some time attributed to Delauney, Professor of Jurisprudence in the University of Paris—a statement scarcely reconcileable with the alleged reputation of the work while in MS. The author's method of dividing the subject is, by first treating of the rules of law in general. This branch of the work is almost of an ethical character. The principle of every law, as having a foundation in utility or some other reason connected with morals or religion, is the main feature of the work, and in this it adopts the system which was afterwards more elaborately carried out and applied to a larger number of subjects by Montesquieu. The substance of the law is divided into private and public. The former class is subdivided into the law of contracts and the law of succession. The public law is divided into government, official and executorial arrangements, crimes, and procedure civil and criminal. There have been several editions of the work in French, generally in two volumes, folio. Although intended for the use of Frenchmen, it does not include the provincial peculiarities of tenure, but is nearly an echo of the Roman law purified of matters peculiar to Roman habits and customs, and thus it became a book for Europe at large. In 1722 it was translated into English by William Strahan, 'with additional remarks on some material differences between the civil law and the law of England,' 2 vols. folio. This translation is the most extensive systematic work on the civil law in the English language. Domat paid great attention to the law merchant, and it is believed that this translation has been of extensive service in keeping the mercantile law in general, and the admiralty and consistorial systems of England in unison with the civil law, and consequently with the practice of the rest of Europe. Domat's work used to be in high esteem in Scotland before the study of civil law was neglected at the Scottish bar. A posthumous work by Domat, 'Legum Delectus, ex Libris Digestorum et Codicis,' was published at Amsterdam in 1703, 4to.

DOMICILE. In the Roman law Domicile (*Domicilium*) was defined to be that place which a person 'makes his family residence, and principal place of business; from which he does not depart unless some business requires: when he leaves it he considers himself a wanderer, and when he returns to it he deems himself no longer abroad.' (*Cod.* lib. 10, tit. 40 (39), 1, &c.) Similar definitions of the term are given by modern jurists.

The constitution of domicile depends on the concurrence of two elements—1st, residence in a place; and, 2nd, the intention of the party to make that place his home. Domicile cannot be established except it be *animo et facto*, that is, actually and in intention also. It is sometimes not very easy to determine in what place a person actually has his domicile. It is obviously a question depending upon the evidence in each particular case, which is of course capable of every variety both in nature and degree. The evidence as to the place of residence is frequently far from clear, while the intention of the party has to be gathered from circumstances yet more difficult to come to a conclusion upon.

The following rules appear to comprise the generally adopted principles on the subject:—

1. The domicile of the parents is the domicile of the child. '*Patris originem unusquisque sequitur.*' (*Cod.* lib. 10, tit. 32 (31), 36.) This is usually called the domicile of origin or nativity, and is in most cases the same with the place of birth. But the mere accident of birth in a place where the parents may happen to be *in itinere*, or on a visit, will have no effect in determining the domicile of origin. An illegitimate child, having no father in contemplation of law, follows the domicile of his mother.

2. Minors are generally considered incapable of changing, by their own act, the domicile of origin during their minority. If the father change his domicile, that of the children follows it; and if he dies, his last domicile will be that of his infant children. It has been much questioned whether the guardians of minors, idiots, or lunatics can change their domicile. It has been held in England that a mother, being guardian, might change the domicile of her children, provided it was not done for a fraudulent purpose, which would be presumed in the absence of any reasonable motive. In Scotland, a minor, after the age of puberty, is not personally under the control of his guardian, and may change his domicile by his own act.

3. A married woman follows the domicile of her husband.

4. A widow retains the domicile of her late husband till she acquires another.

5. The place where a man resides is, for a great many purposes, to be considered his domicile, and, *primâ facie*, is to be taken to be so till other facts establish the contrary.

6. Every person of full age, who removes from one place to another, with the intention of making the latter his place of residence, immediately constitutes it his domicile.

7. The domicile of origin must be considered to prevail till the party has not only acquired another, but manifested and carried into effect an intention of abandoning his former domicile, and abiding by another as his sole domicile. But the domicile of origin cannot be preserved by a mere floating intention of returning to it at some future period, or revived by a mere abandonment of the acquired domicile, unless perhaps where the party dies *in itinere* towards the intended domicile. 'It is to be remembered,' says Sir Wm. Scott (Lord Stowell), 'that the native character easily reverts, and that it requires fewer circumstances to constitute domicile in the case of a native subject than to impress the national character on one who is originally of another country.'

8. An acquired domicile is not lost by mere abandonment, but continues until a subsequent domicile is acquired, which can be done only *animo et facto*.

9. A married man's domicile is generally to be taken to be where the residence of his family is; unless this conclusion is controlled by circumstances, such as proof that he has altogether abandoned his family, or that their place of residence is temporary: but

10. If a man, whether married or not, has two places of residence at different times of the year, that will be esteemed his domicile which he himself selects, describes, or deems to be his home, or which appears to be the centre of his affairs; *e. g.* that of a nobleman or country gentleman, his residence in the country—that of a merchant, his residence in town.

11. Residence in a place, to produce a change of domicile, must be voluntary. Thus, if it be produced by constraint, as by banishment, arrest, or imprisonment, it cannot affect the domicile. For the same reason a person abroad in the service of the state does not change his domicile. But it has been held that a Scotchman entering the service of the East India Company acquires a domicile in India, which (like a domicile acquired in any of the colonies) is in legal effect the same as a domicile in England.

12. It was held in the Roman law that a man might, under certain circumstances, be said to have no domicile, as when he quits one place of residence with the intention of fixing himself in another. But this is not admitted in our law, in which, as before stated, it is held that the former domicile is not lost till the new one is acquired *animo et facto*. And in the possible case of a man of unknown origin acquiring two contemporaneous domiciles under the same circumstances, the *lex loci rei sitæ* would probably prevail *ex necessitate* in questions as to his personal property.

Thus it appears that domicile, considered in relation to the civil status of the person, is of three kinds—1st, domicile of origin, depending on that of the parents at the time of birth; 2nd, domicile of choice, which is voluntarily acquired by the party; and, 3rd, domicile by operation of law, as that of a wife, arising from marriage.

When a man dies, his personal property must be distributed according to the law of the country in which he was domiciled at the time of his death. In England every person, whether native or foreigner, who is for the time being within England, is amenable to the jurisdiction of its civil courts, and may sue or be sued in them. In Scotland, when the subject of dispute is within the jurisdiction of the courts, an action regarding it may proceed there, and any one who has property within their jurisdiction may be made amenable to the extent of that property. But actions of personal status, as for divorce, establishing a marriage, &c., can only proceed when the parties have established a domicile there by residence for forty days.

(On the subject of Domicile, see Story's *Commentaries on the Conflict of Laws*, c. iii.)

DO'MINIS, DE, MARCUS ANTONIUS, an Italian theologian and natural philosopher, was born, in 1566, of an antient family, at Arba on the coast of Dalmatia; and, having been educated in a college of the Jesuits at Loretto, he completed his studies at the university of Padua.

The progress which he made in the sciences was so satisfactory that the persons in authority at the university used their influence to induce him to enter the order of Jesuits: to this he appears to have consented; and, while passing his novitiate, he gave instruction in mathematics, physics, and eloquence. At the same time he employed his leisure in the study of theology; and it was then that he composed his work entitled 'De Radiis Visus et Lucis in Vitris perspectivis et Iride,' which was published at Venice by one of his pupils, in 1611.

The routine of a college life not suiting his taste, De Dominis quitted Padua; and, on the recommendation of the Emperor Rodolphus, he was appointed bishop of Segni: two years afterwards, he was made archbishop of Spalatro; but, while holding this dignity, he became embroiled with the pope (Paul V.) by taking a part in the disputes between that pontiff and the Venetians respecting the endowment of ecclesiastical establishments. On this occasion he threw out a censure on the conduct of the former; and he further gave offence by rashly entering upon the delicate subject of reforming the manners of the clergy.

Being suspected of an inclination in favour of the Reformed religion, he found it convenient to consult his safety by resigning his archbishopric, and retiring to Venice: this was in the year 1615, and in the following year he came to England, where he experienced a favourable reception from James I. The king appointed him to the deanery of Windsor; and at this time he composed his work entitled 'De Republicâ Ecclesiastica,' the object of which is to show that the pope has no supremacy over other bishops; it is in two parts, of which one was published in 1617, and the other in 1620, both in London: the work was much esteemed at the time, but is now scarcely remembered. He also published a sermon which he preached in 1617, in the chapel belonging to the Mercers' Company; and, in the following year, a work entitled 'Scogli del Cristiano Naufragio quali va scopendo la Santa Chiesa.'

De Dominis appears to have been restless and inconstant; for, after a few years, he expressed a wish to return to the bosom of the Catholic church; and having received from the pope (Gregory XV.) a promise of pardon, he set out for Rome. Soon after his arrival, some intercepted letters gave indications that his repentance was not sincere; and he was, in consequence, committed to the castle of St. Angelo, where, after an imprisonment of a few months, he died, Sept., 1624. Being convicted, after his death, of heresy, his body was disinterred and burnt.

De Dominis has the merit of being the first who assumed that the rainbow was produced by two refractions of light in each drop of rain, with an intermediate reflexion from the back part of the drop; and he verified the hypothesis by receiving the ray of light from a globe of glass exposed to the sun in the same manner as the drops of rain are supposed to be situated with respect to that luminary. He knew nothing of the different refrangibilities of the rays of light; and he conceived that the colours were produced by the different forces with which the rays strike the eye in consequence of the different lengths of path described within the drop, by which it was supposed that they retain more or less of the original impulsive force. He erred also in supposing that the rays which formed one of the bows came from the upper part of the sun's disk, and those which formed the other from the lower.

DON, DAVID, was born at Forfar in Scotland, in 1800. His father was proprietor of a nursery and botanic garden in this place, and is well-known as having been an acute practical botanist, and one who cultivated the botany of his native country with great success. When David was still a young man his father was appointed to the charge of the botanic garden at Edinburgh, and the knowledge which David then possessed of botany attracted the notice of Mr. Patrick Neill and other gentlemen connected with the garden, and they procured for him the means of attending on some of the classes in the University. His father however soon quitted Edinburgh, and again opened his garden in Forfar. David afterwards procured a situation in the establishment of Messrs. Dickson of Broughton, near Edinburgh, where he had the care of the finest collection of plants in Scotland. In 1819 he came to London, and was recommended to Mr. Lambert, who had at that time a large collection of plants. He was soon appointed by Mr. Lambert to be his librarian and curator, and lived entirely in his house.

One of his earliest publications was the description of a number of species of plants which were either entirely new, or had only been found in a few localities where they had been collected by his father and others in Scotland. It was entitled 'Descriptions of several New or Rare Native Plants, found in Scotland chiefly by the late Mr. George Don of Forfar.' It was published in the third volume of the Memoirs of the Wernerian Society of Edinburgh. This work was a valuable contribution to our native botany. He shortly after published in the thirteenth volume of the Transactions of the Linnæan Society 'A Monograph of the genus Saxifraga.' On account of the varying characters of the various organs of the plant, this genus has always presented many difficulties in its investigation. This attempt at describing the various species of the genus gained for him a reputation as a sound botanist. In 1822 the office of librarian to the Linnæan Society became vacant, and he was appointed to that post. In this position he had great opportunities of improving his knowledge of botany. The collections of plants from India in the Linnæan Museum turned his attention to that part of the world, and in 1825 he published descriptions of species of plants in Nepaul under the title 'Prodromus Floræ Nepalensis,' 12mo. Almost every volume of the Transactions of the Linnæan Society after his appointment as librarian contains papers by him on various departments of systematic botany.

On the death of Professor Burnett, in 1836, he was appointed to the chair of botany at King's College, London, a position which he held till his decease. As a teacher he was much beloved by his pupils: time was never made an object when he had the advantage of his class in view. The same urbanity of manner and liberality in imparting all he knew distinguished him in his position at the Linnæan Society. As a lecturer, however, he failed in expressing himself with perspicuity and facility.

The following is a list of his papers published in the Transactions of the Linnæan Society:—

A Monograph of the genus Saxifraga, vol. 13.

Descriptions of nine new species of Carex, natives of the Himalaya Alps, in Upper Nepaul, vol. 14.

Description of Cowania, a new genus of Plants; and of a new species of Sieversia, vol. 14.

Description of a new genus (Lophospermum) belonging to the Natural family of Plants called Scrophularineæ, vol. 15.

On the Origin and Nature of the Ligulate Rays in Zinnia, and on a remarkable multiplication observed in the parts of frutification of that genus, vol. 16.

Descriptions of the new genera and species of the class Compositæ, belonging to the Floras of Peru, Mexico, and Chili, vol. 16.

On the plant which yields the Gum Ammoniacum, vol. 16.

Observations on the Tropæolum pentaphyllum Lam., and 'Additional Observations,' on the same, vol. 17.

On the modifications of Æstivation observable in certain plants formerly referred to the genus Cinchona, vol. 17.

Remarks on some British Ferns, vol. 17.

Descriptions of five new species of the genus Pinus, discovered by Dr. Coulter in California, vol. 17.

Descriptions of Indian Gentianeæ, vol. 17.

Descriptions of two new genera of the Natural Family of Plants called Coniferæ, vol. 18.

Description of a new genus of Plants (Catophractes) belonging to the Natural Family Bignoniaceæ, vol. 18.

Descriptions of the Indian species of Iris, vol. 18.

An account of the Indian species of Juncus and Luzula, vol. 18.

A Monograph of the genus Disporum, vol. 18.

A Monograph of Streptopus, with the description of a new genus (Prosartes), now first separated from it, vol. 18.

The following is a list of his papers published in the Memoirs of the Wernerian Society of Edinburgh:—

Descriptions of new Plants from Nepaul in the Herbarium of A. B. Lambert, Esq., vol. 3.

Illustrations of the Natural Family of Plants called Melastomaceæ, vol. 4.

A Monograph of the genus Pyrola, vol. 5.

On the classification and division of Gnaphalium and Xeranthemum of Linnæus, vol. 5.

The following papers were published in the 'Edinburgh New Philosophical Journal:'—

Observations on Philadelpheæ and Granateæ, two new families of plants.

On the affinities of Empetreæ, vol. 2.

On the Rhubarb of Commerce, the Purple-coned Fir of Nepaul, and the Mustard-Tree, vol. 2.

Description of the genus Malesherbia, of the Flora Peruviana, with remarks on its affinities, vol. 2.

Observations on the Cow-tree of the Caracas, and on the culture of the Nutmeg, vol. 3.

Remarks on the irritability of the Stigma, and on the origin and nature of certain parts of the fructification in Pinus Larix, vol. 4.

On the general presence of Spiral Vessels in the Vegetable Structure, vol. 6.

Descriptions of the genera Columellia, Tovaria, and Francoa, vol. 6.

An attempt at a new classification of the Cichoraceæ, vol. 6.

On the characters and affinities of Darwinia, Brunfelsia, Browallia, Argylia, Eccremocarpus, and of a Plant improperly referred to the latter genus, vol. 7.

On the affinities of Vellozia, Barbacenia, Glanx, Aucuba, Vivinia, Deutzia, and of a new genus of the order Rubiaceæ, vol. 8.

On the anomalous structure of the leaf of Rosa Berberifolia, vol. 8.

A Monograph of the family of Plants called Cunoniaceæ, vol. 9.

On the characters and affinities of certain genera chiefly belonging to the Flora Peruviana—various papers, vols. 10, 14.

Descriptions of some new species of Malesherbia, Kageneckia, Quillaja, and of a new genus of Salicariæ, vol. 12.

Additional remarks on Ercilla, Macromeria, Aitonia, and Citronella, vol. 14.

On the Coniferæ at present growing in Australia, vol. 14.

On the characters and affinities of the genus Codon, vol. 15.

On the connexion between the Calyx and Ovarium in certain Plants of the order Melastomaceæ, vol. 15.

Some remarks on the Plant which yields the Cascarilla Bark, vol. 16.

An attempt at a new arrangement of the Ericaceæ, vol. 17.

On the characters of certain groups of the class Personatæ, vol. 19.

These numerous works are sufficient proof of his industry, and they have a real value. Don's knowledge of plants was most extensive, and his appreciation of species ready and exact. He was not, however, fully alive to the importance of studying plants in their morphological relations, and many of his papers are open to criticism on this ground. His constitution was robust and strong, but at the end of 1840 a malignant tumor appeared on his lip, which, although removed at first, speedily reappeared, and terminated his existence on the 8th of December of the same year.

(*Proceedings of Linnæan Society.*—Don's *Works.*)

DONEAU, Latinized DONELLUS, HUGUES, a lawyer, was born at Châlons-sur-Saône, in France, in 1527. He is said to have been idle in his youth, and an anecdote is preserved, according to which he was frightened into diligence by a threat of his father to have him brought up as an assistant to a swineherd. He studied literature at Tournon and jurisprudence at Toulouse, and subsequently at Bourges, where he took a degree as Doctor of Laws, in 1551. He soon afterwards began to teach jurisprudence at Bourges, and continued to do so till the massacre of St. Bartholomew, in 1572. He had embraced the opinions of the Huguenots, and, dreading to be involved in ruin with others of his persuasion, he made his escape to Geneva, being aided by his pupils, among whom he seems to have been popular, and who had determined to defend his person if he were attacked. After having remained a short time in Geneva, he was called by the Calvinist Elector Palatine Frederic III. to be Professor of Law at Heidelberg. Ludwig IV., the successor of this prince, who did not follow his religious opinions, made changes in the university which drove Doneau thence, and leaving Heidelberg, in 1579, he settled in Leyden. Having adopted the faction in favour of the Earl of Leicester, he was obliged to leave Holland and return to Germany. He died at Altorf on the 4th of May, 1591. He was a voluminous commentator. His earliest work appears to have been 'In titulum de Usuris in Pandectis Commentarius,' Paris, 1556. A collection of his commentaries was published in five volumes, folio, at Frankfort, in 1596, and again in 1626, with the title 'Commentariorum de Jure Civili libri xxviii., ex recensione et cum supplementis Scipionis Gentilis.' One of the most complete extant lists of Doneau's works will be found in the printed catalogue of law books in the Advocates' Library, Edinburgh. His Life is in the Supplement of *Les Vies des plus célèbres Jurisconsultes*, by Taisand.

DONELLUS. [Doneau, P. C. S.]

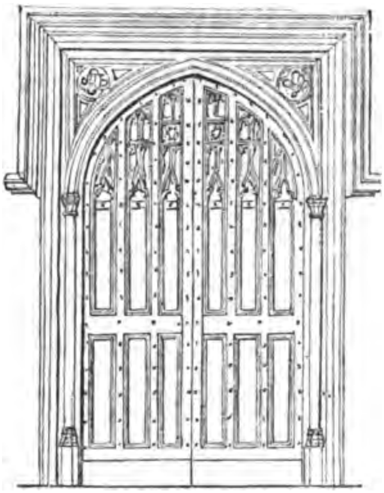
DONOVAN, EDWARD, a writer on various departments of Natural History. One of his earliest publications was 'A Natural History of British Insects.' This work was commenced in 1792, and finished in 1816. The whole was comprised in sixteen volumes, octavo. Although at the time these works were published, especially the earlier volumes, it was of great assistance in the study of Entomology, it has been surpassed both in execution and matter by more recent works. It will however always be an important work in the history of the literature of Entomology. In 1794 he published a little work on the formation of museums of natural history, entitled 'Instructions for Collecting and Preserving various subjects in Natural History,' 8vo., London. From 1794 to 1797 he published at intervals four volumes of a work containing drawings and descriptions of British Birds, entitled 'The Natural History of British Birds,' 8vo. In 1798, he commenced a series of illustrated works on the insects of Asia. These were called 'An Epitome of the Insects of China,' 1798, 4to., London; 'An Epitome of the Natural History of the Insects of India,' 1800, 4to., London. 'An Epitome of the Insects of Asia,' 1798-1805, 4to., London, 3 vols. These works had an extensive sale, and did much for creating a taste for the study of general entomology. In 1805 he published a work entitled 'Descriptive Excursions through South Wales and Monmouthshire in the year 1804 and four preceding Summers,' London, 2 vols. 8vo. In 1823 he commenced a periodical work entitled 'The Naturalist's Repository, or Monthly Miscellany of Exotic Natural History.' Of this work three volumes appeared containing descriptions and drawings of various animals from different parts of the world. He also published 'An Essay on the Minute Parts of Plants in general.'

Although constantly occupied on his various works, his profits from them seem to have been small. So great was his dissatisfaction at the small profits which he received from the publishers of his works, that in 1833 he published 'A Memorial respecting my Publications on Natural History,' in which he endeavours to prove that whilst he had been ruined, those who sold his books had realised large sums.

Science is not indebted to Donovan for any new discovery or important generalisation; but the field which his labours occupied was an important one, and his illustrated works have done much to diffuse a knowledge of and engender a taste for the study of natural history. He died on the 1st of February, 1837.

DOOR. In every style of architecture doors (or more properly speaking, doorways) are important features, the entrance into a building being naturally marked out for decoration, if only by its situation as a central and therefore a principal point in the general design; consequently, even where doors and windows are treated nearly alike, the former are distinguished from the other apertures, either by being of larger dimensions, or by being embellished more elaborately. For the mode of decorating doorways in classical architecture, or the Temple style of the antients, we refer to the article Door, in this Cyclopædia, merely adding, in the way of further remark, that they and columniation furnished almost the only features of design in such structures, windows being all but totally unknown to them; and even as to doors themselves, there was only a single lofty one within a portico forming the façade of a temple, a circumstance not attended to by every one, because generally overlooked by those who give us classical porticos far more scrupulously literal than need be in regard to columniation, yet having internally comparatively small doors, if not windows also. In the antique style the dressings of doorways are very simple compositions, however elaborately their details may be enriched; in nearly all cases alike, the architrave mouldings forming the jamb of the door bear a standard fixed proportion to the width of the aperture or door itself, which last generally fills up the entire opening, except where what answers to a modern *fanlight* is left between the door and the lintel of the doorway, as in the Temple of Vesta of Tivoli, that of Hercules at Cora, and the Pantheon at Rome, in all which that space was filled in with open or lattice work in metal, for the admission of air and light, whereby a door and window over it were united into one composition. The two last-mentioned examples are further remarkable, as instancing the mode resorted to for enlarging the doorway to the proportions required by the rest of the design, without increasing the aperture in the same degree, namely, by filling up the space between the architrave dressings and the door by antæ or pilasters, as is shown in the article Door, vol. ix. p. 86.* In Gothic architecture similar *contraction* of the aperture of doorways was practised, or, as it may more properly be termed in that style, any requisite degree of *extension* could be given to the general framing of a doorway by merely increasing the depth of the *splay* within which the door was placed, and the number of the shafts or other mouldings enclosing the opening; by this means, what would else have been a comparatively insignificant feature, was rendered an important and highly ornamental one. Even in the most magnificent portals, and in the façades of the largest structures, in the Gothic or Pointed style, the doors themselves are usually of moderate size, and the aperture is besides frequently divided into two by a central pillar or shaft; whereas very spacious and lofty doors would have been attended with the inconvenience of exposing the interior too much, whenever they were opened. Little judgment, therefore, and not much more knowledge of the style itself was shown in making the entrance-doors of Fonthill Abbey of the preposterous height of thirty feet, dimensions that would have been lofty to excess even for a gateway, except such a one as the beautiful Erpingham Gate at Norwich.

In Gothic doorways the side splays and the arch or arch-mouldings above may be enlarged or increased to almost any extent, and that without producing heaviness, or looking like exaggerated decoration. In many instances the width of the splays or dressings around the opening is equal to the width of the opening itself; and in some the former even exceeds the latter. And this breadth of splay, it should be observed, constitutes a marked distinction between doors and windows in the Gothic style; for though the apertures of both kinds strongly resemble each other in general shape and design, the latter do not admit, under any circumstances, of anything like a similar enlargement of their external dressings. Never is a small window attempted to be made a principal and ornamental feature by means of a deep splay filled in with decorations; never is a large one placed within a wide and deeply-recessed splay, bearing the same proportions to the aperture as the respective parts of a doorway generally do to each other. Nor is such difference of treatment—so fortunate in itself, inasmuch as it conduces to æsthetic variety—a merely arbitrary one, but is dictated by sound architectural propriety; for a Gothic window is not a mere gap in the wall, standing in need of external dressings to render it an ornamental feature; on the contrary it furnishes its own decoration, and the larger the window the more numerous the mullions, and the more complex the tracery; consequently, all the more rich the design of the window. Another difference between Gothic doorways and windows is, that in the former the doors themselves are sometimes square-headed, the apertures being carried up only to the spring of the arch, in which case the tympanum, or space between the opening and the arch, is usually filled in with sculpture. A third difference between doors and windows—at least to doors in the Perpendicular style—is, that for the doors the general design is formed into a square-headed composition, and surrounded in its upper part by a series of external weather-mouldings termed a *label*; and although labels are a very general, not to say universal, accompaniment to windows in the Tudor or perpendicular domestic style, they are almost unknown for large windows with a head formed by a single arch. The annexed example, from the Bishop's Palace at Lincoln, not only shows the usual composition of a labelled doorway, but also the mode of pannelling and the species of tracery employed for the doors themselves; which, though quite in keeping with, is still of quite distinct design from the corresponding parts of windows. It will be observed that the *munnions*, as they are termed, are not moulded like the *mullions* of windows (to which they answer), but merely form the general surface upon which the pannels are sunk, and are decorated by being *studded* with large-headed metal nails. Almost as frequently as not, instead of being divided by a cross rail, or *style*, the pannels are continued from top to bottom. In more ancient examples the doors are generally plain; that is, not pannelled, but are decorated with large metal hinges of rich and fanciful scroll-work pattern; also with similar ornaments round the door handles and locks. Of such ornamental metal-work upon doors some elaborate specimens are given in Heideloff's 'Ornamentik des Mittelalters.' For an example of a doorway of unusually ornate design, extended by canopied niches on its sides, we refer to that from King's College Chapel, Cambridge, in the article Gothic Architecture, P. C. p. 326. To treat satisfactorily of so multifarious a subject as that of doors and doorways in Gothic architecture would require a work devoted to them alone, after the manner of Donaldson's publication on doors, but would form one of considerably greater extent.



DOPPELMAYER, JOHANN GABRIEL, a German mathematician, born at Nürnberg in 1671, was the son of a trader in that city, who had distinguished himself by his taste for physics, and is said to have made some improvements in the air-pump.

He was sent for instruction to Altorf, and he completed his education at the university of Halle: here he applied himself to the study of the law; but, abandoning this pursuit, he cultivated with diligence the different branches of natural philosophy. In the year 1700 he made a journey to Basle; from whence he proceeded to Holland, and he subsequently made a visit to England. After an absence of two years he returned to Nürnberg, where, in 1704, he was appointed professor of mathematics and astronomy; and this post he held during the remainder of his life. In December, 1733, he was admitted a fellow of the Royal Society of London; and in 1740, a member of the Academies of Sciences at St. Petersburg and Berlin. He died December 1, 1750.

Doppelmayer was acquainted with the French, Italian, and English languages, besides Latin and his native tongue: he acquired, at a time when such manual operations were not below the attention of Sir Isaac Newton, considerable skill in grinding lenses for object-glasses, and in polishing specula for reflecting telescopes; and in the latter part of his life he distinguished himself by the performance of electrical experiments.

He published, in German (1714) and also in Latin (1731), an Introduction to Geography, as an accompaniment to the Atlas of Homann; Notices of the Mathematicians and Artists of Nürnberg, in German (1730); and a Celestial Atlas engraved on thirty plates, with descriptions in Latin (1742). He published a translation, in Latin, of Street's Astronomical Tables; also translations, in German, of Wilkins's Defence of Copernicus, and of Bion's 'Traité de la Construction, etc. des Instrumens d'Astronomie.' But his principal work is one entitled 'Neu-entdeckte Phænomena von Bewunderns-würdigen Würckungen der Natur, welche bey der fast allen

---

* We take this opportunity of correcting an awkward mistake in the cut referred to, where the divisions on the scale are figured as representing *ten* feet each, whereas they ought to be only five, the entire width of the doorway being not forty-eight but twenty-four feet

Corpern zukommenden electrischen Kraft in einem Systemati vorstellig gemacht,' 4to., Nürnburg, 1774.

DORE'MA, a genus of plants belonging to the natural order Umbelliferæ. It has an epigynous cup-shaped disk; the fruit slightly compressed from the back, and edged; 3 distinct piliform primary ridges near the middle, and alternating with them 4 obtuse secondary ridges, the whole enveloped in wool; vittæ 1 to each secondary ridge, 1 to each primary marginal ridge, and 4 to the commissure, of which 2 are very small.

D. ammoniacum, is a glaucous green plant, with a perennial root, large leaves 2 feet long, somewhat bipinnate, the pinnæ in 3 pairs, the leaflets inciso-pinnatifid, with oblong mucronulate entire or slightly lobed segments, from 1 to 5 inches long and ½ to 2 inches broad, the petiole very large downy and sheathing at the base; the teeth of the calyx acute membranous minute, the petals ovate, reflexed at the point; the fruit elliptical, compressed, surrounded by a broad flat edge. This plant is a native of Persia, in the plains of Yerdekahst and Kumisha in the province of Irak; and near the town of Jezud Khăst in very dry plains and gravelly soil, exposed to an ardent sun. This plant is one of those which yields gum ammoniacum, but it is probable that there are several species of plants which yield this as well as the other gum resins of the order Umbelliferæ.

(Lindley, *Flora Medica.*)

DORIGNY, SIR NICOLAS, a distinguished French designer and engraver, was born at Paris in 1657. He was the son of Michel Dorigny, who married Vouet's daughter, but his father died when he was very young, and Nicolas was educated as an advocate. His taste however led him to follow the arts as a profession, and he accordingly went to his brother Louis at Rome, who was a painter and engraver, and put himself under his tuition. He lived twenty-eight years in Italy, devoting his time chiefly to etching and engraving, and he became one of the first of the French historical engravers in his style, being inferior to Girard Audran alone. His works are however very hard, though they are drawn with great vigour and abound in expression, and his bold heavy lines appear to have been executed with extreme ease; but there is no delicacy of light and shade or tone in any of his works.

Dorigny engraved many celebrated Italian paintings during his long stay in Italy, including three of the best pictures in Rome: the Transfiguration, by Raphael, in 1705; the Taking down from the Cross, by Daniele da Volterra, in 1710; and the Lame Man healed by St. Peter, by Cigoli: he engraved also the Gallery of Cupid and Psyche after Raphael.

He became acquainted at Rome with some English gentlemen, who persuaded him to visit England for the purpose of engraving the cartoons of Raphael. He arrived in England in 1711, and commenced his task in the spring of the following year: Queen Anne had given him a room in Hampton Court, with the necessary perquisites. The expense was defrayed by subscription at four guineas the set. The prints were, with the assistance of Charles Dupuis and Claude Dubose, finished April 1, 1719, when he presented two complete sets to George I., who gave him a purse of 100 guineas, and knighted him in the following year. As his sight at length failed him, he determined to desist from further practice, and in 1723 he made a sale of his drawings, and in 1724 returned to Paris. His drawings were sold for 320*l.*, at the sale of which the drawings of the cartoons brought 52 guineas, and a lot of 104 heads and other studies from them, 74*l.*

These heads were afterwards engraved by various French artists, and published with some other studies by John Boydell, under the title 'The School of Raphael, or the Student's Guide to Expression in Historical Painting; illustrated by examples engraved by Duchange and others, under the inspection of Sir Nicolas Dorigny, from his own drawings after the most celebrated Heads in the Cartoons at the King's Palace.'

Dorigny was elected a member of the French Academy of Painting in 1725, and died at Paris in 1746. He engraved altogether 153 plates, according to Vertue.

His older brother Louis was a good fresco-painter: he lived chiefly in Italy, and died at Verona in 1742, aged eighty-eight.

(Vertue, *Catalogue of Engravers*, &c.; Watelet, *Dictionnaire des Arts*, &c.; Huber, *Manuel des Amateurs*, &c.)

DORO'NICUM, a genus of plants belonging to the natural order Compositæ, to the suborder Corymbiferæ, the tribe Senecionidæ, and the section Senecioneæ. It has the florets of the ray ligulate and pistilliferous; those of the disk tubular, with both stamens and pistils; the involucre hemispherical, of 2 or 3 rows of equal scales; the pappus pilose, wanting in the ray. The species are deciduous herbaceous plants. Two are natives of Great Britain.

D. pardalianches, with cordate denticulate leaves. It has a stem from 2 to 3 feet in height, erect, solitary, hollow, and hairy. It is a rare plant, and found in damp and hilly woods and pastures. It has its specific name from πάρδαλις, a tiger, and ἄγχ,ειν, to strangle, on account of the use said formerly to have been made of the plant for the purpose of destroying wild animals. With the species of Arnica, and other plants of the order it has the common name of Leopards' Bane.

D. plantaginerum, the second British species, has ovate leaves, and the stem-leaves clasping. It attains about the same height as the last, and its flowers are also yellow. *D. scorpioides*, *D. caucasicum*, *D. austriacum*, and *D. pardalianches* are natives of the continent of Europe.

(Koch, *Flora Germanica*; Babington, *Manual of Botany*.)

DORTMUND, the capital of a circle of the same name in the government of Arnsberg, in the Prussian province of Westphalia, is situated in 51° 30′ N. lat. and 7° 27′ E. long., in a very pleasant fertile country on the banks of the Emscher. It is an old-fashioned ill-built town, and surrounded with a wall with five gates. There are four Lutheran churches and one Roman Catholic, three hospitals, and a gymnasium illustre, founded in 1543, a private lunatic asylum, and a poor-house. It was formerly a free imperial city, and a member of the Hanseatic League, had the privilege of coining money, and exemption from duties of custom in the whole empire. It is the seat of several tribunals, and of the chief mining offices for the provinces between the Weser and the Rhine. The inhabitants, who are about 7000, have manufactories of linen, woollen, and cotton, nails, tobacco, and vinegar, great breweries, and an extensive trade in corn and colonial productions. In 1802, the town was allotted as an indemnification to Nassau-Diez, and passed in 1806 to the grand-duchy of Berg, when it became the capital of the department of the Ruhr: in 1818 it was transferred to Prussia.

(Hassel, *Die Preussische Monarchie*; Stein, *Geogr. Lexicon*; Cannabich, *Lehrbuch*; Müller, *Wörterbuch des Preussischen Staates*.)

DOSSI, DOSSO and GIOBATTISTA, two celebrated Ferrarese painters of the early half of the sixteenth century. They were born about 1480-1490, in Dosso, near Ferrara, and first entered the school of Lorenzo Costa, after leaving whom they studied together six years in Rome, and five years in Venice. Though they always worked together, they were constantly disputing: Giobattista, the younger, was deformed, and his disposition was the type of his body; he was only fit to be employed in the accessory parts of painting, having great skill in landscape and in decoration, but no skill in the human figure. Dosso, on the other hand, was a master in the figure, and Giobattista was always employed by Alfonzo I. and Ercole II., dukes of Ferrara, together with his brother, and was forced to execute the accessory parts of his brother's pictures.

There are still several of their joint works in or about Ferrara; they made the cartoons of the tapestries in the cathedral of Ferrara, and of those in the palace and in San Francesco at Modena, representing the deeds of the family of Este, which, according to Vasari, Pordenone was commissioned by Ercole to execute, but he died in 1540, by poison it is alleged, shortly after his arrival at Ferrara for the purpose: Vasari mentions the two Dossi with unjust depreciation. They are praised and enumerated by Ariosto among the other great painters of Italy and the immortal artists of Greece; after enumerating the latter, Ariosto says (*Or. Fur.* xxxiii. 2)—

> 'E quei che furo a' nostri dì, o sono ora,
> Leonardo, Andrea Mantegna, Gian Bellino,
> Duo Dossi, e quel ch' a par sculpe e colora
> Michel, più che mortale, Angel divino;
> Bastiano, Rafael, Tizian,' &c.

Dosso painted the portrait of Ariosto, and made illustrations to the Orlando Furioso; he painted also the head of Ariosto in a picture of Paradise on the ceiling of the vestibule of the refectory of the convent of San Benedetto at Ferrara: the portrait is in the possession of the Academy of Sciences of Ferrara, formerly the Academy Degli Intrepidi.

There is a good collection of Dosso's oil paintings in the gallery of Dresden, where there are several of his works, the best of which is the four fathers, Saints Gregory, Ambrose, Augustus, and Jerome, disputing on the miraculous conception of the Virgin; the figures are of the size of life, but the style has much of the hardness of the early Italian schools. Dosso survived his brother some years: he died about 1560.

(Frizzi, *Guida di Ferrara*; Lanzi, *Storia Pittorica*, &c.; Valery, *Voyages en Italie*.)

DOUCE, FRANCIS, was born in 1762. He was the youngest son of Thomas Douce, who was one of the Six Clerks. [Six Clerks, P. C.] Francis was sent to school at Richmond in Surrey, where he learnt Latin and some Greek. He afterwards held a situation in the Six Clerks' office. His father died in 1799, having previously resigned to him his office as one of the Six Clerks. The bulk of his father's property, which was very considerable, was bequeathed to his elder brother, and the rest was left to himself and his sisters. Francis Douce's share was about 5000*l.* in money and ground-rents of houses, besides the emoluments of his office, which were large. He married in 1799, but his wife's temper did not suit him, and he himself was very irritable, and they lived together uncomfortably. They seem to have had no children. A very large addition was made to his property in 1823, by Nollekens, the sculptor, who made him one of his executors, and left him nearly one-half of the fortune which he had accumulated. [Nollekens, P. C.] Douce was a Fellow of the Antiquarian Society, and was in habits of constant intercourse, both personal and by correspondence, with almost all the leading antiquarians of his time. He was a great collector of scarce books, prints, coins, medals, and all kinds of curious antiquities. He died at his residence in Gower Street, London, March 30, 1834.

Douce published, in 1807, 'Illustrations of Shakspeare and Ancient Manners,' 2 vols. 8vo. London. The book was roughly treated by some of the reviews, and the author was greatly offended. He also published, about the beginning of 1834, 'The Dance of Death, exhibited in elegant Engravings on Wood, with a Dissertation on the several Representations of that Subject, but more particularly of those ascribed to Macaber and Hans Holbein, by Francis Douce, F.A.S., Esq.' 8vo. London. The substance of the dissertation had appeared about forty years before, in illustration of Hollar's etchings, published by Edwards, of Pall Mall, London. The engravings, of which there were forty-nine, were executed by Bonner and Byfield, two of the best engravers on wood then living. These are the only works which Douce published separately. He has some essays in the 'Archæologia,' and there are many communications by him to the 'Gentleman's Magazine.'

Douce was a mere antiquarian. As a critic on Shakspere, his remarks are of little value when true, and they are frequently erroneous, though sufficiently arrogant. As an illustrator of antient manners, he has been more successful.

The largest amount of money he bequeathed to two friends, but he left many sums of 1000*l.* and under to relations and to several of his antiquarian associates. His printed books, prints, drawings, illuminated manuscripts, coins, and medals, he left to the Bodleian Library, Oxford. His miscellaneous antiquities he left to Dr. Meyrick, of Goodrich Castle, Wales. The manuscripts of his own writing, together with all his correspondence, he directed to be enclosed in a strong box, and sealed up, and given to the British Museum, with this inscription on the box, 'Mr. Douce's Papers, to be opened in the year 1900.' If the British Museum refused to accept the box on these terms, it was then to be given to the Bodleian Library. His will contains another curious direction—'I give to Sir Anthony Carlisle 200*l.* either to sever my head or to extract my heart from my body, so as to prevent my return to vitality.'

(*Gentleman's Magazine*, 1834.)

DOUGLAS, DAVID, was born at Scone, in Perthshire, in 1798, where his father was a working mason. He received a plain education at the parish school of Kinnoul, and was early placed as an apprentice in the garden of the earl of Mansfield at Scone Palace. As a lad he was remarkable for his fondness for books and the study of plants. In the winter he devoted his evenings to reading, and in the summer to making botanical excursions for the purpose of collecting the wild plants of the neighbourhood. In 1818 he went to live at Valleyfield, the seat of Sir Robert Preston, Bart., whose garden was then celebrated for its choice collection of exotic plants. Here he was treated by the head-gardener, Mr. Stewart, with great kindness, who procured him access to Sir Robert's valuable botanical library. From Valleyfield he removed to Glasgow, where he was employed in the botanic garden of the university. His intelligence attracted the attention of Dr. (now Sir William) Hooker, who was the professor of botany at Glasgow, and he made him his companion in his botanical excursions for the purpose of collecting materials for his 'Flora Scotica.' By Sir William Hooker he was recommended to the Horticultural Society of London as a botanical collector, and in 1823 he was sent to the United States, where he procured many fine plants, and greatly increased the collection of fruit-trees in the possession of the society. In 1824 he was sent by the Horticultural Society to explore the vegetable productions of the country adjoining the Columbia River, and southwards towards California. The vessel in which he went out touched at Rio de Janeiro, where he collected many rare orchidaceous plants and bulbs. In the course of his voyage round Cape Horn he shot many rare and curious birds. He visited the island of Juan Fernandez, which he describes as 'an enchanting spot, being fertile and delightfully wooded.' Here he sowed a quantity of garden-seed, with the wish, he says, that he might 'add to the collection of a second Robinson Crusoe, should one appear.' He arrived at Fort Vancouver, on the Columbia River, in April, 1825. During his journey he sent home from time to time large numbers of beautiful plants, with seeds and dried specimens. The latter are now existing in the herbarium of the society at Chiswick. Of the genus Pinus he discovered several species of gigantic size, one of which has been named after himself, *P. Douglasii*. In the spring of 1827 he went from Fort Vancouver across the Rocky Mountains to Hudson's Bay, where he met Captain (now Sir John) Franklin, Dr. Richardson, and Captain (now Sir George) Back, returning from their second overland arctic expedition. With these travellers he returned to England, bringing with him the results of his researches. Shortly after his return he was elected, free of expense, fellow of the Linnæan, Zoological, and Geological Societies. He remained in London two years, and sailed again for the Columbia River in 1829. He afterwards went to the Sandwich Islands, where he had remained some months when an accident put an end to his existence. The natives of the Sandwich Islands are in the habit of making pits, in which they catch the wild bulls. In one of his excursions Mr. Douglas fell accidentally into one of these pits, in which an infuriated animal was already trapped. The animal fell upon him, and he was found dreadfully mutilated and quite dead. This occurred on the 12th of July, 1834.

Of modern botanical travellers, Douglas was one of the most enterprising and successful. Almost all the new hardy plants of our gardens were introduced by him. To him we are not only indebted for many valuable timber trees, for numerous species of the beautiful genus Ribes, and other ornamental shrubs; but the favourites of every garden—the Clarkias, Penstemons, Œnotheras, and Lupines, were almost all first collected by him. A list of all the plants collected by him would occupy too much space, but an idea of the value of his labours may be formed by the following enumeration of the number of species commonly growing in our gardens, which are the result of his various voyages:—

Of Ranunculaceae	Four species
Berberaceae	Two species
Rhamnaceae	One species
Papaveraceae	Three species
Cruciferae	One species
Violaceae	One species
Silenaceae	One species
Alsinaceae	One species
Linaceae	One species
Malvaceae	Two species
Aceraceae	Two species
Geraniaceae	One species
Leguminosae	Thirty-three species
Limnanthaceae	One species
Rosaceae	Twenty species
Onagraceae	Fifteen species
Loasaceae	One species
Portulacaceae	One species
Grossulaceae	Fourteen species
Saxifragaceae	Two species
Umbelliferae	One species
Cornaceae	One species
Caprifoliaceae	Four species
Valerianaceae	One species
Compositae	Eleven species
Lobeliaceae	Two species
Ericaceae	Four species
Polemoniaceae	Fifteen species
Hydrophyllaceae	Eight species
Solanaceae	One species

Scrophulariaceae	Twenty-seven species
Labiatae	Two species
Primulaceae	One species
Verbenaceae	One species
Nyctaginaceae	One species
Polygonaceae	One species
Garryaceae	One species
Coniferae	Eight species
Iridaceae	Two species
Hemerocallidaceae	Two species
Asphodelaceae	Four species
Liliaceae	Eleven species
Melanthaceae	One species.

Of these, 53 are woody plants and 145 herbaceous plants. His dried collection of Californian plants alone consists of about 800 species, but these were only a part of his extensive herbarium.

(*Gardener's Magazine*, vols. xi. and xii.; *Companion to the Botanical Magazine.*)

DOUMA THEBA'ICA. [DOOM, P. C.]

DRABA, a genus of plants belonging to the natural order Cruciferæ, the suborder Latiseptæ, and the tribe Alyssineæ. It has an oval or oblong pouch, slightly convex, the seeds many in each cell, not margined, in two rows, the filaments simple. The species are perennial or annual branched herbs, with linear oblong or ovate leaves, yellow or white flowers.

D. verna, common Whitlow Grass, has a leafless scape, glabrous above, with lanceolate acute attenuated leaves, hairy below, the petals deeply cloven, the pouch oblong, shorter than its pedicel. It is an exceedingly common plant, ornamenting old walls and dry banks in the spring, before other flowers make their appearance. It is found throughout Europe, and is most abundant in Great Britain. It is the *Erophila verna* of De Candolle.

D. aizoon, Evergreen Whitlow Grass, has naked smooth scapes, linear acute keeled stiff ciliated leaves, the style as broad as the hairy pod, but one-half shorter. It is a native of Bavaria, Austria, Hungary, Transylvania, and the Carpathian mountains, particularly on Mount Chocsz.

D. aizoides has a leafless glabrous scape, with linear, rigid, acute, keeled, glabrous, ciliated leaves, the stamens as long as the slightly notched petals, the style elongated. It is a native of gravelly soils in almost every country of Europe. It is a rare plant in Great Britain, and has been found on rocks and walls at Pennard Castle, near Swansea. The other British species are *D. rupestris*, a rare plant found on mountains in Scotland; *D. incana*, also a mountainous species, and *D. muralis*, found on the shady sides of rocks, walls, and mountains, but it is a rare plant in Great Britain.

Above sixty species of Draba have been described. They are all insignificant plants, inhabiting the temperate and colder parts of the world. They are not often cultivated, but are adapted for rock-work. They are apt to drop off in winter when exposed, and the best way to preserve them is to keep them in pots as other alpine plants. They grow best in a mixture of sand, loam, and peat, and the pots should be well drained with potsherd. They may be propagated by dividing the roots or by seeds.

(Babington, *Manual*; Don, *Gardener's Dictionary*.)

DRACONTIUM (from δράκων, a snake, because the stem is mottled like the skin of a serpent), a genus of plants belonging to the natural order Araceæ. It has a cymbiform spathe, with a cylindrical spadix, quite covered with hermaphrodite flowers, the perianth 7-9-parted; 7-9-stamens, with oblong 2-celled anthers, opening obliquely by a pore at the apex, and distinct from their filaments; the ovary 2-3-celled, each cell containing one pendulous ovule; a 1-3-seeded berry; seeds without albumen.

D. polyphyllum has a tuber resembling a small cake, producing one or two leaves, with long clouded spotted petioles, resembling the skin of a snake. The spathe is large, of a purple colour, very deep inside, hooded, acute, and appearing after the leaves have withered. It smells so powerfully on first expanding, that persons have been known to faint from the stench. It is also said to excite the nerves of hearing, and even induce a state of catalepsy. It is a native of Guiana, Surinam, and other parts of equinoctial America, where it is called Labarri, and regarded as a remedy against the bite of the Labarri snake, which its spotted leaf-stalks resemble in colour. Its use in this respect is doubtful, but its powerful action on the system might render it available in the treatment of many diseases. There is a species of Dracontium in India, called by Ainslie by the same name, which is a valuable remedy in asthma, and is used in hæmorrhoids.

The *Dracontium fœtidum* of Linnæus, the Skunk-weed and Skunk Cabbage of the United States, is now referred to the genus *Symplocarpus*. It differs from Dracontium in its ovaries being 1-celled, and in its spathe being cucullate. It emits a powerful odour. When the tubers are dried and powdered they are used as an antispasmodic in America. It has been recommended in asthma and chronic bronchitis, also in certain cases of hysteria, dropsy, and epilepsy.

(Lindley, *Flora Medica.*)

DRAIN TRAPS [SEWERS, P. C., p. 319; BUILDING, P. C. S., p. 208], contrivances to prevent the escape of foul air from drains, but to allow the passage of water into them.

They often fail to produce the intended effect, and great expense is often incurred in attempting to apply a remedy in the wrong place. 'The drains smell, we shall have rain,' is a common expression, but perhaps few inquire why drains send forth their peculiar intimation of a change in the state of the atmosphere. It has become the practice to trap drains where they leave the house in order to prevent the ingress of rats from the sewer, so that a large quantity of air is enclosed in the drain between these large traps and the smaller ones, at the sinks in the house. Now this air being liable to expansion from various causes (among which are the diminution in the pressure of the atmosphere indicated by the falling of the mercury in the barometer, and also the introduction of hot water), occasionally displaces the very small column of water in the sink-traps, and escapes into the house, to the serious annoyance of the inmates. The remedy is, to insert one end of a pipe into the highest part of the drain so that the foul air may escape at the other extremity of the pipe where it can produce no inconvenience.

DRAINAGE. [SEWERS, P. C.]

DRAMATIC LITERARY PROPERTY. [COPYRIGHT, P. C. S.]

DRAWER. [BILL OF EXCHANGE, P. C.]

DREBBEL, CORNELIUS VAN, was born at Alkmaar, in Holland, in 1572. He is chiefly distinguished by being the inventor of the thermometer; or, at least, by sharing that honour with Santorio. His instrument, which is said to have been first used in Germany in 1621, consisted of a tube of glass containing water and connected with a bulb containing air: by the expansion and contraction of the air, in consequence of the variations of temperature, the column of water was allowed to rise or fall in the tube; and thus the height of the column, being measured by a scale, served as an indication of the temperature.

Drebbel also discovered the means of producing a bright scarlet dye for woollens and silks; and, according to Beckmann, he communicated the discovery to Kuffler, a dyer, at Leyden, who had married his daughter. The process was afterwards introduced into France by the persons who established the Gobelines manufacture, the objects of which were celebrated for the brilliancy of their scarlets. It has been asserted that he was the inventor of the telescope and microscope; but this is probably without foundation, though he may have made some improvements on those instruments.

The reputation which Drebbel acquired during his life is less due to his useful discoveries than to a pretended knowledge of the causes of many natural phenomena; few persons, in an age of ignorance respecting physical science, being able to impugn his claim to such knowledge. The emperor Rudolph II. granted him a pension, and Ferdinand II. made him the tutor of his son; but a revolution taking place in Austria, he was imprisoned in that country, and, but for the interference of the king of England, James I., he would have been executed. Drebbel spent the rest of his life in this country; and it is said that, on his arrival, he presented to the king a glass globe which exhibited the phenomena of the tides, thunder, and rain, with the sun and planets in perpetual motion; he is also said to have contrived a boat which could be rowed under the surface of water, and in which a person might read without artificial light. He died in London, in the year 1634.

Drebbel wrote, in Dutch, two works which were afterwards translated into Latin and French: one of these is on the Nature of the Elements, the Winds, Rain, &c.; and the other, on the Quintessence, with the manner of obtaining it from minerals, vegetables, &c.

DREDGING-MACHINES are machines employed for deepening and clearing away deposited matter from the beds of navigable rivers, canals, harbours, and basins; dredging being the term applied to such operations in common with the somewhat similar one of fishing for oysters. [Pectinidæ, P. C., p. 363.]

Some machines employed for this purpose may be compared to ploughs, harrows, or great shovels, used only to loosen the silt or deposit, preparatory to its removal either by the action of the retiring tide or by artificial scouring or sluicing. Others not only detach the sand or silt from the bottom, but also bring it above the surface of the water and discharge it into a vessel in which it may be removed to be made use of as ballast; or, when it is not wanted for this purpose, in which it may be carried to some place where it may be emptied into deep water without doing any mischief. Boats or barges for the latter purpose are frequently made with one or more large funnel-shaped openings in the bottom, through which their contents may be discharged by simply releasing a kind of trap-door.

One of the simplest contrivances for performing this operation is that known as the spoon dredging-machine, which consists of a strong ring or hoop of wrought-iron, partially edged with steel, about two feet or rather more in diameter, attached to the end of a pole thirty or forty feet long, and carrying a large bag of bullock's hide perforated with a number of small holes. This apparatus is connected by ropes and tackle with a barge or lighter, from the side of which it is let down and manœuvred in such a manner that the steel edge of the hoop cuts into the soft bottom, and scoops a large quantity of silt into the bag, which is then drawn up to the surface. The water taken up with the silt runs through the holes in the bag, which, when sufficiently elevated, is swung over the vessel and turned so as to discharge its contents. The pole is sometimes made of two pieces, capable of sliding upon one another, to adapt the machine to various depths. By this machine, which is commonly worked by from two to four men, the quantity of stuff raised in a tide from a depth of from two and a half to three fathoms, may, with a tolerably favourable bottom, range from twenty to sixty tons.

The bucket dredging-machine is adapted for performing the operation on a much more extensive scale, and with the aid of inanimate power. It was, indeed, originally worked by men, and has been worked by the power of horses walking in a circular path in the boat, but neither of these plans is eligible, and, without the steam-engine to work it, the advantages of this form of machine are questionable. The distinguishing feature of this machine is a long massive framework with a wheel at each end, over which a series of endless chains, or a band formed by two or more chains laid side by side, is placed in a manner resembling the apparatus of Dr. Spurgin, described under Wheels, P. C., p. 313; so that by turning one of the wheels the whole chain is set in motion. Attached to the chain is a series of iron buckets, edged with steel, and perforated with numerous small holes. This framework, with its chain of buckets, is attached by one end to supports elevated above the vessel, while the other end, which is suspended by adjustable tackle, dips obliquely into the water. In some cases the bucket-frame is mounted outside, but parallel with, the vessel to which it is attached; but a better arrangement is to divide the hinder part of the vessel by an opening in the line of the keel, sufficiently capacious to allow the working of the bucket-frame within it. By means of the tackle attached to its lower end the bucket-frame is let down until it reaches the bottom, when, the steam-engine being set to work, the chain of buckets begins to perform its circuit, by which every bucket is, in succession, made to scoop up a quantity of silt, which it carries up to the top of the oblique frame, the water running away through the holes in the bucket as it proceeds. On reaching the wheel at the upper end of the frame the bucket assumes an inverted position, and consequently pours out its contents into a barge which is brought under the stern of the vessel to receive it, after which it descends on the under side of the frame to be refilled. In the new edition of the 'Encyclopædia Britannica' is a long article upon 'Dredging,' illustrated by very detailed engravings and descriptions of a large steam dredging-machine, in which the peculiarities required in the construction of steam-engines for such use are minutely explained.

DREVET, PIERRE, the name of two very distinguished French engravers, father and son. The father was born at Lyon in 1664, and was the pupil of Germain Audran; and, says Watelet, but for his son, who surpassed him, would have been the best portrait-engraver of his own or any previous time. He died at Paris in 1739, aged seventy-five.

Pierre Drevet, the son, was born at Paris in 1697, and was a complete master in his art already in his thirteenth year, when he executed a plate of the Resurrection of Christ, after J. Audré, which, in correctness of drawing and delicacy of execution, is equal to the works of any of his contemporaries. In his twenty-sixth year he produced his masterpiece, the full-length portrait of Bossuet, after Rigaud, in which every object in the picture is executed with such truth and delicacy, that the substance and material of each is easily and clearly distinguished—flesh, draperies, wood, the various ornaments—all have a peculiar and characteristic style of execution. He executed several other portraits of nearly equal merit. His style, in the opinion of some, was less adapted for history than for portrait, as being extremely laboured; it drew the attention from the subject as a whole to the parts, and destroyed the unity of effect. Some of his last works are executed in a freer style. He engraved exclusively after French masters, but his works are not numerous. He died at Paris in the same year as his father, 1739.

(Watelet, *Dictionnaire des Arts*, &c.; Huber, *Manuel des Amateurs*, &c.)

DRIFT. [Detritus, P. C.; Diluvial Formation, P. C. S.]

DRILL. To what is given on the subject of drills under Boring Instruments, P. C. S., p. 225, we may add a reference to a contrivance styled a universal drill-stock, invented by Mr. Morgan Evans, and described in the 'Transactions' of the Society of Arts, vol. liii. part i. pp. 85-87, which offers peculiar facilities for boring holes in confined situations, where neither a brace nor any ordinary drill-stock could be applied; the necessary pressure being applied through the medium of a screw abutting upon any fixed point which can be found or temporarily applied over the hole, while the rotatory motion is given, in cases where a bow cannot be used, by a fixed lever-handle, with a ratchet and click to provide for its retrogression between each cutting stroke.

DRONERO. [Saluzzo, P. C.]

DRO'SERA (from δρόσος, dew), a genus of plants belonging to the natural order Droseraceæ. It has a calyx deeply 5-cleft; 5 petals; 5 stamens; 3-5 styles, deeply bifid; a many-seeded 1-celled capsule, with 3-5 valves. The species are herbs inhabiting bogs and mossy swamps. The leaves are furnished with reddish glandular hairs, which discharge from their point a viscid acrid fluid. Insects are often caught upon these hairs, and hence they have been supposed to be irritable, and to resemble those of the *Dionæa muscipula* or Venus's Fly-trap, a plant belonging to the same order.

D. rotundifolia, common or round-leaved Sun-dew, has orbicular spreading leaves, hairy petioles, erect peduncles, seeds with a loose chaffy coat. This plant is a native of Europe, in boggy places especially, where the Sphagnum grows. It is employed in Italy for making the liqueur called *Rossoli*. It is an acrid and caustic plant, and has been supposed to cause rot in sheep. It curdles milk, and has a reputation for removing corns, bunions, and warts. When distilled with wine a stimulating spirit is procured which was formerly much used as an excitant.

Two other species, *D. longifolia* and *D. anglica*, are natives of Great Britain. The first is a common bog-plant, but the latter is only common in the British Islands in Ireland. About forty species of this genus have been described. They have been found in boggy places in all parts of the world, except in the extremes of heat and cold. They are all singularly beautiful, and worthy of cultivation. They thrive best in small pots, which should be three-parts filled with peat earth, and sphagnum should be planted on it; the Droseras should be planted in the moss, and the pots placed in pans of water. The New Holland and Cape of Good Hope species will require the stove. They may be propagated by seeds, but foreign plants should be brought over in cases, for which purpose those of Mr. Ward are admirably adapted.

(Don, *Gardener's Dictionary*; Loudon, *Encyclopædia of Plants*.)

DRUMMOND, CAPTAIN THOMAS, was born at Edinburgh, in October, 1797, the second of three sons. His father died whilst he was an infant; his mother removed to Musselburgh, where she resided many years, devoting herself entirely to the education of her children. Drummond throughout life expressed in the warmest manner his obligations to his mother, and attributed much of his success in after-life to her intelligence and vigilance. He was early entered at the High School of Edinburgh, and there formed an acquaintance with Professors Playfair, Leslie, and Brewster, and also with Professors Wallace and Jardine, whose pupil he more especially was.

In February, 1813, he was appointed to a cadetship at Woolwich. His mathematical abilities soon made him conspicuous, and he was moved from the sixth to the fifth academy without the usual examination, and passed with such rapidity through that academy, and the fourth and third, that at Christmas of the year in which he joined he entered the second academy.

Much of his success was doubtless to be attributed to the admirable preliminary education he had received, but much also to a character of determined perseverance, and to the vigorous and well-regulated mind he brought to bear on all subjects. To this it was probably due that he never became exclusively a mathematician, but advanced equally in all the various branches of study, being at that time, as he continued through life, distinguished for general knowledge and for aptitude to seize on information of every kind. His mathematical character at Woolwich has been thus well and justly sketched by his friend and master, Professor Barlow:—'Mr. Drummond by his amiable disposition soon gained the esteem of the masters under whom he was instructed; with the mathematical masters in particular his reputation stood very high, not so much for the rapidity of his conception as for his steady perseverance, and for the original and independent views he took of the different subjects that were placed before him. There were among his fellow-students some who comprehended an investigation quicker than Drummond, but there was no one who ultimately understood all the bearings of it so well. While a cadet in a junior academy, not being satisfied with a rather difficult demonstration in the conic sections, he supplied one himself on an entirely original principle, which at the time was published in Leybourne's 'Mathematical Repository,' and was subsequently taken to replace that given in Dr. Hutton's 'Course of Mathematics,' to which he had objected. This apparently trifling event gave an increased stimulus to his exertions, and may perhaps be considered the foundation-stone of his future scientific fame. After leaving the academy he still continued his intercourse with his mathematical masters, with whom he formed a friendship which only terminated in his much lamented death.'

During his preliminary and practical instruction in the special duties of the Engineer Department, his talent for mechanical combinations became conspicuous, one of which is thus described by his contemporary and friend, Captain Dawson, to whose information this notice is largely indebted:—'The various inventions to supersede the use of the old pontoon led Drummond himself to consider the subject, and he made a model, like a man-of-war's gig or galley, sharp at both ends, and cut transversely into sections for facility of transport, as well as to prevent it from sinking if injured in any one part: each section was perfect in itself, and they admitted of being bolted together, the partitions falling under the thwarts or seats. The dockyard-men to whom he showed it said it would row better than any boat except a gig, and it was light, and capable of being transported from place to place on horseback.'

This early period of his career was also largely devoted to the acquisition of military knowledge, partly from the associations around him, and partly from the circumstances of the times. Jomini and Bousmard were his favourite authors, and often has the morning light surprised him in deep discussion on the details of Waterloo and the strategy of the recent campaigns.

At Chatham, the practical and varied applications of scientific knowledge brought by Colonel (now General) Pasley to the aid of military science, offered the highest attractions to a mind like Drummond's. During the period of his service at Chatham, his military fervour led him to obtain leave of absence for the purpose of visiting the army of occupation in France, and attending one of the great reviews.

Before he joined at Chatham he had served a short time at Plymouth, and after his Chatham course was completed he was stationed at Edinburgh. The duties there offered nothing to engage his attention, relating merely to the charge and repairs of public works; but he was happy in being again thrown among his family and friends, and more in the opportunity again afforded him of pursuing the higher studies in which he delighted, at the college and classes, and among the scientific society of his native city. He found the duties however so trivial, and the prospects of the service so disheartening, that for some time he meditated leaving the army for the bar, and had actually entered his name at Lincoln's Inn with this view.

But in the autumn of 1819 he fortunately became acquainted with Colonel Colby, when that officer was passing through Edinburgh on his return from the trigonometrical operations in the Scottish Highlands. The opportunity which these duties afforded of combining scientific pursuits with the military service induced him to abandon his intention of forsaking the corps, and in the course of the following year an offer from Colonel Colby to take part in the trigonometrical survey was gladly accepted. He had now the advantage of a residence during each winter in London, and, with a definite object in view, again devoted himself, and more closely than ever, to the study of the higher branches of mathematics.

During this period he also devoted considerable attention to the study of chemistry, and attended the lectures of professors Brande and Faraday. The society of his friend Dr. Prout, it is believed, first led his mind to this science, and, with his usual felicity of application, he soon made his new knowledge available to the duties he was employed on. The incandescence of lime having been spoken of in one of the lectures, the idea struck him that it could be employed to advantage as a substitute for argand lamps in the reflectors used on the survey for rendering visible distant stations; because, in addition to greater intensity, it afforded the advantage of concentrating the light as nearly as possible into the focal point of the parabolic mirror, by which the whole light would be available for reflecting in a pencil of parallel rays, whereas of the argand lamp only the small portion of rays near the focus was so reflected. On this subject his first chemical experiments were formed. Captain Dawson recollects Drummond mentioning the idea when returning from the lecture, and that on the way he purchased a blowpipe, charcoal, &c. That evening he set to work, and resolved that he would thenceforth devote to his new pursuit the hour or two before his evening studies began, remarking 'how much Dr. Prout had done during the intervals of active professional occupations.'

At this period (1824) a committee of the House of Commons recommended that the survey of Ireland should be begun, and that Colonel Colby should make arrangements for carrying it on. The objects of this survey required a work very different from the survey in England. Except himself and a small number of officers, everything was to be formed by Colonel Colby for the work. Instruments of improved construction were required. Among others, a means of rendering visible distant stations was desirable. The recent experience of the Western Islands had shown the probability that in a climate so misty as Ireland the difficulty of distant observations would be greatly increased, and Colonel Colby at once saw the important results which might follow such an improvement of the lamp as that which Drummond had devised. Under his judicious advice the experiments were prosecuted, and were rapidly attended with success; their progress and results are detailed by the author in the 'Philosophical Transactions' for 1826, as well as the first application of the lamp to actual use in Ireland. When a station, Slieve Snaught in Donegal, had long in vain been looked for from Davis Mountain, near Belfast, the distance being 66 miles and passing across the haze of Lough Neagh, Mr. Drummond took the lamp and a small party to Slieve Snaught, and by calculation succeeded so well in directing the axis of the reflector to the instrument, that the light was seen, and its first appearance will long be remembered by those who witnessed it. The night was dark and cloudless, the mountain and the camp were covered with snow, and a cold wind made the duty of observing no enviable task. The light was to be exhibited at a given hour, and to guide the observer, one of the lamps formerly used, an argand in a lighthouse reflector, was placed on the tower of Randalstown church, which happened to be nearly in the line at 15 miles. The time approached and passed, and the observer had quitted the telescope, when the sentry cried, 'The light!' and the light indeed burst into view, a steady blaze of surpassing splendour, which completely effaced the much nearer guiding beacon.

An apparatus invented by Colonel Colby, consisting of flat plates of polished tin, at angles calculated to reflect the sun's rays in the required direction was resorted to, and with entire success. It was however somewhat elaborate; because, from the rapid motion of the sun, or rather of the earth, in its orbit, the same pole and set of plates would only answer for a single station, and for a short time on a very few days; the principle however was now obvious, and the elements which had been called into play soon suggested the more perfect instrument. From a calculation, of which the variables were the relative position of two stations and that of the sun, a happy step led to an instrument by which the problem should be as it were solved by construction—a telescope in the line between the objects, connected with one to be directed on the sun and carrying a mirror; such accordingly was the first heliostat of Drummond; its mechanism is described in the paper already referred to ('Phil. Trans.' 1826), and, like the lamp, it was used successfully in the first season of the trigonometrical operations in Ireland. It was originally intended to give this instrument a divided circle, by which its direction could be fixed; but as this was not effected, a theodolite was necessary in conjunction with it, and practice soon showed that if a theodolite were used, a more simple and less costly heliostat might be adopted. This accordingly was devised by Mr. Drummond before the second season; the direction being effected entirely by the theodolite, instead of being, as before, dependent partly on the theodolite and partly on the adjustments of the heliostat. The telescope of the heliostat now became useless, and it remained a simple mirror moveable in two directions, *i. e.* on a horizontal and on a vertical axis, of which the light was guided by a directing staff previously placed by aid of the theodolite. This instrument proved so satisfactory that it has ever since remained in the form adopted on the survey, and it is every season found more and more useful. By its aid several observations have been made at distances exceeding one hundred miles; and, such is its facility of direction—owing also, no doubt, in some degree to the great divergence which even the best mirrors give to reflected light—that the theodolite is now frequently dispensed with, and by a few simple distances and measurements computed beforehand, a single soldier is sent with a heliostat to some remote mountain or island, with tolerable certainty that his reflection will be seen as soon as the sun shines after he reaches it. [Drummond's Light, P. C. S.]

Mr. Drummond's original heliostat was not completed till 1825. A heliostat had also been invented by Professor Gauss, of Göttingen, in the process of a survey carried on by him in Hanover. A very simple one had also been used by the late Commander Mudge, of the Royal Navy, while surveying on the Coast of Africa in 1823-4, which consisted merely of a sextant sent forward to the station to be observed, and so adjusted as to throw the sun's light to the observer.

In the autumn of 1824 Colonel Colby made a general reconnoissance of Ireland for the purpose of fixing on the mode of survey, the choice of stations for the great triangulation, and the most fitting place for a base. He selected Mr. Drummond to accompany him on this tour. The Plain of Magilligan was chosen, and Col. Colby's attention was next directed to a fitting apparatus for the measurement.

Colonel Colby's long experience had shown him the defects of the apparatus formerly employed, and he boldly devised one altogether new, in which compensating expansions were to be used to form an unalterable linear measure. The construction of the instruments required long and careful experiments, the charge of which was confided to Mr. Drummond; and so far as was necessary to prepare the instruments for use in the field, they were performed by him or under his direction. It occurred to him that mica, which had then recently been recommended by Sir David Brewster for pendulum rods, might be applicable to this new purpose. Colonel Colby allowed experiments to be tried on that substance, but they were not satisfactory, and Mr. Drummond abandoned the idea. The apparatus was completed according to Colonel Colby's original plan, and successfully used in the base at Magilligan. In the measurement Mr. Drummond was again employed, and whenever Col. Colby was absent on other duty the charge of the operations devolved on him.

At this period of invention and improvement which preceded the commencement of the survey of Ireland, Mr. Drummond gave some consideration to the barometer, an instrument even now susceptible of improvement, but which had not then received so much attention as it has since. His favourite construction was the siphon, and he made one with his own hands, which performed remarkably well; but he was not in possession of various modes of reading which have since been used: some of which, especially Fortin's point, as now applied with a moveable scale by Newman, leave nothing to be desired, at least for the lower limb, and he devised a singular mode of bisecting a reflected image of the surface, a ghost, as he called it; but he arrived at no permanent or practical result, and at length abandoned the subject from a conviction, to use his own words, that the errors to which the barometer was liable from causes beyond control, were greater than the quantities he had been dealing with. His researches on light, and his intimacy with Professor Leslie, led him to the use of the photometer, the æthroscope, and other philosophical instruments of more or less practical utility; among others, Wollaston's thermobarometer; indeed, at this period so active was his mind and so constant his application, that scarcely an instrument existed that he did not examine and consider, with a view to render it useful for the purposes of the survey; and the elaborate collection with which the meteorological observatory on Divis was furnished, presented a singular spectacle on the mountain-top. He carefully made observations and recorded them, till a calamitous storm destroyed the observatory and all its contents together.

A severe illness which Mr. Drummond contracted from exposure during the Irish survey compelled him to return to Edinburgh, where he was unable to devote himself to study, but he had taken much pains to perfect his light, and he now began to revert to the idea that he had early formed of adapting it to lighthouses. In this he was liberally met by the corporation of Trinity-House, and to it he devoted much of his time during the following winters: the experiments he made, with their success, are detailed in the 'Philosophical Transactions' for 1830.

The Corporation of Trinity-House placed at his disposal a small lighthouse at Purfleet; and the brilliant effect of the light as seen from Blackwall, where, at a distance of ten miles, it was sufficiently strong to cast shadows, made it an object of very general interest.

Here perhaps it may be proper to notice the erroneous ground on which Mr. Drummond has received credit for the lime light. He has by some been called the inventor or discoverer of this, and when it is found to have been known before, he is by others accused of piracy. He never claimed the chemical discovery; it has been stated to have grown out of a lecture on the very subject, and it is known that the solar microscope had been exhibited several years before at the London Institution, and probably at other places, by the light of lime burnt under the mixed gases. Mr. Drummond's merit was in rendering practically useful a recondite experiment,—by devising a means of procuring and using without danger agents so turbulent as the mixed gases, making the apparatus sufficiently portable and simple to be employed in the circumstances of exposure required for the survey, and, perhaps more than all, for the happy idea of using this minute spherule of concentrated light as the radiating focus of a parabolic mirror.

But the original object of the lamp, its application to lighthouses, presents difficulties which have yet to be overcome. The abstraction of Mr. Drummond's attention at the moment when he was nearest to success, must, so far as the light is concerned, be considered matter of regret; with its projector it has dropped, but if it be practicable, ingenuity will doubtless sooner or later be directed to render it available, and the Drummond light may yet cheer the home-bound mariner from the Skellig or the Tuskar.

Mr. Drummond lived on terms of intimacy with Mr. Bellenden Ker who was employed in the preparation of the details relating to the Reform Bill, and by him was mentioned to Lord Brougham, then the Lord Chancellor, as a person eminently qualified to superintend the very laborious operations necessary to the perfecting the schedules and laying down the boundaries to the old and the new boroughs. Lord Brougham was previously well acquainted with his talents and attainments. Mr. Drummond, on the recommendation of Lord Brougham, was appointed to this commission, not however without some severe opposition from one of his colleagues, who doubted much as to the propriety of putting at the head of so important a department a young lieutenant of the Engineers. He however more than justified the expectation formed by his patron.

We shall not enter into any detail of his labours; it is sufficient to state that whatever he did met with the most complete approbation of the ministers of the day.

When the Reform Bill was passed, Mr. Drummond returned to his duties on the survey, and he had made preparation for giving an account of the base before adverted to, when he was again called into public life by being appointed Lord Spencer's private secretary. On the dissolution of the government, he received a pension of 300*l.* a year, obtained for him by Lord Brougham, his constant friend.

In 1835 he was made under-secretary for Ireland; he much distinguished himself in the report on railways in Ireland, being at the head of the Commission. We shall not attempt to trace his labours as a politician or on the railway commission, but his talents and assiduity were admitted by all, even his strongest political opponents. He laboured incessantly at his duties, and probably hastened his death by his continued application. This took place April 15, 1840, 'in the plenitude of mental power and maturity of knowledge, beloved in private and esteemed in public.' No better estimation of his character can be given as an upright and virtuous man, when it is stated that Lord Spencer wrote to the person who states this, that it was 'one of the most pleasing recollections of his political life that it had made him acquainted with Drummond.' And whilst this article was passing through the press, Lord John Russell, in the House of Commons, adverting to a celebrated remark of Mr. Drummond's when in Ireland, that property had its duties as well as rights, said he was proud to name him as his ever-to-be-lamented friend. Soon after his death there was a subscription for a statue, which has been executed at Rome, to be placed in Dublin.

(See *Mem. in Papers connected with Duties of the Royal Engineers*, vol. iv.—MSS.)

DRUMMOND'S LIGHT. The difficulty of distinguishing the stations chosen for the angular points of the triangles in a geodetical survey, when those stations are many miles asunder, renders it necessary to have recourse to illuminations even in the day-time; and the late Captain Drummond, of the Royal Engineers, invented a heliostat which reflected the sun's rays in sufficient abundance to render the station which was to be observed visible.

This was a plane mirror of a rectangular form and mounted on a stand with joints by which it could be fixed at any angle with the horizon. On the stand was a telescope which was capable of being moved horizontally, with the mirror, and directed to the distant station, while another telescope was directed to the sun. The adjustments of the mirror were such that, when the telescopes were directed, as has been said, the face of the mirror reflected the rays of the sun on the distant station, and illumined it sufficiently to render a mark there visible in the telescope of the theodolite by which the required angle was to be taken.

When it was required to observe the angles subtended between distant stations at night, the white or blue lights were first employed in this country; the materials being fixed, at the station, at times agreed upon by the parties employed in performing the operations: Argand lamps, with parabolic reflectors, were used by the French, and subsequently by the English geodists; but a light which Captain Drummond obtained has been found to exceed in brilliancy any of the others. This is produced by placing a ball or disk of lime, about a quarter of an inch in diameter, in the focus of a parabolic mirror, at the station to be rendered visible, and directing upon it, through a flame arising from alcohol, a stream of oxygen gas. (*Philosophical Transactions*, 1826, p. 324.)

The cistern containing the alcohol is supported on a stand, behind the reflector, and is connected by a tube of caoutchouc with the lower part of a hollow stem supporting the upright wire at the top of which is fixed the ball of lime on a level nearly with the cistern: the spirit ascends in the stem, and afterwards, through three or more tubes, to the ball. The vessel containing the oxygen gas is connected, by a flexible tube, with an orifice in a cylindrical box on the same stem, from whence it ascends through three flexible caoutchouc tubes to the ball, after passing with friction through three small cylinders. The whole apparatus is attached to a stand which carries the mirror; and adjustments are provided by which the ball may be placed exactly in the focus of the mirror. The intensity of the flame is from sixty to ninety times as great as that of an argand burner, while the expense is only about ten times as great. The lime made from chalk is preferred to any other; and such is the brilliancy, that stations above sixty miles from one another have been very distinctly visible even in hazy weather.

Captain Drummond suggested in a paper which was printed in the 'Philosophical Transactions' for 1830 (p. 383) that burning lime should be employed for lighthouses; and he proposed that, instead of alcohol, hydrogen gas should be employed with the oxygen gas. The gases are to proceed from separate vessels, or gasometers, and enter a chamber through a series of small apertures: the united gases are then to pass through two or three pieces of wire gauze, and issue in two streams against the ball or disk of lime. To prevent the latter from wasting too rapidly in one place it is made to revolve once in a minute; and in order to keep up a constant light, it is proposed to have an apparatus by which a number of balls may be successively made to fall in the focus of the mirror.

A light of this kind may also be employed as a signal in determining the difference between the longitudes of stations.

DRYAS, a genus of plants belonging to the natural order Rosaceæ, and to the tribe Dryadeæ. It has the calyx 8-9-cleft, in one row; 8-9 petals; numerous stamens; the fruit composed of numerous small nuts, tipped with the persistent hairy styles, which are straight at the extremity, and aggregated on a dry receptacle; the seed ascending. The species are herbs or under-shrubs, with the stipules adnate to the sides of the petioles.

D. octopetala has crenate-serrate obtuse leaves, the sepals three or four times as long as broad, more or less pointed, the base of the calyx hemispherical. This plant has white flowers, with a woody prostrate stem and simple leaves with a woolly pubescence beneath. It is a native of Alpine districts of Europe, and is found on the mountains of Scotland and Ireland, and in Yorkshire in England.

D. depressa has crenate-serrate obtuse leaves, the sepals twice as long as broad, and blunted and rounded at the end, the base of the calyx truncate and nearly flat. This species has only been found at Ben Bulben, in Sligo, and has been recently described by Babington in the 'Annals of Natural History.' There are three other species described, one a native of Greenland, and two natives of North America. They are all evergreen prostrate plants. When cultivated they thrive best in a border of peat soil. They may be propagated by dividing the roots, or by seeds. They may be also planted in pots as other Alpine plants.

(Babington, *Manual of British Botany*; Don, *Gardener's Dictionary*.)

DRYOPS, the name given by Olivier to a genus of pentamerous coleopterous insects of the family *Clavicornes*. The type is the *Dermestes auriculatus* of Geoffroy, a little oblong grey sluggish beetle, not uncommon in Europe in the neighbourhood of watery places. Fabricius changed the name of this genus into *Parnus*. It includes fourteen species, of which seven are American and seven European. The name *Dryops* was applied by Fabricius to another genus of *Coleoptera*, of which the *Œdemera femoralis*, a Swiss insect, was the type. Changes of this kind are highly censurable, increasing as they do the confusion arising from a complicated synonymy.

DUAREN, or DUARE'NUS FRANÇOIS, a French lawyer, was born about the year 1509. His youth was chiefly devoted to literature; and he is said to have acquired the rudiments of his professional education from conversation with M. Budé, Maître des Requêtes at Paris, to whose children he was employed as tutor. He afterwards taught law at Bourges, where in his old age, as defender of the established system of jurisprudential instruction, he carried on a long controversy with Cujacius, then in his youth. This dispute, of a kind so frequently exhibited when a rising genius invades old settled principles, was conducted with so much animation between the factions, headed by these two leaders, that it was compared to a civil war. Cujacius acknowledged that to the exertions he had to make in this controversy he owed much of his subsequent legal knowledge and critical discrimination.

Duaren died at Bourges in 1559. His works were published at Leyden, in 1584, in two volumes folio; and there are subsequent editions. Some of his minor works are published in the 'Tractatus Tractatuum.' There is a Memoir of him in Taisand's *Les Vies des plus célèbres Jurisconsultes*.

DUCCIO DI BUONINSEGNA, a celebrated old painter of Siena, and one of the earliest of the Italian painters, was born in or near Siena, in the latter half of the thirteenth century. He signed himself Duccius, or Magr. Duccius; Buoninsegna, or Segna, was the name of his master or father, who was still living in 1308. There are some of his works in the Siena Academy.

Duccio was to the school of Siena what Cimabue was to that of Florence. His active career was probably between 1285 and about 1315; he is mentioned in the Siena archives of 1285, when he may have been about twenty-five or thirty years of age; and he is mentioned also as late as 1311, when he completed his great work, the celebrated altarpiece of the cathedral, which he commenced in October, 1308 This picture was the most extensive production of its class in its time, and cost, including gold and ultramarine, about 3000 florins, an immense sum. Duccio's portion, however, was small, though probably enough: it was only sixteen pence or soldi per day; but at this time ten soldi would buy a picture. The picture was on a pannel made of poplar and chesnut, covered over with canvas which was primed with plaster. It was carried in procession to the cathedral, and placed on the high altar with great ceremony. As the altar was free on all sides, Duccio painted the altarpieces on both sides: on the principal side, or that facing the people, are represented in large figures the Madonna and child, surrounded by saints and angels and the four patrons of Siena; on the other side is a series of small pictures illustrating the history of the passion of Christ, in figures about six inches high, all executed with great skill and surprising care, but in the Byzantine style of design. It was removed from the altar in the early part of the sixteenth century to give place to a tabernacle, and was afterwards cut in two, and the halves were placed in the choir where they still remain.

There are other works by Duccio extant; but Rumohr has shown Vasari's statement respecting him and the pavement of the cathedral of Siena to be incorrect. The first mention of the pavement in the archives is in 1445, more than a century after the death of Duccio. Vasari's account of him is altogether worthless. Vasari states that he was the artist of some of the decorations of the pavement, and was the inventor of the peculiar style in which the figures are executed, which he terms gray in gray. But these figures are in various styles: some in a species of niello, and others in a kind of mosaic; and they were executed at different periods by various artists, and all apparently subsequently to 1445. (See Rumohr, *Italian Researches*, vol. ii., p. 4, et seq.) Titius, vicar-general of Siena, and Duccio's contemporary, says of him, that as many painters proceeded from his studio as the warriors who of old descended out of the Trojan horse. The year of his death is not known; Della Valle supposes he died about 1340; Rumohr places his death upwards of twenty years earlier.

(Von Rumohr, *Italienische Forschungen;* Vasari, *Vite de' Pittori*, &c., ed Schorn; Della Valle, *Lettere Sanesi*, ii. 75, 76; Lanzi, *Storia Pittorica*, &c.)

DUCHANGE, GASPARD, an able French etcher and engraver, was born at Paris in 1662, and died there at the advanced age of ninety-four. He was the pupil of Jean Audran, and was one of the best historical and portrait engravers of his period. He was, according to Watelet, the best of all engravers in representing female flesh. Three of his most celebrated works were the Io, Danaë, and Leda of Correggio, of which he afterwards destroyed the plates on account of their indelicacy. He engraved until his ninety-first year, and his works are considerably numerous.

(Watelet, *Dictionnaire des Arts, &c.;* Huber, *Manuel des Amateurs, &c.*)

DUDLEY LIMESTONE, an equivalent term for the Wenlock limestone of the Silurian system.

DUFRESNOY. [Fresnoy, Du, P. C.]

DULCAMA'RA. [Solanum Dulcamara, P. C.]

DUPONCEAU, PETER S., LL.D., was born in the Ile de Rhé, in France, probably between 1750 and 1760. When he had finished his studies in his native province, he went to Paris, apparently with no other prospects than those of a literary adventurer; and there he made the acquaintance of many of the men of letters of the time, among others of Court de Gebelin, the author of the celebrated work entitled 'Le Monde Primitif,' &c., who took him into employment as his secretary. In this situation he was found, in the year 1777, by the Baron de Steuben, in passing through Paris on his way to embark for America, whither he was proceeding to take part in the insurrection of the English provinces that had just broken out. The German volunteer proposed to the young Frenchman to accompany him in the double quality of secretary and aide-de-camp, and, Duponceau having accepted the offer, they set out together. He served four campaigns in the American army; and after the peace in 1783, he was appointed by the American government to a place in the office of the Secretary of State for Foreign Affairs. In this line of employment he remained till about the beginning of the present century, when, in the hope, we are told, of acquiring a more independent position, he betook himself to the study of the law, and in due time commenced practice. But after some years he retired from the bar, and devoted himself to literary researches. These particulars we learn from a notice prefixed to Duponceau's 'Mémoire sur le Système Grammatical des Langues de quelques Nations Indiennes de l'Amérique du Nord,' by M. J. B. B. Eyriès, under whose care the work was printed, in 8vo., at Paris, in 1838. This Mémoire, to which a prize founded by Count Volney had been adjudged by the Institute of France in 1835, contains an account and examination of the languages of what the author denominates the Algonquin races, or the tribes calling themselves the Chippeways or Ojibbeways. These form, according to Duponceau, one group of the Indian tongues of North America, as those of the Iroquois, the Sioux, the Esquimaux, and the aborigines of Florida, severally form other groups or families. Their great divisions are into the Chippeway, the Lenni-Lénâpé, and the Mohegan. Duponceau's examination is very elaborate, and appears to be acute and sensible; his work extends to nearly 400 pp., without including a long preface running to above 70 more. The author, upon his success in gaining the Volney prize, was made a correspondent of the Institute; and he was also a member of several other European literary societies, as well as president of the American Philosophical Society (in which office, previously held by Franklin, Rittenhouse, and Jefferson, he succeeded Chief Justice Tilghman, in 1828), and of the Society of History and of the Athenæum of Philadelphia. M. Eyriès adds that Duponceau had translated from the German MS. the Lenni-Lénâpé Grammar of Zeisberger, and the Swedish work of Campanius on the district of North America formerly called New Sweden, now forming part of the state of Pennsylvania. If these works have been published, we have not met with them. The only other works of Duponceau that we have seen are the following:—'A Dissertation on the Nature and Extent of the Jurisdiction of the Courts of the United States,' 8vo., Philadelphia, 1834; 'A Brief View of the Constitution of the United States,' 8vo., Philadelphia, 1834; and 'A Dissertation on the Nature and Character of the Chinese System of Writing,' 8vo., Philadelphia, 1838. The two legal tracts are discourses of little pretension, addressed to the students of the Law Academy of Philadelphia, of which Duponceau was for many years provost: the object of the philosophical disquisition, of which there is a copy in the British Museum, presented by the author, is to refute the common notion that the Chinese written characters do not in any sense represent words, but only ideas, and the inference thence deduced, that they may be read and made use of by other nations who do not understand the Chinese spoken language—as for instance by the Japanese and Coreans. Duponceau shows this to be impossible, as well from the nature of language generally as from the true nature of the Chinese writing, which, although neither alphabetic nor syllabic, he explains to be still lexicographic, or strictly representative of particular vocables with their grammatical accidents (differing in every two languages), and not merely pictorial or vaguely indicative of ideas or things, like the writing (improperly so called) of the Mexicans, a system adapted only to the rudest and most limited purposes. This able man, whose works are all, as far as we have examined them, marked by careful research and sound information, as well as by just and independent thinking, died at Philadelphia, on the 2nd of April, 1844.

DUPUYTREN, GUILLAUME, Le Baron, was born at Pierre-Buffière, a little village of the department of Haute-Vienne, in France, on the 5th of October, 1777, or 1778. His parents were poor, and at the age of three years he was stolen from them by a lady of rank, who wished to adopt him as her son. He was however returned to his parents, and received his early education at the college of Magnac-Laval. During one of the college vacations, whilst he was playing in his native village when a troop of cavalry passed through, one of the officers was much struck with the appearance of young Dupuytren, and being pleased with his answers to his questions, obtained his own and his parents' consent to take him with him to Paris, and to educate him. The officer had a brother in the Collége de la Marche, under whose care Dupuytren was placed. Here he had a brilliant career, and determined on pursuing medicine as a profession. He commenced the study of pharmacy under Lagrange and Vauquelin, and also attended the dissecting room. He is described at this time as occupying a room with a fellow student, the furniture of which consisted of three chairs, a table, a sort of bed on which the friends alternately reposed, and their means were so scanty that they were obliged to live on bread and water. During this period he always commenced his work at four o'clock in the morning.

In the month Frimaire of the year three of the Republic of France (the end of 1794) a new school of medicine was formed in Paris under Fourcroy. The office of prosector as well as the chairs of the professors were given by concours; for one of these positions Dupuytren contended, and was placed first on the list. His emolument was barely sufficient to keep him in health. During his need he was visited by Saint Simon, who, after stating to him his views of society, would have presented him with two hundred francs to relieve his necessities, but Dupuytren refused it. In 1801 he contended with M. Dumeril for the position of chef des travaux anatomiques, which he lost by one vote; but a few months after, Dumeril having been appointed to a professorship, the place was given to Dupuytren.

Up to this time morbid anatomy had only been pursued in the same manner as descriptive anatomy. Little had been done towards regarding the appearances of bodies after death as the result of certain definite actions in life; and the facts recorded by Bartholin, Bonet, Manget, Morgagni, and Lieutaud, had never been systematised, nor any general principles deduced from them. Dupuytren saw this, and devoted himself with ardour to pathological anatomy. He however determined to connect this branch of inquiry with surgery. The results of his labour were not however published by himself, as indeed very little that he has done has ever been, but appeared in a work by M. Marandel, entitled 'Essai sur les Irritations,' Pâris, 1807. In this work the organic lesions of the body are distributed into species, genera, orders, and classes; and although the work contains many errors of observation, and much hasty generalization, it must be regarded as a successful effort toward forming a science of morbid anatomy.

In 1803 Dupuytren took his degree in the faculty of medicine. On this occasion he wrote a thesis on some points of anatomy, physiology, chemistry, and pathological anatomy. This thesis contained important statements of facts and deductions. The principal subjects were, the structure of the various canals of the bones, the use of the lateral ligaments, the nature of the chyle, and on the nature of the morbid formations called false membranes. It was published in Paris in 1804. The same year a society was also constituted in the faculty of medicine for the purpose of discussing and publishing papers on medical subjects. From 1804 to 1821 this society published seven volumes, under the title 'Bulletin de la Faculté de Médecine de Paris, et de la Société établie dans son sein,' 8vo. The bulletins were drawn up by Merat and Dumeril, and contain a great number of reports and memoirs which had been communicated to the society by Dupuytren. Among the most important were papers on the influence of organic lesions on health; a description of several monstrous fœtuses; description of two children, one a dwarf, the other a giant; and on the cause of death in drains and *fosses d'aisance*. The result of his researches on this last subject led to important alterations in the construction of drains, &c., so as to secure a more perfect ventilation, and thus the frequent occurrence of death amongst the workmen has been prevented. In his researches on this subject he was assisted by Thénard the chemist, who was his intimate friend. Thénard also assisted him at this time in some researches upon the nature of diabetes mellitus. Although the surgeon and the chemist arrived at no satisfactory conclusions with regard to this disease, they observed and recorded many important facts. The result of their investigations was published in the 'Bulletin' for 1806.

The same year, 1803, a vacancy having occurred in the office of assistant-surgeon at the Hôtel Dieu, Dupuytren was a candidate. This office was given to Dupuytren after examination by public concours. In 1811 Sabatier died, who had long filled the chair of surgery with the highest reputation. The concours for this office took place in 1812, when Dupuytren, Roux, Tartra, and Marjolin were the candidates. The examination consisted of written replies to certain surgical and anatomical questions, a defence by each of the candidates of his own particular positions, operations upon the dead body, and a thesis. Dupuytren was successful. The subject of the thesis was the operation of lithotomy. That presented by Dupuytren was published in Paris, with the title 'De la Lithotomie; Thèse présentée au Concours pour la Chaire de Médecine opératoire,' 4to. In 1815 he was transferred to the chair of clinical surgery, which he held till his death. In 1818 he was advanced to the post of senior surgeon to the Hôtel Dieu.

Although it would be difficult to point out a single department of surgery or morbid anatomy on which the views, opinions, and observations of Dupuytren are not known, yet he has left no record of these in works written by himself. During the twenty years, however, that he held the office of professor of clinical surgery at the Hôtel Dieu, his lectures were published in the various French medical periodicals, and many courses have been also published in the English medical periodicals. A collection of them has also been published in Paris by a society of young medical men, under the title 'Leçons Orales de Clinique Chirurgicale, faites à l'Hôtel-Dieu de Paris, par M. le Baron Dupuytren, recueillies et publiées par une Société de Médecins,' 1832, 8vo. This work extended to four volumes, and embraces the views of Dupuytren on most of the important points of surgery. His views on morbid anatomy have been fully given by Roche and Sanson in their great work on medico-chirurgical pathology, entitled 'Nouveaux Elémens de Pathologie Médico-chirurgicale,' 5 vols. 8vo., Paris, 1833. In the 'Répertoire d'Anatomie' of Breschet and Royer-Collard, and the 'Médecine Opératoire de Sabatier' of Sanson and Beguin, the surgical and pathological views of Dupuytren have found faithful reporters.

The improvements introduced by Dupuytren in the treatment of surgical diseases were always founded on his great anatomical and pathological knowledge, and modern surgery owes much of its success to his exertions. One subject to which he turned his attention was artificial anus, and he proposed an operation in this painful state which has been perfectly successful. On this subject he presented a Memoir from his own hand to the Académie Royale de Médecine. It was published under the title 'Mémoire sur une Méthode Nouvelle pour traiter les Anus accidentels.' Besides this, and the papers before referred to, the following subjects on which he wrote are amongst those which have distinguished him both as a pathologist and surgeon:—on the Nerves of the Tongue; on the Motions of the Brain; on the Function of Absorption; on the Influence of the Eighth Pair of Nerves; on Amputation of the lower Jaw-bone; on the Ligature of Arteries; on Fracture of the Fibula; on Congenital Dislocations; on Retraction of the Fingers.

In the department of practical surgery he was eminently successful; he possessed almost entire control over his feelings; and, with great anatomical knowledge, accuracy of perception, and perfect steadiness of manipulation, his operations were regarded as the most successful of the surgical staff of the Parisian hospitals. His presence of mind never forsook him; and the difficulties and accidents which must sometimes occur in operative surgery were always made subservient to the instruction and guidance of the pupils. During his career as an operative surgeon he invented many instruments. Amongst these is the enterotome, with which the operation for artificial anus is performed, and which has rescued many victims from the grave. Other instruments of his invention are—a double-bladed bistoury, for the bilateral operation for stone in the bladder; a cataract-needle; a compressor in cases of hæmorrhage; a *porte-ligature*, and others.

His performance of his duties, as surgeon and clinical teacher, was remarkable. Although he had one of the largest private practices in Europe, and accumulated through it probably the largest fortune ever made by a medical man, he never neglected his public duties. He spent from four to five hours every morning in visiting his patients at the Hôtel Dieu, performing operations, making post-mortem examinations, giving clinical instruction, and in consultations. Every evening he returned to the hospital at six, for the purpose of visiting the worst cases and performing urgent operations. These severe duties he never intermitted, even during sickness, and when suffering from attacks of disease. These labours, however, at last told upon even his iron constitution, and in November, 1833, he first gave symptoms of decay. On the fifth of that month he was seized with a slight attack of apoplexy, which lasted only a short time, but left behind it a difficulty of speaking, as well as an inclination of the mouth towards the right side. He still continued his duties at the Hôtel Dieu; but his friends at last persuaded him to make a journey to Naples. He remained in that city till May, 1834. He resumed his visits and lectures at the hospital, and struggled on till February, 1835. He died on the 8th of the same month. He retained his intellectual faculties to the last, and, aware of his approaching end, wished that the medical paper might be read to him the evening before he died, 'in order,' as he observed, 'that he might carry the latest news of disease out of the world.' He however repudiated the suggestion that he was a sceptic in religion, and received, previous to his death, the last sacrament of the Roman Catholic Church.

In his will he left the bulk of his enormous fortune, amounting to 280,000*l.*, to an only daughter. He also left 200,000 francs for the purpose of endowing a chair of pathological anatomy. This sum being found larger than was necessary to endow merely the chair, a certain portion of the income has been appropriated to maintaining, in connection with the chair, a museum of pathological anatomy, which is called the Musée Dupuytren. He left his body, to be carefully examined, to his two friends MM. Broussais and Cruveilhier, who published a minute account of the post-mortem examination. He was buried in the cemetery of Père la Chaise, on the 10th of February. The funeral was attended by all the professors of the faculty, and deputations from the Academy of Medicine and the Institute, and the funeral car was drawn by students from the church to the tomb. Orations were delivered at the grave by MM. Orfila, Larrey, Bouillaud, Royer-Collard, and Tessier.

Although Dupuytren will ever be remembered as a clever and a brilliant operative surgeon, it is not on this that his reputation rests. It was the scientific character that he gave to his clinical instruction that placed him far above those who had preceded him, and which led to the cultivation of surgery upon principles founded on physiological and pathological inquiries, rather than on rules founded on the practice and authority of previous writers. If he has left no great works by which to judge of the value of his labours, he has yet raised up a body of enlightened practitioners of surgery in France, who in their numerous writings have ever been anxious to acknowledge Dupuytren as their master.

Although admired and venerated as a surgeon, Dupuytren was not beloved as a man. Early in life he met with one of those disappointments which, however common in society, leave durable impressions on susceptible minds. In the midst of the gaieties of Paris, and mixing in all its society, he remained a perfect anchorite, and few, if any, were permitted to know his heart. He regarded all with suspicion and mistrust, and never allowed the opinions of others to influence him in his conduct. He was susceptible to the slightest injury, and never forgot an affront. He required of others the same exactitude and excellence which he himself possessed, and would hear of no excuse for the non-fulfilment of duty. These qualities induced fear and respect in the minds of most by whom he was surrounded, but in others hatred. He thus had strong friends and bitter enemies; and it is to be feared that the activity of his enemies was in some measure the cause of that estrangement from society, and that cynical character which were the most conspicuous failings of this great man.

(*Lancet*, vol. i., 1834-5; *Eloge du Baron G. Dupuytren*, par E. Pariset; *Revue Médicale*, 1835; Callisen, *Medicinisches Schriftsteller Lexicon*.)

DURAND, JEAN NICOLAS LOUIS, author of several works on architecture, and Professor of Architecture at the Ecole Polytechnique, was born at Paris, September 18, 1760. His father was a shoemaker in such very poor circumstances that there was no other prospect for the boy than that of being obliged to follow either the same or some other manual employment. It was, however, young Durand's good fortune to be rescued from such lot by the generous interposition of a benevolent individual, who, having been struck by the boy's natural cleverness, offered to defray the expense of his education. He was, accordingly, placed in the Collége Montaigne, but quitted it much sooner than was intended, owing to the strictness of the discipline there, and to his having incurred some severe punishment. Yet, notwithstanding his disgust with the school, he had profited by the instruction which he had received, and had imbibed a taste for classical studies which he continued to cultivate. The consequence of his being thus thrown again upon his father might have been very serious, had not a sculptor who had seen several sketches and drawings by him proposed to take him (then about the age of fourteen) as his pupil. Still great as was his natural taste for drawing, it was of a kind that led him to apply with more relish to the architectural accessories of sculpture than to the human figure. While his leisure time and voluntary studies were all given to architecture, his progress in those which he was professedly pursuing did not answer the expectation of his instructor. To his mother he had confided—if not his repugnance for sculpture, his far stronger inclination for the other art; which being communicated to his first benefactor, he again exerted himself in behalf of his former protégé, and recommended him to Panseron the architect (author of 'Elémens d'Architecture,' Paris, 1772). Under him, his advance was exceedingly rapid; and within the course of about two years he became draftsman to Boulée, the King's architect, at a salary of fifty pounds sterling, which enabled him to support his mother, who had just before been left a widow in almost destitute circumstances. This connection with Boulée proved most fortunate, for besides his other practice Boulée had frequent commissions for designs from foreign courts, which gave Durand not only a wider field of practical study, but opportunities of suggesting to his principal many ideas of his own. Nor did his assiduity and ability fail to be duly appreciated by Boulée, who several times offered to raise his salary, and as he had invariably refused to accept any advance, afterwards settled an annuity upon him, which he received till his death. While with Boulée, he also attended some of the courses of instruction at the Académie Royale d'Architecture, where he joined the competitions, and in 1780 obtained the great prize, the subject being a design for a college adapted to a site whose shape was an equilateral triangle. About a dozen years later, the demand on the part of the National Convention (1793) for designs for public edifices of utility or embellishment, proposed to be erected in various parts of France, afforded Durand and Thibaud (who had become strongly attached to each other while both were with Boulée) an opportunity of displaying their talents upon a variety of subjects. They produced conjointly eleven different designs, to each of which was appended the following motto or device: 'next to the happiness of being useful to one's country, is the happiness of living unknown,'—a sentiment not a little singular, as coming from those who are supposed to be impelled to generous exertion by the hope of honourable distinction for their names,—a sentiment however which seems to be acted upon by the generality of architects, who of all artists are the least anxious to identify their own names with their works. Of those eleven designs four obtained the great prize, and are published in Detournelle's collection of 'Les Grands Prix.' After this, though the friendship between Durand and Thibaud continued unabated, they ceased to practise in concert with each other. In fact Durand practised scarcely at all during the latter and greater portion of his life, for on being appointed to the professorship at the Ecole Polytechnique, which he held for forty years, he gave himself up almost entirely to its duties, and to the self-imposed task of providing works of instruction for the pupils, and also the profession in general. Of these the most celebrated as a 'show-book,' is the 'Recueil et Parallèle des Edifices de tous Genres,' 1800, consisting of eighty-six plates of oblong or double folio size, and forming a sort of historical gallery or museum of architecture. Yet though interesting as facilitating a general view of the subject, and affording a comparison of different buildings drawn to the same scale, its real usefulness is by no means so great as it at first seems. Notwithstanding the size of the volume, which is such as to render reference to it very inconvenient, there are so many different subjects upon the same plate that they are necessarily upon a very inadequate scale, and some of them so small, that they might have been larger even on a duodecimo page. In other respects, too, they are far from being shown satisfactorily, there being seldom more than a mere general plan and elevation of each; besides which the collection is little other than a compilation of all the most celebrated, consequently the most generally known buildings. Thus, without being sufficiently popular in form and subject for the mass of the public, the work is too general in its nature for professional study except as a synopsis of the subject, and a sort of catalogue raisonné. The new edition now in the course of publication will be improved by the addition of several new plates, but they consist for the most part of subjects taken and reduced from other works—from Schinkel, Klenze, and other architects, but, rather strange to say, there is not among them all a single example from any living or recent English architect. The 'Recueil' itself contains no text, but Legrand's 'Essai sur l'Histoire Générale de l'Architecture' was published as an accompaniment to it in a separate octavo volume. Durand's other work, the 'Précis des Leçons d'Architecture,' 2 tom. 4to., is generally considered a valuable one of its kind, yet has been objected to as seeking to establish formal mechanical rules that are rather derogatory from true art. Accordingly, though greatly commended by some, his '*interaxal* system' of laying out a plan by first dividing the whole of it into a number of squares, determined by the intercolumniation adopted for the order, if there be one, has been scouted by some as a dull and plodding process, calculated only to produce wearisome monotony of arrangement, and to cramp instead of stimulating imagination. There is another publication by Durand entitled 'Partie Graphique des

Cours d' Architecture,' &c., 4to., Paris, 1821. He died at Thiais, in the neighbourhood of Paris, December 31st, 1834.

DURAND, NICHOLAS. We notice this other French architect of the same name, because he is said by Nagler to have been the father of the preceding, although he does not state that circumstance while speaking of him whom he supposes to have been the son of Nicholas. But as all other accounts agree in making *Jean* the son of a shoemaker, there can be little doubt of Nagler's having fallen into a mistake: which being the case, we hardly know how to trust his account of *Nicholas* in other respects. If it be correct he must have lived to a very great age, for though born (at Paris) in 1738, he was still living in 1824 at Châlons-sur-Marne, but whether that was just before his death is not said. He was considered one of the best architects of his time, and built the Hôtel de la Préfecture (1758) and the Porte Dauphine (1769) at Châlons; and at Langres the Hôtel de Ville (1772), the Hôtel Dieu (1774), and the Dominican Convent, which last is commended by Wiebeking as one of the best buildings of that period in France.

DURHAM, JOHN GEORGE LAMBTON, EARL OF, was born at the family seat of Lambton Hall, or, as it has been latterly called, Lambton Castle, in the bishopric of Durham, on the 12th of April, 1792. His father was William Henry Lambton, Esq.; his mother, the Lady Anne Barbara Frances Villiers, second daughter of George Bussey, fourth earl of Jersey The family is said to have possessed its manor of Lambton ever since the twelfth century, the male succession never having been interrupted since that remote date. The property was originally of inconsiderable value: the wealth of the family, arising principally from coal-mines, dates from the time of Major-General John Lambton, the late Lord Durham's grandfather, who succeeded to the estate in 1774, and died at the age of eighty-four, in 1794. He was fourth son (his three elder brothers having all died unmarried); and so was his father, Ralph Lambton, Esq. The Lambtons, however, had held an eminent place among the county gentry from the beginning of the last century; and either the head or some other member of the family represented the city of Durham in parliament from 1727 till the death of the late earl's father, at the age of thirty-three, 30th December, 1797, after he had sat in the House of Commons for about ten years. Mr. William Henry Lambton, who was, like his ancestors, a decided Whig, was an intimate friend and associate of Charles Fox, and the other leaders or chief members of his party; and he was also highly popular with his constituents.

The subject of the present notice, whose mother was remarried in 1801 to the Honourable Charles William Wyndham, third son of Charles, second earl of Egremont, and survived till 1832, was educated at Eton. On the 1st of January, 1812, he was married at Gretna Green to Miss Harriet Cholmondeley, described in the 'Annual Register' as 'daughter of the late celebrated Madam St. Alban;' and about the same time he is stated to have entered the 10th Hussars. By Miss Cholmondeley, who died 11th July, 1815, he had three daughters, who all died before himself, though not till after they had all attained the age of womanhood. On the 9th of December, 1816, he married the Lady Louisa Elizabeth Grey, eldest daughter of Earl Grey.

Meanwhile, on the vacancy occasioned by the death of Sir Henry Vane Tempest, Bart., on the 1st of August, 1813, Mr. Lambton had been returned to parliament for his native county. He very soon took a part in the proceedings of the House, his maiden speech having been delivered on the 12th of May, 1814, in seconding an unsuccessful motion of Mr. C. W. Wynne for an address to the Prince Regent against the annexation of Norway to Sweden. He continued to sit for the county of Durham so long as he remained a commoner, and, though he did not speak often, to make a considerable figure in the debates; especially distinguishing himself in 1815 by moving for the production of papers relative to the transfer of Genoa to Sardinia, and by opposing the new Corn Law Bill; in 1816, by bringing forward the subject of Mr. Canning's mission to Lisbon, and by opposing the addition made to the incomes of the royal dukes, and the continuance of the Alien and Bank Restriction Acts; in 1818, by opposing the Indemnity Bill demanded by ministers; in 1819, by his opposition to the six repressive bills brought in by the government after the great Reform meeting at Manchester; and in 1821, by his reprobation of the late proceedings against the queen, and by a plan of parliamentary reform which he submitted to the House on the 17th of April, and which, after a languid discussion of two nights, was rejected by a majority of 55 votes to 43, he himself being, by an accident, not present at the division. The leading parts of this scheme were, that the representation of the counties and universities should remain the same as it was, but that for cities and boroughs should be substituted electoral districts of 25,000 inhabitants each; that elections should not extend beyond six days; and that the duration of parliaments should be limited to three years. The subject of parliamentary reform occupied a principal share in Mr. Lambton's attention from this time, but his views underwent great modification in the course of the next ten years.

His exertions in the House of Commons, however, now began to relax under the pressure of ill health; and his name is scarcely connected with any measure of consequence down to the great and eventually successful renewal of the Reform agitation in 1830. With the generality of his party, he supported both the Canning ministry of May, 1827, and that of Lord Goderich, by which it was succeeded, in October, of the same year; and on the dissolution of the latter, in January, 1828, he was raised to the peerage with the title of Baron Durham of the city of Durham. It is said that the king insisted it should be of the city, and not of the county. We find the date of Lord Durham's patent variously given the 17th and 29th of January, 1828.

On the formation of the ministry of Lord Grey, in November, 1830, Lord Durham was made Lord Privy Seal; and the preparation of the government Reform Bill was intrusted to four persons, of whom he was one, the others being Lord John Russell, Sir James Graham, and Lord Duncannon. It is known that Lord Durham proposed the introduction of the ballot into the scheme, and persuaded his colleagues to agree with him; but the ballot was excluded from the bill as actually drawn up and brought forward in the Commons by Lord John Russell on the memorable 1st of March, 1831. A speech which Lord Durham delivered on the 28th of March, in the House of Lords, in explanation of the measure, was published. The plan reported by the four persons was also materially improved by making 10*l.* instead of 20*l.*, the qualification. He took no part in the discussion of the second Reform Bill in the House of Lords, where it was defeated on the second reading, on the 3rd of October. His eldest son, a beautiful boy, whose features will live for ever in the well-known picture by Lawrence, had died of consumption, at the age of thirteen, on the 24th of September. He spoke several times, however, in support of the third and last bill, which was discussed in the Lords in April and May, 1832, and especially made a very able speech in committee on the 22nd of May, 'on the enfranchisement of the metropolitan districts,' which was published. He lost his third daughter by his first marriage on the 12th of June, 1832, at the age of seventeen; and his second on the 3rd of January, 1833, at that of nineteen. On the 12th of March in the latter year he resigned his office in the government, and three days after was made Earl of Durham. The earldom of Durham had hitherto been considered as attached to the office of the Bishop of Durham as Count Palatine, and had never, at any rate, been otherwise bestowed. But a few years after this (in 1836) the bishop's palatine jurisdiction was abolished by the 6 & 7 Will. IV. c. 19.

In the summer of 1833 Lord Durham was dispatched on a special mission to Russia, with the object of inducing the emperor to soften the severity of the proceedings against the unhappy persons who had been engaged in the late Polish insurrection; but it was not attended with any success; and it is well known that he was never able even to mention the word Poland to the emperor. From the time of his return to England, after a few months' absence, he may be regarded as having more distinctly joined the section of the Liberal party which advocated still further reforms in the representation, and as having thus gone to a certain extent into opposition to the existing government. The difference of views that had arisen between his lordship and his former colleagues was proclaimed somewhat explosively at the great dinner given to Lord Grey at Edinburgh, on the 15th of September, 1834; and he followed up this beginning by a succession of similar exhibitions in various parts of the country during the remainder of the year. A collection of his speeches upon these occasions was afterwards published. In 1835 however he was removed from that noisy scene by being a second time sent out to Russia, as ambassador at the court of St. Petersburg; and he retained that post till the summer of 1837, and made himself, it is said, extremely acceptable to the emperor His eldest daughter died, at the age of twenty-three, in December, 1835, three months after her marriage to the Honourable John George Brabazon Ponsonby, eldest son of Viscount Duncannon.

Lord Durham's last political undertaking was perhaps his most important—the pacification of the troubles and dissensions of Canada, to which country he was sent out as High Commissioner and Governor-General, with extraordinary powers, in 1838. He arrived at Quebec on the 27th of May; but a misunderstanding or difference of views soon arose between him and the ministry at home; and, conceiving that he was not supported as he ought to be, without having been either recalled or having obtained leave to return, he re-embarked from the same port on the 1st of November following. His arrival in London on the 7th of December was speedily followed by the publication of a report addressed to the Queen, dated 'London, 31st January, 1839,' of great ability and interest, detailing the history of his colonial administration, vindicating his conduct, and explaining the principles on which he had proceeded, and on which he conceived that the management of the affairs of Canada ought to be conducted. But his unprecedented step of leaving his government without permission occasioned a rebuke, and he was not allowed to land under the usual salute. He in consequence made his wife resign her household place.

The state of his health now no longer permitted him to take any part in public affairs, at least beyond attending occasionally in the House of Lords. At last, early in the summer of 1840, he retired, with no hope of recovery, to the Isle of Wight; and he died at Cowes, on the 28th of July. A son, the present Earl and three daughters, one of whom is since dead, survived him. Lady Durham died at Genoa, in her forty-fifth year, on the 26th of November, 1842.

Lord Durham retained his popularity as a public man to a considerable extent to the last, though it was impaired by his always apologising for the Russian emperor at meetings, and by his letter to a Durham voter against out-and-out Reforms. He was much beloved by his private friends, and possessed a remarkable power of gaining the good-will and warm regard even of persons with whom he came casually into contact, or with whom he had only a comparatively slight intercourse. With a good deal of ostentation and even hauteur of demeanour when he presented himself to the public eye, his manners in private life are said to have been simple and winning; his temper was not good, chiefly owing to the irritation of bodily disease; but his heart was kind and generous; and nobody doubted his entire sincerity in the political opinions of which he was the advocate, not excepting those of them which seemed to contrast most strongly with some of his personal habits or natural tastes and dispositions, nor even those others which he was sometimes charged with being readier to preach than to act upon. It was believed that at the moment at least he always thought as he spoke. But in truth most of the inconsistency and tergiversation attributed to him was to be laid rather to the account of the excited imaginations of his admirers and followers, who interpreted his words by their own hopes and wishes. As a politician however, his most remarkable quality was certainly rather boldness than prudence; and his boldness was more impulsive, or the produce of mere temperament, than founded upon deep consideration and a steady resolute strength of character. As a statesman, it may be concluded from his whole career that he was much more largely endowed with the talent of overlooking than with that of overcoming difficulties.

(*Gent. Mag. for September*, 1840; *Peerages and other registers*; *Parliamentary Debates*; *Annual Register*; *Lord Durham's printed Speeches*, &c.)

DÜRRENBERG, the celebrated salt-mine, is in a mountain, in the duchy of Salzburg, a league from Hallein, 1067 feet above the city: it yields annually 300,000 cwt. of salt. The mine has been worked ever since the year 1123, and gives employment to a great number of men.

There are also salt-works at Dürrenberg, in the Prussian duchy of Saxony, three leagues from Merseburg. The mine at Dürrenberg was first opened in 1763, and the estate of Dürrenberg belonging to it, was purchased in 1760 by Prince Xavier, who at that time had the administration of the electorate of Saxony. The works are very extensive, the buildings being 6000 feet in length, with admirable machinery, a steam-engine, &c. These works being situated in that part of the kingdom of Saxony which was ceded to Prussia by the treaty of Vienna, May 18, 1815, a convention was concluded with Prussia in 1819, and renewed in 1828, by which 170,000 cwt. of salt are to be annually delivered to Saxony at a certain fixed price. Müller says, that the works yield annually 6000 lasts of salt, weighing 4000 lbs. each, besides a considerable quantity of salt for manure.

(Brockhaus, *Conversations Lexicon*; Stein, *Geographisches Lexicon*; Hörschelmann; Müller, *Wörterbuch des Preussischen Staates*.)

DUTY. [RIGHT, P. C.]

DYER, GEORGE, was born in London, March 15, 1755. He was educated at Christ's Hospital, where, when his standing in the school gained him access to the library, he acquired that taste for extensive reading which produced the works which will preserve his name: he was at the school from the age of seven to nineteen. While at school he was much noticed by Dr. Askew, physician to the hospital, at whose table he was a frequent guest, in company with much of the distinguished part of the literary world. It is worth note that this singular specimen of a simple mind and want of knowledge of the world around him had very early opportunities of seeing mixed society. In 1774 he entered at Emanuel College, Cambridge, and took the degree of B. A. in 1778. After being for a time usher at a free grammar school, and several others, he returned to Cambridge, not taking up his residence in college, but in the family of his friend Robinson, the dissenting minister, as tutor to his children and pupil of their father. He had by this time become a dissenter himself. Of the Life of Robert Robinson, which he afterwards wrote, Dr. Parr said that it was one of the best specimens of biography in the language. He officiated for some time at Oxford as a dissenting minister, of the Baptist persuasion; but after relinquishing this duty, and again residing for some time in Cambridge, he finally settled in London in 1792. From that time till 1830 his time was employed at first as a reporter in the House of Commons (which occupation he abandoned after two months' trial of it), afterwards as a private teacher, finally in various literary undertakings presently mentioned: at the last-named date his eyesight gradually failed, and at length he became totally blind. He died at his chambers in Clifford's Inn, March 2, 1841.

Dyer was a poet, a scholar, and an antiquarian, deeply versed in books and their history. As a poet he attracted notice, but not fame; contemporary histories of living authors call him a 'pleasing poet,' 'of considerable genius,' &c. phrases the meaning of which there is no mistaking. As a scholar he edited some plays of Euripides and an edition of the Greek Testament; but he is best known as editor, or joint editor, of Valpy's combination of the Delphin, Bipont, and Variorum editions of the Classics, in a hundred and forty-one volumes, in which all the original matter and *additamenta*, except the preface, were contributed by him. As an antiquarian, his principal works are—'History of the University and Colleges of Cambridge,' 2 vols. 8vo. London, 1814; 'Privileges of the University of Cambridge,' 2 vols. 8vo. London, 1824; the first volume containing the charters, statutes, &c., the second being a supplement to the history; and in connection with these, 'Academic Unity,' 8vo. London, 1827, being a translation with additions of the 'Dissertatio Generalis' in the second work. Dyer published many other works of less note (a list of which is in the postscript of the second volume of the 'Privileges,' &c., just mentioned), and was a large contributor to the magazines.

Dyer was a man of a remarkable simplicity of character, and not only remarkable, but remarked and recorded, and that in a singular manner. His friend Charles Lamb (so well known under the signature of Elia), and who, in the London Magazine for October, 1823, had called him 'the gall-less and single-minded Dyer,' seems to have been in want of matter for December, until he remembered that he had a friend on whose good-nature no amount of reliance was too great. Accordingly, in an article headed 'Amicus Redidivus,' he describes one G. D., with such allusions as made identification easy enough, as walking into the New River in a fit of absence, a thing which G. D. himself always denied with as much good faith as his chronicler could have wished. Some years before, in the same magazine this wicked Elia had made a supposed meeting with G. D. in a library at Oxford the substratum of another article, in which the simplicity of his friend was made the subject of many a good joke; such for instance as the following, which seems to have been that worst of all jokes, the true one: 'D. commenced life, after a course of hard study in the "house of pure Emanuel," as usher to a knavish fanatic schoolmaster at ——, at a salary of eight pounds per annum, with board and lodging. Of this poor stipend, he never received above half, in all the laborious years he served this man. He tells a pleasant anecdote, that when poverty, staring out at his ragged knees, has sometimes compelled him, against the modesty of his nature, to hint at arrears, Dr. —— would take no immediate notice; but, after supper, when the school was called together to even-song, he would never fail to introduce some instructive homily against riches, and the corruption of the heart occasioned through the desire of them, ending with "Lord, keep thy servants, above all things, from the heinous sin of avarice. Having food and raiment, let us therewith be content. Give me Agar's wish,"—and the like; which to the little auditory sounded like a doctrine full of Christian prudence and simplicity, but to poor D. was a receipt in full for that quarter's demands at least.' Mr. Dyer was as angry at these articles as it was in his nature to be; and took his revenge by informing the public, in a note to the postscript at the end of the 'Privileges,' &c., that the facetious Elia never was at Oxford. 'What, however,' he continues, 'he says of G. D. and his pursuits there is funny enough, when not too complimentary.'

The history of Cambridge is rather a sketch than a history; but it is the sketch of a man who had all the reading necessary for writing the history: and it may be added that the materials for the early annals of the university are very defective. Dyer has given a good account of his materials: it is to be wished that he had made more specific references to them in the body of the work. But it will be found, on examination, to be the work of a very honest man; for to this character he has a most unimpeachable title. That a bibliographer, whose whole life had been passed in libraries, and all whose enjoyments lay in antiquarian research, should never have acquired so much of the habit of minute description as to put the dates to his own list of his own works, will not surprise those who are acquainted with the early antiquaries. Nevertheless, the 'History of Cambridge' is a very important addition to what existed on the subject: and nothing but the opportunities of a Wood will surpass it.

It is said that Mr. Dyer left Memoirs of his own life, which, considering the extent of his acquaintance with the literary men of the commencement of this century, will probably, if ever they should be published, be a useful addition to the sources of biography.

DYNAM. In estimating the effect of mechanical labour, it is desirable to have some idea of a simple unit well fixed in the mind. All who have studied know how much advantage there is in referring every kind of pressure to weight, and measuring it by the weight which will balance it. Thus if one hundred pounds weight will bend a spring into a certain position, we have no difficulty in substituting an opposite force to the weight for the recoil of the spring at the point of application. It is equally convenient to arrive at a distinct notion of a unit of useful effect in the workmanship of machines; but it may not at first be so apparent that the thing is practicable. Nevertheless, the theory of dynamics contains the means of showing that all the effects of a given power are convertible in the following manner. Exclude friction and useless resistances, and suppose that a steam-engine, for instance, will exhaust a certain quantity of fuel in raising a ton through a hundred feet, no power being thrown away. Suppose also that the same machine, with the same fuel, will completely expend the power of that fuel in drawing a certain iron cylinder into wire of a thousand times its length. Then, if a machine could be constructed which acts by the descent of a weight, and draws wire without any loss of power, the descent of a ton through a hundred feet would just be sufficient moving power to draw out the cylinder just mentioned to a thousand times its length. We do not of course mean to say that such freedom from loss of power exists. If, for example, a certain quantity of fuel were made to raise water by a steam-engine, and the water so raised were allowed to fall upon a wheel and grind corn, it is certain that the water would not grind so much corn as the steam-engine itself directly applied to that purpose. But this arises from useless increase of resistances, and from badness of adaptation: it is impossible to make all the water in a fall produce its utmost effect upon a wheel. But what we say is, that were it possible to make adaptation perfect, there exists in the water raised exactly the same capability of grinding corn that there is in the fuel which raised the water.

This being the case, we may consider any machine as simply applied to raising a weight, and look upon the weight raised as a dynamical synonyme for any possible effect that the machine could have produced. And the theory further teaches us that the useful effect of any application of power varies jointly as the weight raised, and the height to which it is raised. Thus twice as much power must be expended to raise a double weight to the same height, or the same weight to a double height. Accordingly, the product of the number of pounds raised, and the number of feet to which it is raised, is a *relative* measure of the quantity of power. For example, a certain expenditure of force raises 70 pounds through 20 feet; what comparative expenditure will raise 120 pounds through 210 feet? The product 70×20 or 1400 is to the product 120×210 or 25200 in the proportion of 1 to 18; accordingly, the second work requires 18 times the power of the first. Whether it shall be done by 18 engines, or by an application of 18 times as much power to one engine, is merely a question of adaptation.

We can convert the above relative measurement into an absolute form by assuming as a unit one pound raised through one foot: let this be called a *dynam*, or dynamical unit. Thus in the first job above mentioned, there are 1400 dynams of work to do. Whether it be considered as 1400 pounds raised through one foot, or one pound through 1400 feet, or 100 pounds raised through 14 feet, &c. &c. matters nothing: it is 1400 times as much work as one pound raised through one foot. Thus, what is commonly called a horse power is meant by our engineers to signify 550 dynams in a second: a steam-engine which can raise one pound through 550 feet in every second is said to be of one-horse power.

This term was introduced by French writers, who called the effect of a cubic metre of water raised through one metre, a *dynamie* or *dyname*. Dr. Whewell ('Mechanics of Engineering,' Cambridge, 1841, 8vo. p. 150) proposed to naturalise the term dynam as applied to our most convenient units, the pound and the foot.

It is for want of a distinct notion of this kind that many persons fall into the error about force and its effects, which lead them to contrive perpetual motions. But independently of this, there is great practical utility in having a specific name for a quantity of work done, independently of all incidental circumstances; for something which should allow us a proper expression for the result of a quantity of fuel or other generator of force without the necessity of describing a particular mode of using the force. Watt was really the first who assumed, as a dynamic unit, the simple notion of one pound raised one foot: but he did not venture on a name, though the now common term, the *duty* of an engine, first used by him, has reference to the number of such simple units as may be obtained from the engine. The late Davies Gilbert, in his paper 'On the expediency of assigning specific names to all such functions of simple elements as represent definite physical properties' (Phil. Trans., 1827), proposed to represent the product of the pounds raised and the feet through which they are raised by the term *efficiency*. But he did not go further, and assign a name to the unit of efficiency. This simple step, which is of more importance in the propagation of clear ideas than many persons will think it to be, is due to the French writers.

DYNA'METER. [Divided Eye-Glass Micrometer, P. C. S.]

DYNAMO'METER. [Spring-Balance, P. C.]

DYTI'SCIDÆ, a tribe of pentamerous coleopterous insects, founded on the genus *Dytiscus* of Linnæus. It now includes the following genera:—*Pælobius*, *Matus*, *Coptotomus*, *Eunectes*, *Agabus*, *Ilybius*, *Colymbetes*, *Acilius*, *Hydaticus*, *Dytiscus*, *Cybister*, *Copelatus*, *Anisomera*, *Laccophilus*, *Noterus*, *Hydrocanthus*, and *Suphis*.

The insects composing these genera are almost all oval and flattened in form. They are very variable in size, some being very minute, others several inches in length. Their four posterior extremities are longer than the anterior, flattened, and ciliated. They are all aquatic insects, and organized for swimming, though at the same time capable of flying through the air with facility. They live in fresh water, and swim with great rapidity, chasing other water-insects, and seizing them with their anterior feet. Although capable of existing a long time under water, they are obliged to ascend at intervals to the surface to breathe. This they effect by remaining quiet, when their bodies, specifically lighter than the surrounding fluid, rise to the surface obliquely, their heads downwards, so that the extremity of the abdomen, at which the stigmata of the tracheæ are situated, is exposed to the air on reaching the surface. At night they fly from one pool to another, and hence are often met with in places flooded by temporary rains. The larvæ of the Dytiscidæ leave the water and bury in the earth before changing into pupæ. Thus they are at first aquatic insects, next terrestrial, and in their final stage amphibious.

The typical genus Dytiscus has engaged the attention of Dr. Aubé, who enumerates ten European, one African, and six American species.

INDEX TO THE LETTER D.

VOLUME I.

Daboecia, page 454
Dædalus [Sculpture, P. C.]
Daffodil [Amaryllideæ, P. C.; Narcissus, P. C.]
Dahl, Michael, 454
Daisy [Bellis, P. C. S.]
Dalby, Isaac, 454
Dalton, John, 455
Dammar Pine, Dámmara [Agathis, P. C.]
Dance, 456
Daniell, 457
Daniell, John Frederick, 458
Dannecker, Johann Heinrich, 459
Dapédium, 460
D'Arblay, Madame, 460
Darwaz, 461
Daucus Caróta, 461
D'Avenant, Charles, 461
Davila [Henrico Caterino Davila, P. C. S.]
Days of Grace [Bill of Exchange, P. C.]
Dean of Guild, 462
De Candolle, Augustin Py'ramus, 462
Decker, Sir Matthew, 463
Declarator, Action of, 464
Dekker, Thomas [Decker, Thomas, P. C.]
Del Credere Commission [Agent, P. C.]
Délfico, Melchiorre, 464
Delírium Tremens, 465
Delivery [Deed, P. C.]
Delorme, Philibert, 465
Delthy'ris, 466
Demand and Supply, 466
Demesne [Manor, P. C.]
Demisemiquaver, 469
Dempster, Thomas, 469
Déndrodus, 469
Denína, Carlo Giovanni Maria, 469
Denner, Balthasar, 470
Denon, Dominique Vivant, Baron, 470
Dentária, 471
Denunciation [Diligence, P. C. S.]
Deodára [Abies, P. C., p. 34.]
Departure [Pleading, P. C.]
Deposit, 471
Depression of Mercury, 471
Dercæa [Stenylytra, P. C. S.]
Derméstidæ, 471
Derrick, Samuel, 471
Design, Schools of, 471
Desmídium [Zoocarpes, P. C.]
Desmophyllum, 474
Detrusion, Force of [Materials, Strength of, P. C., p. 11.]
Devastávit [Executor, P. C.]
Devonian System, 474
Diánchora, 474
Diaper, 474
Diastase [Chemistry, P. C. S.]
Diatomáceæ [Zoocarpes, P. C.]
Dibdin, Thomas, 474
Díceras, 474
Dichobune [Anoplotherium, P. C.]
Dichroism, 474
Dictamnus [Fraxinella, P. C. S.]
Dictýocha, 475
Dictyophy'llum, 475
Dicypellium, 475
Die-Sinking, 475
Dieffenbáchia, 476
Diepenbeck, Abraham van, 476
Dies, Albert, 476
Diest, 476
Dietrich, Johann Wilhelm Ernst, 476
Differences, Equations of [Equations of Differences, P. C. S.]
Differential Equations [Equations, Differential, P. C. S.]
Digby, George, Earl of Bristol, 477
Digitária, 477
Diligence, 477
Dillenius [Sherard, P. C.]
Diluvial Formation, 477
Dimerocrinítes, 478
Díodon [Gymnodontes, P. C. S.]
Diony'sius Cato, 478
Diony'sius of Cólophon, 478
Dioscórides, 478
Dióspyros [Ebony, P. C.]
Diótis, 478
Diplacánthus, 478
Dipleúra, 478
Diplocténium, 478
Díplodus, 478
Diplópterus, 478
Diplotaxis, 478
Dipœnus and Scyllis [Sculpture, P. C., p. 126]
Dípsacus [Dipsaceæ, P. C.; Teazle, P. C.]
Dípterus, 478
Dirca, 478
Disaster, 479
Discóboli, 479
Discoídea, 479
Discovery [Invention and Discovery, P. C. S]
Dispart, 479
Disposition, 479
Dissen, Georg Ludolf, 479
Distribution of Electricity, 480
Dithyrócáris, 480
Divided Eye-Glass Micrometer, 480
Dividing Engine, 481
Division of Employments, 482
Doberan, 484
Dobson, William, 484
Docket [Bankrupt, P. C.]
Dodd, Rev. William, 485
Dodwell, Edward, 485
Dog-wood [Cornus, P. C. S.]
Dolomite, 485
Domat, or Doumat, Jean, 485
Domicile, 486
Dominis, De, Marcus Antonius, 487
Don, David, 487
Doneau, Hugues, 488
Donellus [Doneau, P. C. S.]
Donovan, Edward, 488
Door, 488
Doppelmayer, Johann Gabriel, 489
Doréma, 490
Dorigny, Sir Nicolas, 490
Dorónicum, 490
Dortmund, 490
Dossi, Dosso and Giobattista, 490
Douce, Francis, 491
Douglas, David, 491
Douma Thebáica [Doom, P. C.]
Draba, 492
Dracontium, 492
Drain Traps, 492
Drainage [Sewers, P. C.]
Dramatic Literary Property [Copyright, P. C. S.]
Drawer [Bill of Exchange, P. C.]
Drebbel, Cornelius van, 492
Dredging Machines, 493
Drevet, Pierre, 493
Drift [Detritus, P. C.; Diluvial Formation, P. C. S.]
Drill, 493
Dronero [Saluzzo, P. C.]
Drósera, 493
Drummond, Captain Thomas, 493
Drummond's Light, 496
Dryas, 496
Dryops, 496
Duaren, or Duarenus, François, 496
Duccio di Buoninsegna, 496
Duchange, Gaspard, 497
Dudley Limestone, 497
Dufresnoy [Fresnoy, Du, P. C.]
Dulcamára [Solanum Dulcamara, P. C.]
Duponceau, Peter S., 497
Dupuytren, Guillaume, le Baron, 497
Durand, Jean Nicolas Louis, 499
Durand, Nicolas, 500
Durham, John George Lambton, Earl of, 500
Dürrenberg, 501
Duty [Right, P. C.]
Dyer, George, 501
Dynam, 502
Dynameter [Divided Eye-Glass Micrometer, P. C. S.]
Dynamometer [Spring-Balance, P. C.]
Dytiscidæ, 502

E.

EAR-TRUMPET, an instrument employed to aid defective hearing, by collecting and concentrating the waves of sound, so that they may impinge upon the tympanum with increased force.

From what is stated under SPEAKING-TRUMPET, P. C., p. 321, it will be seen that there is some difficulty in distinguishing, in early notices of acoustic instruments, such as were intended to be applied to the ear, to assist in collecting sound, from such as were employed in aid of the voice, to enable a speaker to produce articulate sounds in such a manner as to insure their transmission to a considerable distance. To a certain extent indeed such instruments may be employed for either purpose, some speaking-trumpets being so formed that, if applied to the ear, they would act as hearing or ear-trumpets. The experiment of Kircher, referred to in the above-mentioned article, appears to belong rather to the history of ear-trumpets than of speaking-trumpets.

The common ear-trumpet is a conical tube of metal, the larger end of which expands like the mouth of a trumpet, while the smaller is so shaped as to enter the ear, and conduct the vibrations of sound collected at the wide end direct to the tympanum. The smaller end is frequently curved, in order that it may be applied properly to the ear while the mouth is directed forwards to receive sounds from a speaker in front of the deaf person using it. For the sake of portability, ear-trumpets are frequently made in two, three, or more portions, sliding within one another, somewhat in the same manner as the tubes of an opera-glass.

Various other instruments are employed in aid of defective hearing, some of which are much more convenient, and others more powerful, than the ordinary ear-trumpet. Among those supplied at Dr. Scott's repository for acoustic instruments in the Strand, London, we may mention the *auricle*, a little scroll-like instrument, which may be compared to a shell, formed of gold, and worn in the ear, so that nothing but the expanded mouth is visible; *ear-cornets*, which are small instruments, made of various shapes and sizes, somewhat resembling a French horn or a musical trumpet in appearance, applied to the ears and held in their place by slender springs, which may be compared in their action to the sides of a spectacle-frame; *speaking* or *conversation tubes*, which are flexible elastic tubes of India-rubber and silk, kept open by spiral wire springs, and terminating at one end in what may be termed an ear-piece, and at the other in an open bell-shaped vessel which is held before the mouth of the speaker; and *table sonifers*, which are very powerful acoustic instruments, consisting of a revolving trumpet-shaped cowl, mounted on a pedestal, which may be placed upon a table, is capable of being turned towards any part of the room where conversation may be going on, and of communicating the sound through a flexible tube to the ear of the deaf person. When flexible tubes are employed for such a purpose, their effect is greatly increased by making them of a tapered or conical shape. One ingenious instrument of the ear-trumpet kind is made in the form of a walking-stick. Another, which is held so as to reflect sound into the ear, is styled the *ear conch*, and may be termed an auxiliary ear. It is formed of a kind of metal peculiarly sonorous, and plated. The commoner kind of acoustic instruments are made of tin-plate, japanned; but the better sorts are sometimes formed of silver, or of gong-metal, which is considered the best metal for the purpose.

Hebert (*Engineer's and Mechanic's Encyclopædia*, vol. i. p. 463) quotes an opinion from Dr. Morrison, of Aberdeen, that that end of an ear-trumpet which is applied to the ear should not be made so small as to enter the ear, but should be large enough to include the whole of the external ear. This opinion is said to be sanctioned by the experience of the gentleman referred to, who, having been deaf for many years, found no relief from ordinary ear-trumpets, but found one which he had made of block-tin, on the proposed plan, answer beyond his most sanguine hopes.

EARLE, JOHN, was born at York about the year 1601. Being sent to Oxford, and entered as a commoner at Christ-church College, he was afterwards, in 1620, admitted as a probationary fellow on the foundation of Merton College. He took the degree of Master of Arts in 1624, and that of Doctor in Divinity in 1642. About 1631, when he was proctor, he was appointed chaplain to Philip earl of Pembroke, who was then chancellor of the university, and lord chamberlain of the king's household. The earl presented him to the rectory of Bishopstone in Wiltshire; and to the same influence probably he owed also his appointment to be chaplain and tutor to Prince Charles, and chancellor of the cathedral of Salisbury. Of all these preferments he was soon deprived by the civil wars. After the battle of Worcester he fled from England, and, meeting Charles II. at Rouen, was made his chaplain and clerk of the closet. Earle remained abroad during the whole exile of his master. Immediately after the Restoration he was made dean of Westminster. In 1662 he was consecrated bishop of Worcester, whence he was translated in the next year to the see of Salisbury. He continued to attend much at court; and on the breaking out of the plague in 1665, he accompanied the king and queen to Oxford, where, in University College, he died on the 17th of November in that year. His tomb stands near the high altar of Merton College Chapel. Bishop Earle was a zealous cavalier and staunch high-churchman, but is represented on all hands, by Baxter as well as others, as having been a man of moderate and kindly dispositions. He is now remembered on account of his work called 'Microcosmography, or a Piece of the World discovered, in Essays and Characters,' 8vo., 1628. This volume was several times reprinted with additions in the author's own lifetime, the eighth edition appearing in 1650. The edition by Dr. Bliss, 1811, 12mo., is the eleventh, and contains notices of the author's life and of his other works, with several small English poems of his, and specimens of his Latinity. Except these little pieces, and the Microcosmography, he published nothing but a Latin translation of the Icon Basilike; 'Εἰκὼν Βασιλική, vel Imago Regis Caroli, in illis suis Ærumnis et Solitudine,' Hague, 1649, 12mo. Wood mentions as his an unprinted Latin translation of Hooker's 'Ecclesiastical Polity,' which however has not been seen by any one in modern times. Earle's 'Microcosmography' is one of the best, as it was one of the most popular, among the brief sketches of character and manners which were so abundant in our literature for a century after the middle of Elizabeth's reign, and which, receiving the addition of narrative matter, were transformed, in the beginning of the eighteenth century, into the little novels of the Spectator and other periodical works. The bishop's portraits, especially the ethical ones, abound both in shrewdness and in humour, and are very often expressed with great terseness and epigrammatic point.

EARLOM, RICHARD, one of the most distinguished English engravers of the eighteenth century, was born in the early half of that century, and, according to Bryan, was still living in 1816. A few foreign works speak more definitely of the when and whereabouts of Earlom's birth, but they are at the same time vague and contradictory; some state that he was a native of Somersetshire, others that he was born in London about 1728. The dates of his works, which are very numerous, range between 1760 and 1790. As a mezzotinto engraver Earlom has never been equalled; his historical and other figure pieces in this line are excellent, but some fruit and flower pieces, after Van Os and Van Huysum, are of unrivalled beauty and effect. Earlom also executed many etchings and imitations of chalk drawings, the principal of which is the celebrated 'Liber Veritatis,' published by Boydell, consisting of a series of fac-similes from the original sketches of Claude Lorraine, in the possession of the Duke of Devonshire. He engraved from a great variety of masters, English and foreign, as Correggio, Ann. Carracci, Domenichino, Guido, Guercino, Carlo Dolci, Luca Giordano, S. Cantarini, Quentin Matsys, Hemskerk, Teniers, Snyders, Rubens, Vandyck, Rembrandt, Vanderwerf, Velazquez, Mengs, Zoffany, Reynolds, Loutherbourg, West, Wilson, Gainsborough, Jos. Wright, Northcote, Romney, &c. &c.

Among his masterpieces are—the Royal Academy, after Zoffany; Lord Heathfield, after Reynolds; and the Iron Forge, after Wright. There is a list of his principal works in Bryan's 'Dictionary of Painters and Engravers.'

EASTER. The present year (1845) is one of those which are made remarkable by Easter Sunday being kept in direct defiance of the statement made in the act of Parliament (24 Geo. II. cap. 23), by which it is 'the first Sunday after the *full moon* which happens upon or next after the 21st day of March: and if the full moon happens upon a Sunday, Easter Day is the Sunday after.' The act which makes this statement also prescribes rules, that is, copies the rules of the Gregorian calendar, and the tables constructed from them. According to the rules and tables, Sunday, March 23rd, is Easter Day of 1845. But the full moon is on this very day, at past 8 o'clock in the evening: so that by the explanation, Easter Day ought to have fallen on the 30th. The error arises from a mistake and an omission in the act of Parliament: Easter was never determined by the day of the 'full moon,' but by the '*fourteenth day* of the moon,' which words ought to have been written instead of 'full moon;' and moreover, the moon of the calendar is not the moon of the heavens, but an imaginary moon in advance of it, contrived for reasons we shall presently mention.

We shall in this article give as much of the history of Easter, and of the reformation of the calendar, as may explain the discussions upon this subject: referring for fuller information to an article 'on the Ecclesiastical Calendar' in the Companion to the Almanac for 1845: and to some supplemental information in the same work for 1846. The last time the discussion occurred was in 1818, at which period we cannot ascertain that the true explanation was given by any one. When it next happens, the same misunderstandings will be repeated, unless either the explanation given by the act of Parliament be altered in the mean time, or works of reference be made to contain an account free from the usual errors.

The disputes which agitated the Christians of the second century respecting the observance of Easter depended upon two questions: first, whether the feast was to be a version of the passover, to be kept on the fourteenth day of the moon, or an aniversary of the Resurrection, to be kept on the first day of the week; secondly, in what manner the full moon was to be predicted. The details of this dispute do not affect us here, except in one point. It seems clear that towards the end of the second century, the Metonic cycle of nineteen years was frequently introduced into the reckoning. It is the peculiarity of this cycle of 19 years [PERIODS OF REVOLUTION, P. C.; the explanation in METONIC CYCLE, P. C. is insufficient], that the new and full moons return to the same days of the month, generally speaking; that if, for instance, a full moon fall on the 10th of March in any year, it is most likely to fall on the same day in nineteen years, and certainly on the 9th or 11th, if not on the 10th. The astronomers, and all who predicted celestial phenomena for common use, used this Metonic cycle; several modern writers on ecclesiastical history speak as if the Christians had invented the cycle of the golden number, which is only the Metonic cycle with its commencement altered. But it is material to notice that all countries unto which Greek civilization had found its way, had their new and full moons predicted by this cycle.

The Nicene Council (A.D. 325) attempted to bring about a general usage in keeping Easter. What is left of this council is its creed, a synodical epistle, and twenty canons. Whether those canons which now exist are the genuine work of the Nicene Council is nothing to our present purpose, for they do not mention Easter at all: nor should we have noticed them here, had we not seen them cited by name in reference to Easter, to give, as it were, an impression that the council had laid down rules on the subject in a definite form. All their interference in the matter, as far as it can be collected from the earliest historians of the council, Socrates and Theodoret, is contained in one sentence of the synodical epistle, as follows—'We also send you the good news concerning the unanimous consent of all in reference to the celebration of the most solemn feast of Easter, for this difference also has been made up by the assistance of your prayers; so that all the brethren in the East, who formerly celebrated this festival at the same time as the Jews, will in future conform to the Romans and to us, and to all who have of old observed our manner of celebrating Easter.' The case is clear enough: there was a great schism between the Easterns and Westerns, and the council simply decreed that the former should adopt the usual practice of the latter. St. Ambrose, in the next generation, in a letter written A.D. 386, says that the council had got up the method of the cycle of nineteen years, which they had named *Enneadecaëteris*. That is, Ambrose was not astronomer enough to know that both the thing and the name had been current even in elementary works for hundreds of years before the council. In this, as we have mentioned, he has had followers; indeed, the necessity of accounting for the cycle of nineteen years in some way, and the want of knowledge of its astronomical history, has in a manner compelled theological writers to lay it at the door of the Nicene bishops, and thence to infer that they paid a very particular attention to the astronomical part of the settlement of Easter. But in fact their object was merely to keep the Eastern Christians from celebrating the Jewish passover; as long as this point was gained, they do not seem to have thought it necessary to interfere, even as regarded the East, with those differences of astronomical method, which they do not even mention, though they could not be ignorant that they existed in the West. And the result was as follows: from the time of the Nicene Council little or nothing more is heard about celebrating Easter on the fourteenth, instead of the Sunday after, while the disputes about the astronomical cycle of Easter recommenced almost immediately, and lasted for centuries.

Eusebius of Cæsarea, the historian, informs us in his life of Constantine that he had presented to that emperor a treatise on Easter, wherein the mystic character of that festival was explained; apparently a purely theological work. Jerome (*de Scriptor. Eccles.*) mends this statement, and informs us that Eusebius was the author of the cycle of nineteen years. Bede and others have copied Jerome, and Clavius (see the article cited at the beginning) brings forward Bede as more clearly explaining a statement of Ambrose to the same effect. Now Ambrose mentions no such thing; and meeting with the statement of Jerome since we wrote that article, we are inclined to suppose that Clavius meant to have quoted one of the contemporary saints, and wrote down a citation from the other, a supposition which would explain what must otherwise be called a disingenuous proceeding. Hence comes the current story that Eusebius and others were appointed by the council a committee to superintend the drawing up of the rule.

Shortly after the Nicene Council, there were disputes about the proper cycle for Easter. It is unnecessary here to note the various cycles which were proposed. It was not till the time of Pope Hilarius (A.D. 463) that the cycle of nineteen years obtained a permanent footing. This pontiff employed Victorinus of Aquitaine to correct the calendar, and Victorinus actually constructed the cycle of 532 years, or of 28 Metonic cycles. When Dionysius Exiguus (A.D. 530) altered the mode of reckoning, and abandoned the Diocletian era in favour of what he supposed to be the year of the birth of Christ, he adjusted the mode of reckoning employed by Victorinus accordingly, and the cycle of the latter has ever since been called Dionysian. From his time till that of the Gregorian reformation the rule was strictly observed, no disapprobation producing anything but written arguments. So that the Nicene Council neither succeeded, nor, we assert, intended to succeed, in doing more than destroying, among the great bulk of Christians, what was called the *quartadeciman* heresy, the opinion that Easter was to be kept on the fourteenth day of the moon. The settlement of the arithmetical or astronomical question is the work of Hilarius and Victorinus. Not but that these reformers considered themselves as fulfilling the intentions of the Nicene Council: in fact all parties, after the council, made it their authority; all dissentients assumed theirs to be the Nicene faith in this matter; and even the blunder of the British Parliament has been defended by supposing it to be the true intent of the assembled bishops in the fourth century.

The assumption of the so-called Dionysian cycle involved two errors. The Julian year being too long by about a day in 130 years, threw the vernal equinox back by a day in that time: while the rule of the cycle supposed that the equinox remained fixed on the 21st of March. Again, the cycle of nineteen years, which supposes 235 lunations to fill up that time exactly, was wrong in a manner which caused the new moons of the calendar to advance a day in every 300 years. The consequence was, that by the time of Pope Gregory XIII., in 1582, the equinox had receded to the 11th of March, while the calendar new moon generally fell on the fourth day following that of the real new moon. These errors were obvious enough to every astronomer. Sacrobosco and Roger Bacon pointed them out in the thirteenth century. The former says they must be borne on the authority of the council; the latter strongly recommended Pope Clement to make an amendment, and gave a reformed plan which is perfectly good. He had, and where he got it from we cannot guess, the length of the year more correctly than any of his predecessors or contemporaries. Cardinal Cusa and Regiomontanus, in the fifteenth century, pointed out the necessity of a change. Stöffler, Pitatus (who proposed the plan afterwards adopted with the leap years), Paulus Forosempronienis (Bishop of Fossombrone), and others in the sixteenth century, wrote in advocacy of the same thing. The Council of Trent sanctioned an alteration, and referred the details to the see of Rome. A plan was presented to the pope by the relatives of one Aloysius Lilius, deceased, who had occupied himself with the subject. This plan was approved of, and in 1577 a circular was forwarded to princes and universities throughout the Catholic world, stating the nature of the intended alterations, and inviting suggestions. The Jesuit Clavius [Clavius, P. C.] was the person, or the principal person, to whom the concoction of the scheme was intrusted. March 1, 1582, a bull was published, dated February 24th, 1581, abolishing the old calendar, giving a general description of the new one, and announcing that it would be fully explained in a forthcoming work. Clavius published this work, namely, 'Romani Calendarii a Gregorio XIII., Pont. Max. restituti Explicatio,' 4to. Rome, 1603; and it was reprinted in the folio collection of his works. We have nothing here to do with the alteration of the style, but only with what relates to Easter. This calendar had to undergo several severe attacks, particularly from Joseph Scaliger, Moestlinus, and Vieta [Vieta, P. C.]; but these of course produced no effect against established authority, nor, in truth, ought they to have done so in this instance. The calendar answers its purpose exceedingly well, and is, astronomically speaking, better than it was supposed to be by Clavius himself.

Referring for a full description of the details to the article in the 'Companion to the Almanac,' we shall give a slighter account of the process. Clavius held astronomical considerations to be secondary in importance to the general notions of his predecessors and contemporaries. One of these was, that it was not desirable ever to keep Easter on the same day as the Jews keep the Passover. To avoid this, he uniformly lessens the moon's age by a day, taking care, as much as possible, that all the necessary errors of the imperfect cycle shall have the same effect, namely, that of lessening the moon's age, or throwing the new moons forward. Accordingly, his new moons are seldom on the real day, generally one or two days in advance, about as much of one as of the other, and sometimes even three days in advance. It is therefore very important to remember that the moon of the calendar is not the moon of the heavens, and not even the mean moon of the astronomers. So that in the act of parliament, instead of the full moon (being the fifteenth or sixteenth day) of the heavens (the first day being that of new moon), should have been read the fourteenth day of the moon of the calendar. There is evidently a compensating effect: the fourteenth day of a moon, which begins for the most part one or two days after the moon of the heavens, is of course generally the fifteenth or sixteenth day of the moon of the heavens.

Clavius uses the Dionysian cycle in a way which we may describe as follows:—Neglecting the preceding arbitrary alteration, which may be made once for all when everything else is done, there are two things to be provided for. First, the defect of the cycle itself, the error of which is to advance the new and full moons by a day in about 300 years; Clavius took it to be eight days in 2500 years, and accordingly he allowed one day for seven periods of 300 years, and then one day for a period of 400 years, as we shall presently see. Next, the abandonment of three leap-years in every four centuries, which, though necessary for keeping the equinox at or about one day of one month, would destroy the efficiency of the cycle of nineteen years. There are then two shiftings, as it were, of the cycle necessary—arbitrary alterations of the moon's age at certain periods (we are now speaking only of the calendar moon). We shall now give a set of cycles, resembling that in Easter, P. C., from which we shall be able to make the shifts apparent, and to connect them with the above-mentioned necessary corrections. Tables of this form were not given by Clavius himself, but were published in England, we believe, by Lord Macclesfield, at the time of the discussions preceding the alteration of the style in 1752.

In the first column are the days of the month, from March 21 to April 25, and Easter may fall on any one of these days except the first. In the second column are the dominical letters, explained in Dominical Letter, P. C., and which can be found by the table there given. In leap-year, take the second letter of the year in finding Easter. Then follow certain columns, each of which has a heading to show to what years it belongs. Thus, the column headed 1700-1899 belongs to all years from 1700 to 1899, both inclusive. These columns contain the nineteen golden numbers variously dispersed. Every year has its golden number found thus: add 1 to the year and divide by 19; the remainder, or 19, if there be no remainder, is the golden number.

			1583-1699.	1700-1899.	1900-2199.	2200-2299.	2300-2399.	2400-2499.	2500-2599.	2600-2899.
March	21	C	3	14	—	6	17	6	17	—
	22	D	—	3	14	—	6	—	6	17
	23	E	11	—	3	14	—	14	—	6
	24	F	—	11	—	3	14	3	14	—
	25	G	19	—	11	—	3	—	3	14
	26	A	8	19	—	11	—	11	—	3
	27	B	—	8	19	—	11	—	11	—
	28	C	16	—	8	19	—	19	—	11
	29	D	5	16	—	8	19	8	19	—
	30	E	—	5	16	—	8	—	8	19
	31	F	13	—	5	16	—	16	—	8
April	1	G	2	13	—	5	16	5	16	—
	2	A	—	2	13	—	5	—	5	16
	3	B	10	—	2	13	—	13	—	5
	4	C	—	10	—	2	13	2	13	—
	5	D	18	—	10	—	2	—	2	13
	6	E	7	18	—	10	—	10	—	2
	7	F	—	7	18	—	10	—	10	—
	8	G	15	—	7	18	—	18	—	10
	9	A	4	15	—	7	18	7	18	—
	10	B	—	4	15	—	7	—	7	18
	11	C	12	—	4	15	—	15	—	7
	12	D	1	12	—	4	15	4	15	—
	13	E	—	1	12	—	4	—	4	15
	14	F	9	—	1	12	—	12	—	4
	15	G	—	9	—	1	12	1	12	—
	16	A	17	—	9	—	1	—	1	12
	17	B	6	17	17	9	—	9	—	1
	18	C	14	6	6	17	9	17	9	9
	19	D	—	—	—	—	—	—	—	—
	20	E	—	—	—	—	—	—	—	—
	21	F	—	—	—	—	—	—	—	—
	22	G	—	—	—	—	—	—	—	—
	23	A	—	—	—	—	—	—	—	—
	24	B	—	—	—	—	—	—	—	—
	25	C	—	—	—	—	—	—	—	—

Take the first of these columns, namely 1583-1699. Opposite to April 8 is written the number 15. This means that, from 1583 to 1699, whenever the golden number is 15, the fourteenth day of the calendar moon is the 8th of April. And so in like manner throughout these columns each golden number is written opposite the day which is the fourteenth of the calendar moon when that golden number occurs. Thus from 2600 to 2899, the fourteenth of the paschal (calendar) moon is always on the 2nd of April whenever the golden number is 16.

Let us now suppose the first column constructed. It is contrived, as before noticed, so as to make the calendar full moons follow the real ones. To keep this up, whatever alterations must be made in a cycle adapted to the real moon, the same must be made for the calendar moon. As far as 1699 no alteration is requisite, for Clavius does not make the first alteration on account of the incorrectness of the cycle, till 1800, and the year 1600 is leap-year in the Gregorian calendar as well as in the old one. The reader must remember that the cycle of nineteen years is one in which every fourth year is leap-year. As soon as 1700 comes, we have a fourth year which is not leap-year, so that the day which would have been called February 29 is called March 1, and so on. Each golden number then is written one place lower from 1700 to 1899: though it would better have represented the reason of the change if each day of the month had been written one place higher. The same thing takes place at 1800; but here Clavius put the moon back a day, or makes his calendar moon a day older, to correct the accumulated error of the cycle. But the previous step makes the calendar moon, at any given day, a nominal day younger than it would otherwise have been. These two changes destroy each other's effect in 1800, and the cycle continues unaltered till 1899. At 1900 the first change is repeated; but 2000 *is* leap-year in the new calendar, and therefore no change is then requisite. And again, though 2100 is not leap-year, yet as 300 years have elapsed, the correction for the fault of the cycle is introduced at the same time with that for the abandoned leap-year, and the two destroy each other's effects, as before. This column then is good till 2199. The next column is now easily explained: but in the next one to that, or 2400-2499, we begin with a year in which the correction for the cycle is to be made without being destroyed by that arising from abandoning leap-year. That is, the moon, on any given day, is to be a day older than it would otherwise have been. The numbers must then each be put back a day, which is seen to be done. In this manner, if it be remembered that, beginning at 1800, seven following corrections of the cycle are made at the end of periods of 300 years each, and then one at the end of 400 years—the reader would be able to construct farther cycles for himself, if it were not for one peculiarity which we now notice.

At the bottom of the columns it will be seen that there are in one or two places numbers which do not rise or fall with the rest. This was a sacrifice of uniformity to the desire of preserving one characteristic of the old calendar, namely, that the fourteenth of the calendar moon never fell on the same day of the same month at any two epochs which were within nineteen years of each other. This would have happened sometimes, owing to the corrections above described: and Clavius took a very simple method of avoiding it, which is explained in the article already cited. The effect of his method is to produce the slight departure from uniformity of alteration above noted.

It will thus be seen that in the calendar which is now in use, one, two, or even three days of error have not (provided the moon was made too young, not too old) been thought of so much consequence as either ease of calculation, or attention to existing notions upon the subject. Of this we entirely approve, and agree with Clavius in asserting that any rule which is fixed would be better than diversity of usage.

To find Easter by the preceding table, first find the golden number, and then the dominical letter. [Dominical Letter, P. C.] Take the proper column, and find out the day opposite to which the golden number stands. Go on from that day to the next *following* day which has the dominical letter opposite to it: that day is Easter Sunday. For example, take 1847. Add one, and divide by 19; the remainder is 5, the golden number. The dominical letter found in the article cited is C. In the column 1700-1899, we find 5 opposite to March 30, which is the fourteenth of the calendar moon. The next C is opposite April 4, which is Easter Sunday.

Again, to find Easter in 2384. Divide 2385 by 19, and the remainder is 10, the golden number. The dominical letter (the second) is G. In the column 2300-2399 the 10 is opposite to April 7, and the next G is opposite to April 8, which is Easter Sunday.

The dominical letter may be found by a short calculation, as follows.

I. Add one to the given year.

II. Take the quotient of the given year, divided by four, neglecting the remainder.

III. Take 16 from the centurial figures of the given year, if it can be done.

IV. Divide III. by 4, neglecting the remainder.

V. From the sum of I., II., and IV., subtract III.

VI. The remainder of V., after division by 7, is the number under the dominical letter in

G	F	E	D	C	B	A
0	1	2	3	4	5	6

But if the year be leap-year, it is the second dominical letter which is thus found.

As instances, take 1847 and 2384, as above given.

I.	1848	2385
II.	461	596
III.	2	7
IV.	0	1
V.	2307	2975
VI.	4 (C)	0 (G)

The above is for new style; for old style proceed as follows. To the number of the year add its quotient when divided by 4, and 4: the remainder, after division by 7, is to be used as the VI. of the preceding rule. Thus for 1583, we have

1583
395
4
7)1982
283 Rem. 1. Dominical Letter F

The cycle for Easter-day, old style, is given in the article Easter, P. C.

The sole authority on the subject of the Gregorian Calendar is, of course, Clavius, the authorised contriver of it, or at least the person to whom the other delegates of the Roman see (if indeed any of them took any share in the execution of the plan) intrusted the explanation of it. In his work already mentioned, he has given all the results for every year from 1600 to 5000: he thinks his rule will be correct enough as far as 8000. On the mathematical part of the calendar full information will be found in Delambre's 'Histoire de l'Astronomie Moderne,' and Lalande's 'Astronomy.'

With regard to the faulty explanation in the act of Parliament, we find that it was copied literally from the Book of Common Prayer. In this work it appeared for the first time in 1662, directly after the convocation which met at the Restoration of the monarchy had made the alterations mentioned in Liturgy, P. C. The explanation was therefore added by this convocation. Supposing the calendar moon to be spoken of, it would have been correct if the second clause had been omitted. For the calendar full moon is always the fifteenth day, and it is clear that 'the Sunday after the fourteenth, or the next Sunday if the fourteenth fall on Sunday,' is the same thing as 'the Sunday after the fifteenth, or the fifteenth itself, if it be Sunday.' Finding definitions of Easter by the fifteenth, in the second of the two ways just mentioned, to have occurred in times anterior to the Restoration, we suppose that the explanation of 1662 was the result of a confusion of the two.

EASTER-DUES. [Offerings, P. C. S.]

EASTERN EMPIRE. [Roman Empire, P. C. S.]

ECCENTRIC, in Machinery. [Eccentric, P. C. S.]

ECCLESIASTICAL COMMISSIONERS FOR ENGLAND. On the ground that it was 'expedient that the fullest and most attentive consideration should be forthwith given to ecclesiastical duties and revenues,' a royal commission was issued, dated 4th February, 1835, which appointed certain commissioners, and directed them 'to consider the state of the several dioceses in England and Wales, with reference to the amount of their revenues and the more equal distribution of episcopal duties, and the prevention of the necessity of attaching, by commendam, to bishoprics benefices with cure of souls;' and the commissioners were further directed 'to consider also the state of the several cathedral and collegiate churches in England and Wales, with a view to the succession of such measures as may render them conducive to the efficacy of the Established Church; and to devise the best mode of providing for the cure of souls, with special reference to the residence of the clergy on their respective benefices.' The commissioners were required to report their 'opinions as to what measures it would be expedient to adopt' on the several points submitted to their consideration.

The commissioners were the archbishops of Canterbury and York, the bishops of London, Lincoln, and Gloucester, the lord chancellor, the first lord of the Treasury (Sir Robert Peel), and several members of the government, with other laymen. A change in the cabinet having occurred a few months afterwards, a new commission was issued on the 6th of June, 1835, for the purpose of substituting the names of members of the new cabinet.

The four Reports presented by the commissioners were respectively dated 17th March, 1835, and 4th March, 20th May, and 24th June, 1836. A fifth Report was prepared, but it had not been signed when the death of King William IV. occurred, and it was presented as a parliamentary paper (Sess. 1838 (66), xxviii. 9).

The First Report related to the duties and revenues of bishops. The commissioners recommended various alterations of the boundaries of dioceses, the union of the sees of Gloucester and Bristol, the union of the sees of Bangor and St. Asaph, and the erection of sees at Ripon and Manchester. They calculated the net income of the bishoprics of England and Wales at 148,875*l.*, but from the unequal manner in which this revenue was distributed, the income of one-half of the bishoprics was below the sum necessary to cover the expenses to which a bishop is unavoidably subject; and to remedy this state of things, and with a view of doing away with commendams and diminishing the motives for translations, they recommended a different distribution of episcopal revenues.

The Third Report also related to episcopal matters.

The Second and Fourth Reports, and the draft of the Fifth Report, related to the cathedral and collegiate churches and to parochial subjects. They recommended the appropriation of part of the revenues of the cathedral and collegiate churches, and the entire appropriation of the endowments for non-residentiary prebends, dignities, and officers, and that the proceeds in both cases should be carried to the account of a fund out of which better provision should be made for the cure of souls.

The Commissioners stated in their Second Report that they had prepared a bill for regulating pluralities and the residence of the clergy; and in 1838 an act was passed (1 & 2 Vict. c. 106) relating to these matters.

On the 13th of August, 1836, an act was passed (6 & 7 Wm. IV. c. 77) which established the ecclesiastical commissioners as 'one body politic and corporate, by the name of the "Ecclesiastical Commissioners for England."' The number of commissioners incorporated was thirteen, of whom eight were ex-officio, namely, the archbishops of Canterbury and York, the bishop of London, the lord chancellor, the lord president of the council, the first lord of the Treasury, the chancellor of the Exchequer, and such one of the principal secretaries of state as might be nominated under the sign manual. There were five other commissioners, of whom two were bishops; and these five were removeable at the pleasure of the crown. The laymen who were appointed were required by the act to subscribe a declaration as to their being members of the United Church of England and Ireland by law established.

By an act passed 11th August, 1840 (3 & 4 Vict. c. 113), the constitution of the Ecclesiastical Commission was considerably modified by increasing the number of ex-officio members, and by other alterations. In addition to the members constituted ex-officio commissioners under the act 6 & 7 Wm. IV. c. 77, the following were by this act also appointed:—all the bishops of England and Wales, the deans of Canterbury, St. Paul's, and Westminster, the two chief justices, the master of the rolls, the chief baron, and the judges of the Prerogative and Admiralty Courts. By this act the crown is empowered to appoint four, and the archbishop of Canterbury two laymen as commissioners in addition to the three appointed under the former act. Under the former act the commissioners were removeable by the crown; but now each commissioner continues a member of the corporation 'so long as he shall well demean himself in the execution of his duties.' Lay members are required as before to subscribe a declaration that they are members of the Established Church.

Five commissioners are a quorum at meetings of which due notice has been given. The chairman, who has a casting vote, is the commissioner present first in rank; and if the rank of all the commissioners present be equal, the chair is to be taken by the senior commissioner in the order of appointment. Two of the episcopal commissioners must be present at the ratification of any act by the common seal of the corporation; and if they, being the only two episcopal commissioners present, object, the matter is to be referred to an adjourned meeting. The commissioners may summon and examine witnesses on oath, and cause papers and documents to be produced before them.

The act (6 & 7 Wm. IV. c. 77) empowers the ecclesiastical commissioners to prepare and lay before his majesty in council such schemes as shall appear to them to be best adapted for carrying into effect the recommendations contained in the five Reports already mentioned, with such modifications or variations as to matters of detail and regulation as shall not be substantially repugnant to any or either of those recommendations. The king, by an order in council, ratifies these schemes, and appoints a time for their coming into operation. This order must be registered by the diocesan registrar of the diocese within which the place or district affected by the order is situated, and it must also be published in the 'London Gazette.' A copy of all the orders issued during the preceding twelve months must be presented annually to parliament within a week after its meeting. As soon as an order is registered in the diocese, and gazetted, it has the same force as if it had been included in the acts for carrying into effect the Reports of the Commissioners.

By special enactments, and by the joint authority of the Queen in council and the Ecclesiastical Commissioners, changes of great importance have been made in relation to ecclesiastical revenues and duties.

The first act (6 & 7 Wm. IV. c. 77) is entitled 'An Act for carrying into effect the Reports of the Commissioners appointed to consider the state of the Established Church in England and Wales, with reference to Ecclesiastical Duties and Revenues, so far as they relate to Episcopal Dioceses, Revenues, and Patronage.' By this act the dioceses of England and Wales have been re-arranged, four sees have been consolidated into two, two new sees have been created, the patronage of the several bishops has been more equally divided, commendams are abolished, and the revenues of the different sees have been also more equally apportioned. The jurisdiction of archdeacons was also settled by the Act.

The second act (3 & 4 Vict. c. 113) was passed 11th August, 1840, and is entitled 'An Act to carry into effect, with certain modifications, the Fourth Report of the Commissioners of Ecclesiastical Duties and Revenues;' but its enactments also comprehend some of the propositions of the Second Report and of the draft Fifth Report. The main subject of the act is the cathedral and collegiate churches, and the application of parts of their revenues to spiritual destitution in parishes. The act made some change in the constitution of deans and chapters, suspended a large number of canonries, founded honorary canonries, abolished non-residentiary deaneries and sinecure rectories in public patronage; deprived non-residentiary prebends and other non-resident offices in cathedral and collegiate churches of the endowments formerly attached to such offices. Self-elected deans and chapters are abolished: deans are to be appointed by the crown, and the canons by the bishops. Sinecure rectories in private patronage may be bought by the Commissioners and suppressed. The profits of these dignities and offices, and sinecure rectories, are vested in the Ecclesiastical Commissioners, and are carried to a common fund, out of which additional provision is to be made for the cure of souls in parishes where such assistance is most required. Thus the act provided that a portion of the proceeds of prebends suppressed in Lichfield Cathedral should be devoted to making provision for the rector of St. Philip's, Birmingham, and for the perpetual curate of Christ Church in the same town; that the endowments belonging to the collegiate churches of Wolverhampton, Heytesbury, and Middleham should be applied to making better provision for the cure of souls in the districts with which those places are connected; and that the endowments of the collegiate church of Wimborne minster should be applied with a like object to the parish of Wimborne minster. The act empowers the commissioners to annex the whole or any part of the endowments of sinecure rectories abolished by the act or purchased to the vicarages or perpetual curacies dependent on them, when the extent of the population or the incompetent endowment of such vicarages or curacies may render it expedient. Sinecure preferments may be annexed to benefices with cure of souls. Benefices may be divided or consolidated with consent of patrons. Arrangements may be made for a better provision for the spiritual duties of ill endowed parishes by exchange of advowsons or other alterations in the exercise of patronage. When two benefices belong to the same patron, the income may be differently apportioned with his consent.

A third act was passed 21st June, 1841 (4 & 5 Vict. c. 39). Its chief object was to amend and explain the two former acts, but it contains various enactments calculated to carry out the principle of the first two acts as to various regulations and details.

In each of the acts for carrying into effect the recommendations of the Ecclesiastical Commissioners, vested interests are specially protected.

From a return presented to Parliament, it appears that, down to May 1st, 1844, the number of benefices and churches whose incomes had been augmented by the Ecclesiastical Commissioners for England, was 496, and that the annual augmentation amounted to the sum of 25,779*l*.

There is in Ireland a body styled the Ecclesiastical Commissioners, who were appointed under the act 3 & 4 Wm. IV. c. 37 ('Church Temporalities Act') and are empowered to receive the incomes of bishoprics on their becoming extinct in pursuance of the above-mentioned act.

ECCLESIASTICAL COURTS. Courts in which the canon law is administered [Canon Law, P. C.], and causes ecclesiastical determined. Coke, in treating of the distinction between temporal and spiritual causes, says:—'And as in temporal causes, the king by the mouth of his judges in the courts of justice, doth judge and determine the same by his temporal laws of England, so, in causes ecclesiastical and spiritual, as, namely, blasphemy, apostacy from Christianity, heresies, schisms, ordering admissions, institutions of clerks, celebration of divine service, rights of matrimony, divorces, general bastardy, substraction and right of tithes, oblations, obventions, dilapidations, reparation of churches, probate of testaments, administration and accounts upon the same, simony, incests, fornications, adulteries, solicitation of chastity, pensions, procurations, appeals in ecclesiastical causes, commutation of penance, and others (the cognizance whereof belongeth not to the common laws of England), the same are to be decided and judged by ecclesiastical judges according to the king's ecclesiastical laws of this realm.'

In July, 1830, a Commission was appointed to inquire into the Practice and Jurisdiction of the Ecclesiastical Courts in England and Wales. The Report of the Commissioners, which was presented in 1831, was signed by the archbishop of Canterbury, and three of the bishops, the two chief justices, the chief baron, and several other persons of authority and eminence. This report gives the most correct and authentic account which exists of—1, The nature of the ecclesiastical courts; 2, Of the course of proceeding in ecclesiastical suits; and 3, The nature of the processes, practice, and pleadings of the ecclesiastical courts. The report in question has been almost solely used in the present article, with such abridgment and slight alterations as were necessary to bring it within the requisite space which could be devoted to the subject.

The ordinary ecclesiastical courts are—1, The *Provincial Courts*, being, in the province of Canterbury, the Court of Arches, or Supreme Court of Appeal, the Prerogative or Testamentary Court, and the Court of Peculiars; and in the province of York, the Prerogative or Testamentary Court, and the Chancery Court; 2, The *Diocesan Courts*, being the consistorial court of each diocese, exercising general jurisdiction: the court or courts of one or more commissaries appointed by the bishop, in certain dioceses, to exercise general jurisdiction, within prescribed limits; and the court or courts of one or more archdeacons or their officials, who exercise general or limited jurisdiction, according to the terms of their patents, or to local custom. 3. There are also *Peculiars* of various descriptions in most dioceses, and in some they are very numerous: royal, archiepiscopal, episcopal, decanal, subdecanal, prebendal, rectorial, and vicarial; and there are also some manorial courts, which exercise testamentary jurisdiction.

The Provincial Courts of the archbishop of Canterbury, and the archbishop of York, are independent of each other; the process of one province does not run into the other, but is sent by a requisition from the court of one province to the local authority of the other, for execution, when it is necessary. The appeal from each of the provincial courts lies to the Judicial Committee of Privy Council; but before the passing of the statute 2 & 3 Wm. IV. c. 92, the appeal was to the king, and a commission issued under the Great Seal in each individual case of appeal, to certain persons or delegates, to hear and determine the matter in contest. [Delegates, Court of, P. C.]

Of the three Archiepiscopal Courts of Canterbury, the Arches Court is the first. [Arches, Court of, P. C.] This court exercises appellate jurisdiction from each of the diocesan and most of the peculiar courts within the province. It may also take original cognizance of causes by letters of request, from each of those courts; and it has original jurisdiction for subtraction of legacy given by wills proved in the Prerogative Court of Canterbury.

The Prerogative Court has jurisdiction of all wills and administrations of personal property left by persons having *bona notabilia*, or effects of a certain value, in divers ecclesiastical jurisdictions within the province. A very large proportion, not less than four fifths of the whole contentious business, and a very much larger part of the uncontested, or as it is termed common-form business, is despatched by this court. Its authority is necessary to the administration of the effects of all persons dying possessed of personal property to the specified amount within the province, whether leaving a will or dying intestate; and from the very great increase of personal property, arising from the public funds and the extension of the commercial capital of the country, the business of this jurisdiction, both as deciding upon all the contested rights, and as registering all instruments and proofs in respect of the succession to such property, is become of very high importance.

The Court of Peculiars, which is the third Archiepiscopal Court of Canterbury, takes cognizance of all matters arising in certain deaneries: one of these deaneries is in the diocese of London, another in the diocese of Rochester, another in the diocese of Winchester, each comprising several parishes; and some others, over which the archbishop exercises ordinary jurisdiction, and which are exempt from and independent of the several bishops within whose dioceses they are locally situated.

The province of Canterbury includes twenty-one dioceses, and therein the diocese of Canterbury itself, where the ordinary episcopal jurisdiction is exercised by a commissary, in the same manner as in other dioceses.

The province of York includes five dioceses, besides that of Sodor and Man, and the archiepiscopal jurisdiction is exercised therein much in the same manner as in the province of Canterbury.

The Diocesan Courts take cognizance of all matters arising locally within their respective limits, with the exception of places subject to peculiar jurisdiction. They may decide all matter of spiritual discipline; they may suspend or deprive clergymen, declare marriages void, pronounce sentence of separation à mensâ et thoro, try the right of succession to personal property, and administer the other branches of ecclesiastical law.

The Archdeacon's Court is generally subordinate, with an appeal to the Bishop's Court; though in some instances it is independent and co-ordinate.

The Archdeacons' Courts, and the various Peculiars already enumerated, in some instances take cognizance of all ecclesiastical matters arising within their own limits, though the jurisdiction of many of the peculiar courts extends only to a single parish: the authority of some of them is limited to a part only of the matters that are usually the subject of ecclesiastical cognizance; several of the peculiars possess voluntary but not contentious jurisdiction.

The total number of courts which exercise any species of ecclesiastical jurisdiction in England and Wales is 372, which may be classed as follows:—

Provincial and diosesan courts . .	36
Courts of bishops' commissaries . .	14
Archidiaconal courts	37
PECULIAR JURISDICTIONS.	
Royal	11
Archiepiscopal and episcopal . . .	44
Decanal, subdecanal, &c. . . .	44
Prebendal	88
Rectorial and vicarial	63
Other peculiars	17
Courts of lords of manors . . .	48

In 1843 the gross fees, salaries, and emoluments of the judges, deputy-judges, registrars, deputy-registrars, and all other officers in the ecclesiastical courts of England, Wales, and Ireland, amounted to 120,513*l.*, as follows:—

	£
England	101,171
Wales	4,882
Ireland	14,459

The ecclesiastical jurisdiction comprehends causes of a civil and temporal nature; some partaking both of a spiritual and civil character, and, lastly, some purely spiritual.

In the first class are testamentary causes, matrimonial causes for separation and for nullity of marriage, which are purely questions of civil right between individuals in their lay character, and are neither spiritual nor affect the church establishment.

The second class comprises causes of a mixed description, as suits for tithes, church-rates, seats, and faculties. As to tithes, however, the courts of common law can restrain the ecclesiastical courts from trying any cases of modus or prescription, if either of the parties apply for a prohibition.

The third class includes church discipline, and the correction of offences of a spiritual kind. They are proceeded upon in the way of criminal suits, pro salute animæ, that is, for the safety of the offender's soul, and for the lawful correction of manners. Among these are offences committed by the clergy themselves, such as neglect of duty, immoral conduct, advancing doctrines not conformable to the Articles of the church, suffering dilapidations, and the like offences; also by laymen, such as brawling, laying violent hands on any person, and other irreverent conduct in the church or churchyards, violating churchyards, neglecting to repair ecclesiastical buildings, incest, incontinence, defamation; all these are termed 'Causes of Correction,' except defamation, which is of an anomalous character. These offences are punished by monition, penance, excommunication, formerly, and now in place of it imprisonment for a term not exceeding six months [Excommunication, P. C.], suspension ab ingressu ecclesiæ, suspension from office and deprivation.

The canon law has been practised in the ecclesiastical courts as a distinct profession for upwards for three centuries. The rules for the admission of advocates are given in Arches, Court of, P. C. S. The residence of the judges and advocates, and the proper buildings for holding the Ecclesiastical and Admiralty Courts, are at Doctors' Commons, the site of which was purchased by some members of this body in 1567. [Doctors' Commons, P. C.] The members of the society were incorporated in 1768 by a royal charter, under the name of 'The College of Doctors of Laws exercent in the Ecclesiastical and Admiralty Courts.' The proctors discharge duties similar to those of solicitors and attorneys in other courts. [Proctor, P. C.]

The course of proceeding in these courts is as follows:—The mode of commencing the suit, and bringing the parties before the court, is by a process called a Citation, or summons. This citation, in ordinary cases, is obtained as a matter of course, from the registry of the court, and under its seal; but in special cases, the facts are alleged in what is termed an act of court, and upon those facts the judge or his surrogate decrees the party to be cited; to which, in certain cases, is added an intimation, that if the party does not appear, or appearing does not show cause to the contrary, the prayer of the plaintiff, set forth in the decree, will be granted. The party cited may either appear in person, or by his proctor, who is appointed by an instrument, under hand and seal, termed a proxy. The proctor thus appointed represents the party, acts for him and manages the cause, and binds him by his acts.

In Testamentary causes, the proceeding is sometimes commenced by a Caveat, which may be entered by a party interested in the effects of the deceased person, against the grant of probate of will or letters of administration, without notice being first given to him who enters the caveat. This caveat is then *warned* by the party who claims the representation either as executor or administrator, which is in effect a notice to the proctor who enters the caveat, that he must appear and take further steps, if he intends to continue his opposition. Both parties are then assigned by order of court to set forth their respective claims, and the suit thus commences, either to try the validity of an alleged will, or the right to administration, either under an intestacy or with a will annexed. [Administration, P. C.; Executor, P. C.]

There is another process in testamentary matters extremely useful and frequently resorted to. The executor, or other person who claims the grant of probate of a will or other testamentary instrument, may cite the next of kin and other parties interested, under an intestacy or a former will, to appear and see the will propounded and proved by witnesses; and if the parties cited do not appear and oppose the probate, they are barred from afterwards contesting its validity, unless on account of absence out of the kingdom, or some other satisfactory cause.

So again, the next of kin, or other parties entitled either to the grant of letters of administration or under a former will, may cite the executor or other person apparently benefited under a suggested will or testamentary instrument, to appear and propound it; or otherwise show cause why probate should not be granted of the suggested will of the deceased, on the ground of his having died intestate, or why probate should not be granted of a former will; and the parties cited, not appearing, are barred from afterwards setting up the will. But if probate or administration be taken in common form, without citing persons who have an adverse interest, the grant may afterwards be called in, and the executor or administrator cited, and put upon proof of his right, as if no such common form grant had issued. Again, where no grant is applied for by the person primarily entitled to it, such as an executor, residuary legatee, or next of kin, process may be taken out by any person who claims an interest in the effects of the deceased, such as a legatee, a party entitled to a distributive share of the estate, or a creditor, but he must call upon the persons primarily entitled to accept or refuse the grant, or otherwise show cause why it should not pass to such person who claims an interest. Or if a person be dead intestate, without leaving any known relations, a creditor may obtain letters of administration, upon advertising for next of kin in the Gazette and a morning and evening newspaper, provided he serves a process on the Royal Exchange and on the king's proctor, but the Crown has a right to take the grant, if it makes the claim.

In all these and similar cases, the facts must be supported by affidavit, all due notice is required to be given, and the grant is moved for before the court, at its sitting.

The mode of enforcing all process, in case of disobedience, is by pronouncing the party cited to be contumacious; and if the disobedience continues, a significavit issues, upon which an attachment from Chancery is obtained, to imprison the party till he obeys. In cases where some act is required to be done by the party cited, to exhibit an inventory and account, for instance, or to pay alimony, the compulsory process is enforced; but in some cases, where no act is necessary to be done by the party cited, the plaintiff may proceed in pœnam contumaciæ, and the cause then goes on ex parte, as if the defendant had appeared. The party cited, to save his contumacy, may appear under protest, and may show cause against being cited; such as, that the court has no jurisdiction in the subject-matter, or that he is not amenable to that jurisdiction: this preliminary objection is heard upon petition and affidavits; and either the protest is allowed, and the defendant is dismissed, or the protest is overruled, and the defendant is assigned to appear absolutely; and costs are generally given against the unsuccessful party. Either party may appeal from the decision on this preliminary point; or the defendant, in case the judge decides against him on the question of jurisdiction, and on some other questions, may apply to a court of law for a prohibition.

Some other points, such as the claim to administration among persons of admitted equal degree of kindred, objections to an inventory and account, and other similar matters, may be heard upon petition and affidavit, where the facts are not of such a nature as to require investigation in the more formal proceeding of regular pleadings and depositions, with the benefit of cross-examining witnesses.

The form of the pleadings is next to be described. These are intended to contain a statement of the facts relied upon and proposed to be proved by each party in the suit, the real grounds of the action, and of the defence.

Causes, in their quality, are technically classed and described as plenary and summary, though in modern practice there is substantially little difference in the mode of proceeding. All causes in the Prerogative Court are summary.

The first plea bears different names in the different descriptions of causes. In criminal proceedings, the first plea is termed the Articles; in form, it runs in the name of the judge, who articles and objects the facts charged against the defendant; in plenary causes, not criminal, the first plea is termed the Libel, and runs in the name of the party or his proctor, who alleges and propounds the facts founding the demand; in testamentary causes, the first plea is termed an Allegation. Every subsequent plea, in all causes, whether responsive or rejoining, and by whatever party given, is termed an Allegation.

Each of these pleas contains a statement of the facts upon which the party founds his demand for relief, or his defence; they resemble the bill and answer in equity, except that the allegation is broken into separate positions or articles: the facts are alleged under separate heads, according to the subject-matter, or the order of time in which they have occurred. Under this form of pleading the witnesses are produced and examined only to particular articles of the allegation, which contain the facts within their knowledge; a notice or designation of the witnesses is delivered to the adverse party, who is thereby distinctly apprised of the points to which he should address his cross-examination of each witness, as well as the matters which it may be necessary for him to contradict or explain by counter-pleading.

Before a plea of any kind, whether articles, libel, or allegation, is admitted, it is open to the adverse party to object to its admission, either in the whole or in part: in the whole, when the facts altogether, if taken to be true, will not entitle the party giving the plea to the demand which he makes, or to support the defence which he sets up; in part, if any of the facts pleaded are irrelevant to the matter in issue, or could not be proved by admissible evidence, or are incapable of proof. These objections are made and argued before the judge, and decided upon by him, and his decision may be appealed from. For the purpose of the argument, all the facts capable of proof are assumed to be true: they are however so assumed merely for the argument, but are not so admitted in the cause; for the party who offers the plea is no less bound afterwards to prove the facts, and the party who objects to the plea is no less at liberty afterwards to contradict the facts. If the plea is admitted, the further opposition may be withdrawn: if the plea is rejected, the party who offers it either abandons the suit, or appeals against the rejection, in order to take the judgment of a superior tribunal. When a plea has been admitted, a time, or term probatory, is assigned to the party who gives the plea, to examine his witnesses; and the adverse party is assigned, except in criminal matters, to give in his answers upon oath, to his knowledge or belief of the facts alleged. The defendant may proceed then, if he thinks proper, or he may wait until the plaintiff has examined his witnesses, to give an allegation controverting his adversary's plea. This responsive allegation is proceeded upon in the same manner; objections to its admissibility may be taken, answers upon oath be required, and witnesses examined. The plaintiff may, in like manner, reply by a further allegation; and on that, or any subsequent allegation, the same course is pursued.

In taking evidence the witnesses are either brought to London to be examined, or they are examined by commission near their places of residence. Their attendance is required by a a Compulsory, somewhat in the nature of a subpœna, obedience to which is enforced in the same way as in other cases of contumacy. The examination is by depositions taken in writing and in private by examiners of the court, employed for that purpose by the registrars. The examination does not take place upon written interrogatories previously prepared and known; but the allegation is delivered to the examiner, who, after making himself master of all the facts pleaded, examines the witnesses by questions which he frames at the time, so as to obtain, upon each article of the allegation separately, the truth and the whole truth, as far as he possibly can, respecting such of the circumstances alleged as are within the knowledge of each witness. The cross-examination is conducted by interrogatories addressed to the adverse witnesses, and when the deposition is complete, the witness is examined upon the interrogatories delivered to the examiner by the adverse proctor, but not disclosed to the witness till after the examination in chief is concluded and signed, nor to the party producing him till publication passes; and each witness is enjoined not to disclose the interrogatories, nor any part of his evidence, till after publication. In order that the party addressing the interrogatories may be the better prepared, the proctor producing the witness delivers, as before stated, a designation, or notice of the articles of the plea on which it is intended to examine each witness produced.

The examination and cross-examination of witnesses are kept secret until publication passes, that is, until copies of the depositions may be had by the adverse parties, after which either party is allowed to except to the credit of any witness, upon matter contained in his deposition. The exception must be confined to such matter, and not made to general character, for that must be pleaded before publication; nor can the exception refer to matter before pleaded, for that should be contradicted also before publication. The exception must also tend to show that the witness has deposed falsely and corruptly. The exceptive allegations are proceeded upon, when admitted, in the same manner as other pleas. They are not frequently offered, and are always received with great caution and strictness, as they tend more commonly to protract the suit and to increase expense than to afford substantial information in the cause. It is always however in the power of the court to allow further pleading in a cause; and if new circumstances of importance are unexpectedly brought out by the interrogatories, the court will, in the exercise of its discretion, allow a further plea after publication. This may also be permitted in cases where facts have either occurred or come to the knowledge of the party, subsequently to publication having passed.

The evidence on both sides being published, the cause is set down for hearing. All the papers, the pleas, exhibits (or written papers proved in the cause), interrogatories, and depositions are delivered to the judge for perusal before hearing the case fully discussed by counsel. All causes are heard publicly in open court; and on the day appointed for the hearing, the cause is opened by the counsel on both sides, who state the points of law and fact which they mean to maintain in argument: the evidence is then read, unless the judge signifies that he has already read it, and even then particular parts are read again, if necessary, and the whole case is argued and discussed by the counsel. The judgment of the court is then pronounced upon the law and facts of the case; and in doing this the judge publicly, in open court, assigns the reasons for his decisions, stating the principles and authorities on which he decides the matters of law, and reciting or adverting to the various parts of the evidence from which he deduces his conclusions of fact, and thus the matter in controversy between the parties becomes adjudged.

The execution of the sentence, in case there be no appeal interposed, is either completed by the court itself, according to the nature of the case—such as by granting probate or letters of administration, or signing a sentence of separation —or remains to be completed by the act of the party, as by exhibiting an inventory and account, by payment of the tithes sued for, and other similar matters, in which cases execution is enforced by the compulsory process of contumacy, significavit, and attachment. The question of costs in these courts is, for the most part, a matter in the discretion of the judge, according to the nature and justice of the case; and the reasons for granting or refusing costs are publicly expressed at the time of giving the judgment.

Attempts were made more than three centuries ago, to remedy the defects of the ecclesiastical courts. The earliest efforts of this kind were directed to the peculiar jurisdictions. Some of these jurisdictions extend over large tracts of country, and embrace many towns and parishes; others comprehend several places lying at a great distance apart from each other; and some only include one or two parishes. The jurisdiction to be exercised in these courts is not defined by any general law, and it is often difficult to ascertain to what description of cases the jurisdiction of any particular court extends. The commissioners appointed to revise the ecclesiastical laws, in the reigns of Henry VIII. and Edward VI., recommended that the power of the bishop, in matters of discipline, should extend to all places in the diocese, notwithstanding the exemptions and privileges of Peculiars. In the reign of Queen Elizabeth, it was proposed or talked of in convocation that parliament should be applied to, to subject peculiar and exempt rites and jurisdictions of what had belonged to monasteries to the diocesan. Nothing, however, appears to have been done.

In 1812 Sir W. Scott (Lord Stowell) brought a bill into parliament which passed the House of Commons, but was afterwards dropped in the Lords, which provided that 'the power of hearing and determining contested causes of ecclesiastical cognizance should be exercised only by ecclesiastical courts sitting under the immediate commission and authority of the archbishops and bishops, and not by inferior or other ecclesiastical courts.'

In 1832 the commissioners appointed to inquire into the practice and jurisdiction of the ecclesiastical courts, recommended a number of important changes in these courts. In 1833 the Real Property Commissioners expressed an opinion in favour of their extensive reform. In the same year a select committee of the House of Commons made a report in which similar views were urged, and in 1836 a select committee of the House of Lords adopted the same course. From 1836 until the present time several bills have been brought in for amending the ecclesiastical courts, none of which were carried. In 1836 Lord Cottenham brought in an ecclesiastical courts bill. On opening the session of parliament in 1842 a measure for the improvement of the ecclesiastical courts was announced in the speech from the throne; but the bill brought in by the government lingered through the session and was finally abandoned. In 1843 and 1844 other bills with the same object were equally unsuccessful. In the session of 1845 Lord Cottenham brought in an ecclesiastical courts bill, which was identical or nearly so with his bill of 1836. It proposed the establishment of a central court in London, to which all bills were to be sent. Surrogates to act in the towns where there are now diocesan courts, and to grant probates where the amount of property is small, but in every case the will to be sent to London to be registered. The central court to retain the power of the old courts in questions of divorce. In matters relating to church-rates the bill gave an appeal to quarter-sessions where the rate had been illegally levied; and in that of tithes the power of the ecclesiastical courts was to be abolished altogether. The criminal jurisdiction of these courts, and the power of punishing for defamation, incest, and brawling in churches, was also to be abolished. Although approved of by the Lord Chancellor, Lord Cottenham's bill met with the fate of its predecessors, and towards the close of the session it was found impossible to get it passed amidst the crowding of other bills, to which the support of the government was more directly pledged.

By a clause in 6 & 7 Will. IV. c. 77, which was an act for carrying into effect the Reports of the Ecclesiastical Commissioners of 1835, it was enacted that future appointments in any of the ecclesiastical courts in England and Wales (except the Prerogative Court of Canterbury) were not to give a vested interest in any office, nor any claim or title to compensation in case of the abolition of offices.

ECCULIO'MPHALUS, a genus of fossil Gasteropoda, from the mountain limestone chiefly. (Portlock.)

ECHINO'CHLOA (from ἐχῖνος, a hedgehog, and χλόη, grass), a genus of grasses belonging to the tribe Paniceæ. It has compound spikes secund in the whole and in each part; spikelets on one side of a flattened rachis, 2-flowered, the inferior flower rudimentary; 2 glumes, the lower small, 3-nerved, the upper as long as the flower, 5-nerved mucronate; the outer palea of the sterile flower resembling and equalling the upper glume. This is a genus of coarse grasses, of which only one species, the *E. Crus-galli*, grows in Great Britain. It is a strong coarse grass, bearing any climate better than most others, and is found in the vicinity of London.

(Babington's *Manual.*)

ECHINOLA'MPAS, a genus of fossil Echinida, from the oolitic and chalk strata. (Gray.)

ECHINO'PHORA (from ἐχῖνος, a hedgehog, and φορος, in composition signifying 'bearing'), a genus of plants belonging to the natural order Umbelliferæ, and to the tribe Smyrneæ. It has a calyx of 5 teeth, the petals obcordate with an inflexed point, the exterior large and bifid; the flowers of the ray sterile on long stalks, the central fertile and solitary; the fruit ovate terete, embedded in the enlarged receptacle; the carpels with five depressed equal striated wavy ridges; interstices with single vitta, covered by a cobweb-like membrane. The *E. spinosa*, the sea-parsnip, has been admitted into the British Flora, but it must be considered a doubtful native. It has been found in Lancashire and Kent. It is mostly an inhabitant of sandy sea-shores, and has pinnate spinose leaves, and resembles in habit and external character the Eryngium. Three other species are described. When cultivated they require a warm situation and a dry soil. They must be propagated by cuttings of the roots or stems.

(Don, *Gardener's Dictionary.*)

ECHINO'STACHYS, a genus of fossil plants, from the Bunter sandstein. (Brongniart.)

E'CHIUM (from ἔχις, a viper) a genus of plants belonging to the natural order Boraginaceæ. It has a calyx with 5 deep segments; the corolla sub-bell-shaped, throat dilated, naked, limb irregular; the stamens exserted, filaments very long, unequal, style bifid; the nuts wrinkled, attached by a flat triangular base. The species are rough, shrubby, or herbaceous plants, with lanceolate or oblong-lanceolate leaves, and blue or white flowers.

E. vulgare, Viper's bugloss, is covered with hispid tubercles, has an erect simple stem, the leaves lanceolate, 1-ribbed, the stem-leaves narrowed below, sessile, the flowers in short lateral spikes, the stamens longer than the corolla. It is a native of dry places in Great Britain and throughout Europe. It is a remarkably handsome plant. The flowers are at first reddish and afterwards become blue.

E. violaceum is a pilose-hispid plant, with an erect branched diffuse stem, the lower branches prostrate, the radical leaves oblong ovate, stalked, the stem leaves oblong narrowed from a cordate half-clasping base with lateral ribs, the spike panicled elongate simple, the stamens scarcely longer than the corolla. The root of this plant is red, and when kept in an herbarium stains the paper of a violet colour. It is a native of Jersey, also of the South of Germany, Spain, France, Italy, and the South of Taurida.

E. giganteum has a branched stem, hoary at top, with petiolate lanceolate leaves attenuated at the base; the panicles thyrsoid; the spikelets bifid. This plant is a shrub, with whitish blue flowers, and attains a height of 8 or 10 feet, and is one of the largest species of the genus: it is a native of Teneriffe.

Above eighty species of this genus have been described; they inhabit the temperate parts of all quarters of the globe, but are more especially European. A large number of the shrubby species are natives of the Canary Islands, and another entirely different group are inhabitants of the Cape of Good Hope. The great bulk of the European species are herbaceous, as well as those which inhabit South and North America. All the species are worthy of cultivation, and the European species are amongst the handsomest of the indigenous plants of Europe. The shrubby species are all greenhouse plants, and will grow in a mixture of sand, loam, and peat; and cuttings will strike under a hand-glass in this mixture. They may be also propagated by layering and by seed, which sometimes come to perfection in this country. The hardy species will grow very well in any common garden soil, and may be propagated by seeds sown in an open border, in the spring; their general treatment must be the same as other perennial, biennial, and annual plants. They are well adapted for flower borders, and afford a pleasing variety, by the different shades of blue which they exhibit.

(Don, *Gardener's Dictionary*; Babington, *Manual of British Botany.*)

EDA'PHODON, a genus of fossil Placoid fishes, from the London clay and Bagshot sand, three species. (Agassiz.)

EDICTAL LAW. The English Equity has some resemblance to the Roman Edictal Law, or Jus Praetorium or Honorarium, as it is often called. All the higher Roman magistrates (magistratus majores) had the Jus Edicendi or authority to promulgate Edicta. These magistratus majores were Consuls, Praetors, Curule Aediles, and Censors. By virtue of this power a magistrate made Edicta or orders, either temporary and for particular occasions (edicta repentina); or upon entering on his office he promulgated rules or orders, which he would observe in the exercise of his office (edicta perpetua). These Edicta were written on a white tablet (album) in black letters; the headings or titles were in red: the Alba were placed in the Forum, in such a position that they could be read by a stander-by. Those Edicta which related to the administration of justice had an important effect on the Roman law; and especially the Praetoria Edicta, and those of the Curule Aediles. That branch of law which was founded on the Praetorian Edicta was designated Jus Praetorium, or Honorarium, because the Praetor held one of those offices to which the term Honores was applied. The Edicta were only in force during the term of office of the Magistratus who promulgated them; but his successor adopted many or all of his predecessor's Edicta, and hence arose the expression of 'transferred edicts' (tralaticia edicta); and thus in the later Republic the Edicta which had been long established began to exercise a great influence on the law, and particularly on the forms of procedure. About the time of Cicero many distinguished jurists began to write treatises on the Edictum (libri ad edictum). Under the Emperors new Edicta were rarer, and in the third century of our aera they ceased. Under the Empire we first find the Edicta of the Praefectus Urbi mentioned; but these must be considered as founded on the Imperial authority (majestas principis), and to have resembled the Imperial Constitutions. Under the reign of Hadrian, a compilation was made by his authority of the Edictal rules by the distinguished jurist Salvius Julianus, in conjunction with Servius Cornelius, which is spoken of under the name of Edictum perpetuum. This Edictum was arranged under various heads or titles, such as those relating to Marriage, Tutores, Legata (legacies), and so on.

By the term Praetorian Edict the Romans meant the Edicts of the Praetor Urbanus, who was the chief personage employed in the higher administration of justice under the Republic. The Edicta which related to Peregrini (aliens) were so named after the Praetor Peregrinus; and other Edicta were called Censoria, Consularia, Aedilicia, and so on. Sometimes an Edict of importance took its name from the Praetor who promulgated it, as Carbonianum Edictum. Sometimes the Honorariae actiones, those which the Praetor by his Edict permitted, were named in like manner from the Praetor who introduced them. Sometimes an Edict had its name from the matter to which it referred. The Romans generally cited the Edicta by parts, titles, chapters, or clauses of the Edictum Perpetuum by naming the initial words, as Unde Legitimi, and so on; sometimes they are cited by a reference to their contents. Examples of these modes of citing the Edictum occur in the titles of the forty-third book of the 'Digest.' (See the title 'Quorum Bonorum.') In our own law we refer to certain forms of proceedings and to certain actions in a like way, as when we say Quo Warranto, Quare Impedit, and speak of Qui tam actions.

The Jus Praetorium is defined by Papinian (*Dig.* i. tit. i. 7) as the law which the Praetors introduced for the purpose of aiding, supplying, or correcting the law (jus civile), with a view to the public interest. The edict is called by Marcianus 'the living voice of the jus civile,' that is, of the Roman law. (*Dig.* i. tit. i. 8.) The Praetorian Law, as thus formed (Jus Praetorium), was a body of law which was distinguished by this name from the Jus Civile. or the strict law; the opposition resembled that of the English terms Equity and Law. In its complete and large sense Jus Civile Romanorum, or the Law of the Romans, of course comprehended the Jus Praetorium; but in its narrower sense Jus Civile was contrasted, as already explained, with the Jus Praetorium.

The origin of the Roman edictal Law is plainly to be traced to the imperfections of the old Jus Civile, and to the necessity of gradually modifying law and procedure according to the changing circumstances of the times. It was an easier method of doing this than by direct legislation. Numerous modern treatises contain a view of the origin and nature of the Roman Jus Praetorium, though on some points there is not complete uniformity of opinion.

(Böcking, *Institutionen*, vol. i.; Puchta, *Cursus der Institutionen*, vol. i. p. 293; Savigny, *Geschichte des Röm. Rechts*, vol. i.; Heffter, *Die Oeconomie des Edictes*, *Rhein. Mus. für Juris.* i. p. 51; E. Schrader, *Die Prätorischen Edicte der Römer*, 1815.)

EDWARDS, RICHARD, one of our earliest dramatic writers, was born in Somersetshire in 1523. He was educated at Oxford, in Corpus Christi College, where he was successively a scholar and fellow: he took his degree of Master of Arts in 1547. Removing to Lincoln's Inn, he was made, in the beginning of Elizabeth's reign, one of the gentlemen of the Queen's Chapel, and master of the children there, a post which engaged him in theatrical management. He is first heard of as a dramatic poet in the year 1564-5; and his death is said to have taken place in 1566. Although he is highly commended for his dramatic works by Puttenham (no very competent judge), who sets him down as one of the two best writers in comedy and interlude, we learn the names of no more than two of his dramas. One of these, 'Palamon and Arcite,' was never printed, and is lost: the other, 'The excellent comedie of two the moste faithfullest freendes Damon and Pithias,' was printed in a black-letter 4to. in 1571, again, in black-letter, 4to. 1582, and is included in the first volume of Dodsley's 'Old Plays.' Edwards also wrote some of the poems inserted in 'The Paradise of Dainty Devises,' 1575, reprinted in the 'British Bibliographer,' and a death-bed poem, called 'Edwards' Soul-Knell.' His name is interesting as belonging to one of the rude founders of our drama; but his surviving play, in its inartificial structure and unpoetical and undramatic details, offers little that can attract any but the student of literary antiquity. 'The serious portions,' says Mr. Collier very justly, 'are unvaried and heavy, and the lighter scenes grotesque without being humorous.'

EFT. The terms *Eft* and *Newt* are applied almost indiscriminately to all the species of lizards which are found in the British Islands. The word lizard is evidently formed from lacerta, and is comparatively modern. Eft and Newt are the old Saxon words. Eft seems to be more usually applied to the land animals, one of the most common of which is the *zootoca vivipara*, and another less common, the *lacerta agilis*, both of which are described in the article Varanidæ, P. C., pp. 132, 133. Newt is more commonly applied to the animals which inhabit ponds, wet ditches, and other damp places, such as the *triton cristatus* (the great water-newt), *lissotriton punctatus* (the common smooth newt), and other species, of which a description is given under Salamandridæ, P. C., pp. 332-336; and also in the *Penny Magazine* for 1843, p. 97 (No. 703).

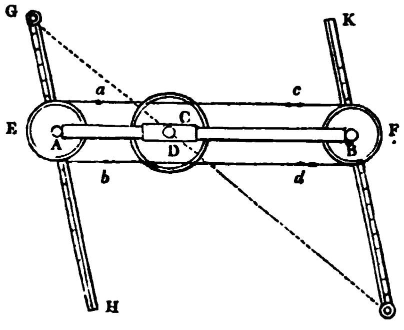
EGG-TRADE. In 1835 the value of eggs exported from Ireland to Great Britain was 68,687*l.*; and perhaps at the present time it may exceed 100,000*l.* At 4*d.* per dozen the number of eggs which this sum would purchase would be 72,000,000. From France and Belgium we imported 96,000,000 eggs in 1840; on which the duty of one penny per dozen produced 34,450*l.* Nine-tenths of the foreign eggs are from France. The departments nearest to England, from the Pas de Calais to La Manche, are visited by the dealers, and their purchases often produce a scarcity in the country markets. At most of the ports of these departments, from Calais to Cherbourg, some vessels are employed in the egg-trade. The weight of 80,000,000 eggs is not far short of 2500 tons. In the last three years the importations of foreign eggs were as follow :—

1842	89,548,747
1843	70,415,931
1844	67,487,920

The consumption of eggs at Paris is estimated at one hundred millions of eggs a year.

EGRA, a locality in Bohemia, famous for fossil Infusoria, especially Campilodiscus, which comprises nearly the whole of the white pulverulent mass. (Mantell, *Medals of Creation*, i. p. 223.)

EIDOGRAPH, from the Greek words εἶδος, a form, and γράφω, draw, is an instrument invented in the year 1821, by the late Professor Wallace of Edinburgh, and described in the 'Transactions of the Royal Society of Edinburgh,' vol. xiii. It is a species of pantograph, and, like the latter, it is used for the purpose of copying plans or other drawings on the same or on different scales.



A rod or beam AB of brass, 30 inches long and five-eighths of an inch square, and made hollow for the sake of being light, slides freely through a hollow rectangular socket C, whose length is 4½ inches; from the lower surface of this socket projects a steel pin of a conical form, and serving as an axis; the pin entering into a tube of a corresponding form which stands vertically on a cylindrical mass D of metal. The mass serves as a base for the whole instrument; and while the beam AB may slide horizontally in the socket C, it is capable of turning with the socket upon the vertical axis in the tube. Each end of the beam AB carries a short tube in a vertical position, and through this passes the conical axle of a wheel or pulley E or F, which is placed below the beam: these wheels are precisely equal in diameter, and are capable of turning freely on their centres in a horizontal plane.

The vertical edge of each of these wheels is grooved so as to receive a piece of very thin watch-spring *a* E *b*, *c* F *d*; and the ends *a* and *c*, *b* and *d* are connected by a steel wire; the pieces of watch-spring are made fast near E and F to the circumferences of the wheels in order to prevent them from slipping on those circumferences; a small movement for the sake of adjustment only being allowed. Swivel screws at *c* and *d* serve to tighten or relax the band as may be necessary.

Under each of the wheels E, F, is fixed a rectangular socket similar to C, and in this slides, horizontally, a rectangular arm G H, K L, each of which is 27½ inches long: these arms, which turn with the wheels E and F, are adjusted by means of the screws at *c* and *d*, so as to be always parallel to one another. At L is fixed a tracing point, like that of a pantograph; and at G a pencil in a socket or tube; the tracer and pencil are to be always in a straight line, passing through the common axis of the mass D, and of the socket C. The pencil is made to press gently on the paper by weights, but it is capable of being raised from thence at pleasure by means of a lever, one end of which is connected with the socket which carries it, and to the other is attached a string which is to be pulled by the operator when necessary: this movement of the pencil carrier is facilitated by means of small friction rollers.

The beam AB is divided on its upper face in 100 or 1000 equal parts, and divisions equal to these are set on the upper face of each arm GH, KL. By these divisions the distances of A and B from the axis of D may have any given ratio to one another, and AG, BL may respectively be made equal to the last-mentioned distances. Thus, the isosceles triangles GAD, DBL will always be similar to one another; and the figure described by the movement of the pencil at G will be similar to the original figure over which the tracer at L may be made to pass. Consequently, a given plan or drawing may be enlarged or reduced in any required proportion.

Professor Wallace contrived an instrument which he called a 'Chorograph,' for describing on paper any triangle, having one side and all its angles given; also for constructing two similar triangles on two given straight lines, having the angles given. See 'Geometrical Theorems,' &c. By William Wallace, LL.D. Edinburgh, 1839.

ELÆODENDRON. (From ἐλαία, an olive, and δένδρον, a tree). A genus of plants belonging to the natural order Celastraceæ. It has a 5-parted calyx; 5 expanding linear-oblong petals; a five-angled very thick fleshy disk; 5 anthers inserted into the margin of the disk; the filaments at length recurved; anthers with a thick connective, roundish, opening longitudinally; the ovary immersed in the disk, 2-celled; the ovules 2 in each cell; the style short, conical; the stigma simple, obtuse; the fruit drupaceous, dry, or pulpy; the nut 1-2 celled; the seeds usually solitary, with a membranaceous or spongy integument erect. The species are small trees with opposite entire glabrous leaves.

E. glaucum has elliptical serrated leaves, hardly 3 times longer than the petioles; the cymes loose, nearly the length of the leaves; the flowers pentandrous. It is a small tree, about fourteen feet in height, and is a native of Ceylon and Coromandel. The tree has been introduced into Great Britain from Ceylon under the name of Ceylon-tea. It has leaves like those of the tea-plant, but it does not appear to be used as a substitute for that plant.

E. Roxburghii has oblong serrato-crenate, opposite and alternate, hard, smooth, shining leaves about 4 inches long and 2 inches broad, with the petioles ¾ of an inch long: the cymes globular, and three times the length of the petioles. It is a native of the mountainous parts of India. It possesses powerful astringent properties, but is not used as an internal medicine.

The fruit of all the species resembles that of the olive, and hence the generic name. *E. orientale* is a native of the Mauritius and Madagascar, where it is called by the French *Bois d'Olive.* *E. Argan* contains in its fruit a fixed oil like the common olive, which is used by the Moors for the same purpose as olive oil is used in Europe.

The species of Elæodendron will grow freely in a mixture of loam and peat, and ripened cuttings will root in sand under a hand-glass.

(Lindley, *Flora Medica;* Loudon, *Encyclopædia of Plants;* Don, *Gardener's Dictionary.*)

ELA'PHRIUM. [CALOPHYLLUM, P. C. S.]

ELA'SMODUS, a genus of fossil Placoid fishes, from the London clay. (Egerton.)

ELASTIC BANDS, in Machinery. [WHEELS, P. C., p. 312; CAOUTCHOUC, P. C. S., p. 283.]

ELATERIN. [CHEMISTRY, P. C. S.]

ELATINA'CEÆ, a natural order of plants belonging to Lindley's Calycose group of polypetalous Exogens. The sepals are 3-5, distinct or slightly connate at the base; the petals hypogynous, alternate with the sepals; the stamens hypogynous, usually twice as numerous as the petals; the ovary with from 3 to 5 cells, an equal number of styles, and capitate stigmas; the fruit capsular, 3-5 celled, with the valves alternate with the septa, which usually adhere to a central axis; the seeds numerous, with a straight embryo, whose radicle is turned to the hilum, and little albumen. The species belonging to this order are annual plants with fistulous rooting stems, and opposite stipulate leaves, inhabitants of marshy places.

This order is nearly allied to Caryophylleæ, from which it has been separated by Cambessedes, on account of the different organization of the seeds, capsules, and stigmas. It agrees with Hypericaceæ in many points, and especially in possessing receptacles for resinous secretions, but differs in having a persistent central axis in the fruit, definite stamens, and so forth. The species are found in marshy places and under water in all parts of the globe. Cambessedes arranged three genera in this order:

1. *Merimæa* (named in honour of Prospero Merimee, an old botanist), with a 5-parted calyx; 5 petals; 10 stamens; 5 styles; a 5-valved, 5-celled, many-seeded capsule, the valves separating, and bent in at the margins so as to constitute dissepiments. This is a South American genus, of which but one species, the *M. arenarioides*, a native of Brazil, has been described.

2. *Bergia* (after Peter Jonas Bergius, professor of natural history at Stockholm, and author of several works on botany), with a 5-parted calyx; 5 petals; 5 styles approximate; the capsule 5-valved, 5-celled from the edges of the cell being bent inwards. There are four species; one is a native of Egypt, one of Java, one of the East Indies, and one of the Cape of Good Hope.

3. *Elatine*, with a calyx 3-4 parted; 3-4 petals; 3-4 or 6-8 stamens; 3-4 styles; the capsules 3-4 celled, many-seeded, the seeds cylindrical, terete, straight, or bent. There are five species of this genus.

E. Hydropiper, water-pepper, has opposite leaves shorter than their petioles, the flowers stalked or nearly sessile, with 8 stamens and 4 ovate petals; the capsule roundish, depressed, 4-celled, the seeds bent almost double, pendulous, 4 in each cell. It has rose-coloured flowers. It grows under water, and is very common in ground subject to inundations throughout France. It is a very rare plant in Great Britain, and has been found only in Wales and Ireland. *E. hexandra* is a minute plant having 6 stamens. It forms small matted tufts under water, and is common in France but rare in Great Britain. *E. tripetala*, of Smith, is identical with this species. *E. triandra* has been found in the neighbourhood of Ratisbon. *E. alsinastrum* is found near Paris.

(Don, *Gardener's Dictionary;* Babington, *Brit. Bot.*)

ELDER. [SAMBUCUS, P. C.]

ELDON, JOHN SCOTT, EARL OF, rose to the eminent station which he ultimately held from a humble beginning. His family has been stated to have been apparently a branch of the Scotts of Balwearie, in Fife, to which the famous Michael Scott, of the thirteenth century, is supposed to have belonged [P. C. xxi. 101]; but for this there is no sort of evidence whatever. All that is known about his ancestry is that his grandfather is reported by tradition to have been a clerk in the office of a coal-fitter at Newcastle, and a man of very good repute; he is described in a written document, of the year 1716, as William Scott, of Sandgate (one of the streets of that town), yeoman. The document in which he is so mentioned is the indenture by which his son, of the same names, was bound apprentice for the usual term of seven years, to a member of the Newcastle company of hostmen, or ostmen, a name of disputed etymology, but which appears to include different descriptions of dealers in the great commodity of the place, coal. This Mr. William Scott, the father of Lord Eldon, followed the business of what is called a coal-fitter, defined by his son's biographer to be 'the factor who conducts the sales between the owner and the shipper, taking the shipper's order for the commodity, supplying the cargo to him, and receiving from him the price of it for the owner.' In this line he prospered so much that at his death, at the age of seventy-nine, 6th November, 1776, he appears to have left to his family, including what some of them had previously received from him, property to the amount of between thirty and forty thousand pounds.

Mr. William Scott was twice married. By his first wife, Isabella Noble, who died January, 1734, he had three children, all of whose descendants are extinct; by his second, Jane Atkinson, daughter of Henry Atkinson, Esq., of Newcastle, whom he married in August, 1740, he had thirteen children, of whom the eldest son, William, afterwards Lord Stowell, was born in 1745, and of whom John was the eighth. He was born in 1751—as he believed, on the 4th of June—at his father's house in Love-lane, Newcastle, the site of which is now partly occupied by other smaller houses, partly taken in to widen Forster Street. He is said to have one day stated in the Court of Chancery that he was born in a chare-foot, as the lower extremities of these lanes or chares are called.

John Scott was educated, with his elder brothers William and Henry, at the royal grammar school of his native place, commonly called the Head School, where the head master was the Rev. Hugh Moises, a respectable scholar and an excellent teacher, but one who did not spare the rod. William went to Oxford in 1761. [STOWELL, LORD, P. C. S.] It was their father's intention to bring up John to his own business; but when he was making arrangements for that purpose in 1766, William wrote home from Oxford advising that he should be sent up to him; 'I can,' he said, 'do better for him here.' Accordingly, on the 15th of May of that year, he was entered a commoner of University College. On the 11th of July, 1767, he was elected to a fellowship in his college, having then just completed his sixteenth year; he took his bachelor's degree 20th February, 1770; gained, in 1771, the chancellor's prize of 20*l.* for an English prose essay on 'The Advantages and Disadvantages of Foreign Travel' (published in 'Talboys's Collection of the Oxford English Prize Essays,' 1830); but forfeited his fellowship by running off, on the 18th of November, 1772, with Miss Elizabeth Surtees, daughter of Aubone Surtees, Esq., banker, of Newcastle, whom he married at Blackshiels in Scotland, the next day. The lady's father was very angry; and it was some little time before he was reconciled; but at last he agreed to give his daughter a portion of 1000*l.*, Mr. Scott making over to his son an equal sum. Meanwhile, it is said, a grocer of Newcastle, a friend of the family, who was well to do in the world, had kindly offered to take the young man into partnership; and it was only another interference of his elder brother William which prevented the father from closing with this proposal. It was then determined that he should enter into holy orders if a University College living fell vacant during the twelve months of grace, as they are called, for which he was still allowed to hold his fellowship; that event did not happen, and he then made up his mind, it is said with some reluctance, to try the profession of the law. He had entered himself a student of the Middle Temple in January, 1773; and he took his degree of master of arts on the 13th of February in the same year. If these dates, which we take from Twiss's Life of Lord Eldon, and which are there supported by documentary evidence, be correct, it will follow that there is an inaccuracy in Lord Eldon's own statement therein quoted (vol. i. p. 84) from what is called his Anecdote Book, according to which he is made to have given up 'the purpose of taking orders' before entering himself as a student at the Temple. Mr. Twiss remarks, indeed, that his relinquishment of the purpose of taking orders was at this time 'but inchoate.'

During the years 1774 and 1775 he held the office of a tutor of University College, where his brother William was at the time senior tutor; but it is believed that all he did in that capacity was to attend to the law studies of some of the members of the college. He received none of the emoluments of the office. One or both of these years also he read the law lectures, as deputy for Sir Robert Chambers, the Vinerian professor; and for this service he had 60*l.* a year. Awkwardly enough, the first lecture he had to read was upon the statute 4 & 5 Phil. and M., c. 8, 'Of young men running away with maidens;' and it so chanced that he had to deliver it immediately after it was put into his hands, and without knowing a word that was in it. 'Fancy me reading,' he said, when telling the story long afterwards, 'with about one hundred and forty boys all giggling at the professor. Such a tittering audience no one ever had.'

Mr. Scott was called to the bar on the 9th of February, 1776, on which he came up with his wife to London, and took a small house in Cursitor Street, from which he soon after removed to another in Carey Street. He naturally joined the Northern Circuit; but it was, as usual, some time before he began to make much by his practice. Indeed after a trial of two or three years his prospects of success in London seemed so unpromising, that he had made arrangements for settling as a provincial counsel in his native town, when, in July, 1788, he was brought into considerable notice by his argument in the cause of Ackroyd *v.* Smithson (1 Bro. C. C. 503), heard before Sir Thomas Sewell, Master of the Rolls; and into still more when Sir Thomas's judgment, which was adverse to his client, was reversed in March, 1780, by Lord Chancellor Thurlow, in accordance with Scott's reasoning, which has decided all similar questions ever since. The question was what should be done with one of a number of shares into which a testator had directed that the money obtained by the sale of his real estates should be divided, the party to whom he had given the share by his will having died in the testator's lifetime. Mr. Scott contended that the share, being land, at the death of the testator came to the heir-at-law. Even for some time after this success however he still retained the idea of settling in Newcastle; and had actually made a house be taken for him in that town, of which he had also accepted the Recordership. One year, apparently 1780, he did not go the circuit, because he could not afford it; he had already, to use his own words, borrowed of his brother for several circuits, without getting adequate remuneration. But when matters were in this state he unexpectedly found such an opportunity of distinguishing himself in an election case (that of Clitheroe) before a committee of the House of Commons as at once changed his position, and with that his plans for the future. Having been applied to in the absence of the counsel who was to have led, Mr. Scott, upon the refusal of the next counsel to lead because he was not prepared, was persuaded to take the conduct of the case at a few hours' notice. It lasted for fifteen days. 'It found me poor enough,' said he, relating the circumstances in his old age, 'but I began to be rich before it was done: they left me fifty guineas at the beginning; then there were ten guineas every day, and five guineas every evening for a consultation—more money than I could count. But, better still, the length of the cause gave me time to make myself thoroughly acquainted with the law.' He was beaten in the committee by one vote; but the ability he had shown did not the less establish his reputation.

All thought of leaving London was now abandoned; his practice from this time increased rapidly; and in June, 1783, on the formation of the coalition ministry of Lord North and Mr. Fox, and the great seal on Lord Thurlow's resignation being put into commission, he was one of several junior counsel who were called within the bar. Erskine was another; and it was at first intended to give precedence to him and Mr. Pigott, both of whom were Scott's juniors; but to this arrangement the latter firmly refused to submit; and his patent, as ultimately drawn out, gave him precedence next after the king's counsel then being, and after Harry Peckham, who had been made one a few days previously, and had been placed before Erskine, though Erskine's patent was of earlier date. A few days after he received this promotion, he was, as is customary, made a bencher of his Inn of Court.

About the same time he was returned to parliament for the borough of Weobly, through the patronage of Lord Weymouth, with whom however he stipulated that he should not be expected uniformly, or as a matter of course, to represent his lordship's opinions. The election took place on the 16th of June. He and Erskine both made their maiden speeches in the same debate, that on the 20th of November, about a week after the opening of the session, on a motion connected with the famous India bill, which eventually upset Fox's government. The two young lawyers were however on opposite sides—Erskine with ministers, Scott with Pitt and the party destined soon after to come into power. The Coalition ministry was turned out on the 18th of December; and on the 24th of March, 1784, the king prorogued, and the next day dissolved, parliament, after the opposition to Pitt and the new government had been gradually brought down in the course of a long series of divisions to a majority of one. Mr. Scott was again returned for Weobly; and in the new parliament he took a prominent part in most of the legal questions that came before the House. In the session of 1785, on the 9th of March, he spoke and voted with Fox against ministers on one of the questions connected with the great Westminster scrutiny; and his speech was considered to have established the doctrine 'that the election must be *finally* closed before the return of the writ, and that the writ must be returned on or before the day specified in it.' This principle the government soon after consented to enact as law by the statute 25 Geo. III. c. 84, 'To limit the duration of polls and scrutinies.'

In March, 1787, Mr. Scott was appointed chancellor of the bishopric and county palatine of Durham, by the bishop, who was a brother of Lord Thurlow, and had just been translated to the see. In June, 1788, on Lord Mansfield's resignation and the appointment of Sir Lloyd Kenyon as his successor in the chief-justiceship of the King's Bench, the attorney-general, Mr. Pepper Arden, was made master of the rolls, in room of Kenyon; the solicitor-general, Sir Archibald Macdonald, became attorney-general; and the office of solicitor-general was conferred on Scott. At the same time he was also knighted. A few days afterwards he was re-elected for Weobly; and he was a fourth time returned for the same place to the new parliament which met in November, 1790. He held the office of solicitor-general till February, 1793, when he was made attorney-general on the promotion of Sir Alexander Macdonald to the place of Chief Baron of the Exchequer. On this occasion he was returned a fifth time for Weobly. To the next parliament, which met in September, 1796, the last in which he sat as a member of the House of Commons, he was returned, along with Sir Francis Burdett, for the Duke of Newcastle's borough of Boroughbridge.

The period of Sir John Scott's tenure of the office of attorney-general extends to the year 1799. It is memorable for the state trials connected with the political excitement produced in this country by the breaking out of the French Revolution. Muir, Palmer, Skirving, Margarot, and Gerald, had all been convicted of sedition in Scotland, and sentenced to fourteen years' transportation, when in October, 1794, Hardy, Horne Tooke, Thelwall, Holcroft, and their associates, were indicted for high treason at the Old Bailey. Only Hardy, Tooke, and Thelwall were tried; all three were acquitted; and the prosecutions against the other prisoners were dropped. There has been much difference of opinion as to the wisdom of the course taken by the government on this occasion, but perhaps too much stress has commonly been laid on the single fact that none of the trials issued in a conviction. There can be no doubt that the evidence, although it was held insufficient to support the charge of high treason, produced an immense effect upon the public mind; and the accused were dismissed from the bar unharmed, but to a great extent disarmed. The attorney-general naturally came in for a principal share of the obloquy which the proceedings excited; but his demeanour in the conduct of the trials was admitted on all hands to have been characterised by moderation and good temper. His answer to the question so often asked,—Why he had not prosecuted for a misdemeanour? always was, that in his deliberate opinion the offence was treason or nothing; but he never could get over the next question, How could any one expect a jury to convict of treason, when it required a speech of eleven hours to state the charge? In his own written account however, as quoted by Mr. Twiss from the 'Anecdote-Book,' vol. i. pp. 282-286, he lays the principal stress upon the desirableness of bringing out all the evidence. His words are, 'The mass of evidence, in my judgment, was such as ought to go to the jury for their opinion, whether they were guilty or not guilty of treason. Unless the whole evidence was laid before the jury, it would have been impossible that the country could ever have been made fully acquainted with the danger to which it was exposed; . . . . . and it appeared to me to be more essential to securing the public safety that the whole of their transactions should be published, than that any of these individuals should be convicted.'

In July, 1799, on the death of Sir James Eyre, Chief Justice of the Common Pleas, Sir John Scott claimed and obtained that office, agreeing at the same time to go into the House of Lords. His title of Baron Eldon was taken from a manor of that name, consisting of above 1300 acres, in the county of Durham, which he had purchased for 22,000*l.* in 1792. It appears from Lord Eldon's fee books, as far as they have been preserved, that his annual receipts when at the bar had been in 1785, 6054*l.*; in 1786, 6833*l.*; in 1787, 7600*l.*; in 1788, 8419*l.*; in 1789, 9559*l.*; in 1790, 9684*l.*; in 1791, 10,213*l.*; in 1792, 9080*l.*; in 1793, 10,330*l.*; in 1794, 11,592*l.*; in 1795, 11,149*l.*; in 1796, 12,140*l.*; in 1797, 10,861*l.*; and in 1798, 10,557*l.* His removal to the bench was a great sacrifice of income, but he considered that his health and comfort required his retirement from the laborious office of attorney-general. His claim however was at first opposed by both Pitt and Loughborough the chancellor, both of whom were desirous of giving the office to Sir R. Pepper Arden, then Master of the Rolls.

When it became known that Sir John Scott was to be the new Chief Justice of the Common Pleas, Lord Kenyon, then Chief Justice of the King's Bench, publicly congratulated the profession on the appointment of one, who, he said, would probably be found 'the most consummate judge that ever sate in judgment.' And Lord Eldon proved an admirable common law judge. 'On the bench of a common law court,' it is remarked by his biographer, 'no scope was allowed to his only judicial imperfection, the tendency to hesitate. . . . Compelled to decide without postponement, Lord Eldon at once established the highest judicial reputation; a reputation, indeed, which afterwards wrought somewhat disadvantageously against himself when lord chancellor, by showing how little ground there was for his diffidence, and consequently how little necessity for his doubts and delays.' He was also much attached to his office, and to the end of his life used to express the strong regret with which he had left the Court of Common Pleas.

But on Lord Loughborough's resignation of the Great Seal in April, 1801, about a month after Mr. Pitt had been succeeded as prime minister by Mr. Addington, Lord Eldon became lord chancellor (14th April). His own account was that when he was made Chief Justice of the Common Pleas, the king had insisted upon his giving a promise, that, whenever he should call upon him to take the office of chancellor, he would do so. He continued to hold this office till the 7th of February, 1806, when, on the accession of the Whig ministry of Mr. Fox and Lord Grenville, he was succeeded by Lord Erskine; he resumed it on the 1st of April, 1807, on the return of his party to power; and he finally resigned it on the 30th of April, 1827, when Mr. Canning became prime minister, and the Great Seal was given to Lord Lyndhurst. He was raised to the dignities of Viscount Encombe and Earl of Eldon in 1821.

Lord Eldon's judicial character has been elaborately drawn by several competent pens. The reader may be especially referred to the volumes of his biographer, Mr. Twiss; to a series of articles in the 'Law Magazine,' Nos. 41 to 44 inclusive; and to the Second Series of Lord Brougham's 'Historical Sketches of Statesmen who flourished in the time of George III.' It is admitted on all hands that in legal learning he never had a superior, if he had an equal, in Westminster Hall; and, although his intellect was not capacious, nor his general powers of mind of a commanding order, in the acuteness and subtlety with which he applied his professional knowledge he was perhaps unrivalled by any judge that ever sat upon the bench. The great fault that is imputed to him is the hesitation which he showed in coming to a decision, or at any rate, as has been said to have been rather the case, in pronouncing one. But this habit, however distressing to individual suitors, was not so permanently mischievous as might be feared. Indeed the anxious consideration with which his judgments were formed enhances their value and authority.

During nearly all the time that Lord Eldon sat on the woolsack he took a leading part in the general debates of the House of Lords; he was also understood to be one of the most influential members of the cabinet; and he was certainly one of the staunchest and most uncompromising supporters of all the great principles of the old Tory or Conservative party. The two great measures of Parliamentary Reform and Roman Catholic Emancipation in particular were steadily opposed by him on all occasions, and to the last. Indeed it was his inflexibility on the latter of these two questions that occasioned his final retirement from office.

Opinions will of course be divided on Lord Eldon's character as a public man. The facts of his long career are now generally known; and sufficient time has elapsed to enable the present generation to form a tolerably correct estimate of the men who directed affairs in the eventful period of the latter part of the reign of George III. and the Regency. So much we may affirm without incurring the imputation of judging in a mere party spirit; that the reputation of Lord Eldon as a profound lawyer will be permanent, while his career as a statesman was not marked by any measure that places him among the great men of his age or country.

Lord Eldon survived in retirement till the 13th of January, 1838, and was succeeded in his peerage by his grandson, the present earl, the son of his eldest son John, who was born at Oxford, 8th March, 1774, and died 24th December, 1805; having married on the 22nd of August, 1804, Henrietta Elizabeth, daughter of Sir Matthew White Ridley, Bart., who after her first husband's death became the wife of James William Farrer, of Ingleborough, Yorkshire, Esq., now one of the Masters in Chancery. Lord Eldon's other children were Elizabeth, born in 1783, who married George Stanley Repton, Esq.; Edward William, born in 1791, and Henry John, born in 1793, who doth died in infancy; William Henry John, born in 1795, who died in 1832; Frances Jane, born in 1798, who married the Rev. Edward Bankes, Rector of Corfe-Castle, and Prebendary of Gloucester and Norwich, and died in 1838. Lady Eldon died in 1831.

(*The Public and Private Life of Lord Chancellor Eldon, with Selections from his Correspondence*, by Horace Twiss, Esq., one of her Majesty's Counsel, 3 vols. 8vo., Lond. 1844.)

ELECTION-COMMITTEES. The course of elections of members of the House of Commons from the issuing of the writs to the returns made to the Clerk of the Crown is briefly sketched in the article HOUSE OF COMMONS, P. C. The Clerk of the Crown certifies the returns made to him to the House. [CLERK OF THE CROWN, P. C. S.] This mode of adjudicating election-petitions is the subject of the present article.

Till 1770, when the act well known as the Grenville act was passed, questions of controverted elections were decided by the whole House of Commons: and every such question was made a party contest. The Grenville act introduced a plan, which, with several modifications, continued till 1839, of appointing committees for the trial of election petitions by lot. Since 1839 a different system has been in operation, under which the choice of members of election-committees has not been left to chance, and their individual responsibility has been increased by diminishing the number of members. By the 7 & 8 Vict. c. 103 (passed last year, 1844), the number of members of an election-committee was reduced from seven to five, including the chairman.

The 7 & 8 Vict. c. 103, now regulates the constitution and the proceedings of committees on controverted elections.

At the commencement of every session, the Speaker appoints by warrant six members of the House to be a General Committee of Elections. The General Committee of Elections, when appointed, proceed to select, 'in their discretion, six, eight, ten, or twelve members, whom they shall think duly qualified, to serve as chairmen of election-committees;' and the members so selected for chairmen are formed into a separate panel, called the Chairmen's Panel. The members of the General Committee of Elections are excused from serving as members of election committees, and all members of the House of Commons above the age of sixty are also excused from this service. The House also allows other special grounds of exemption; the principal ministers for instance are excused from serving on election-committees, so long as they hold their offices, on account of their official duties. After the General Committee of Elections have appointed the Chairmen's Panel, they divide the remaining members of the House who are not exempted from service, into five panels; and members are chosen to serve on elections from these panels, in an order of succession determined by lot. All election-petitions are referred by the House to the General Committee of Elections; and this General Committee give notice, as provided by the act, of the days on which particular election-committees will be appointed, and of the panel from which members will be taken. 'The General Committee shall meet at the time appointed for choosing the committee to try any election-petition, and shall choose from the panel then standing next in order of service, exclusive of the chairmen's panel, four members, not being then excused or disqualified for any of the causes aforesaid, and who shall not be specially disqualified for being appointed on the committee to try such petition for any of the following causes: that is to say, by reason of having voted at the election, or by reason of being the party on whose behalf the seat is claimed, or related to the sitting member or party on whose behalf the seat is claimed by kindred or affinity in the first or second degree, according to the canon law.' (§ 55.) At least four members of the general committee must agree in the appointment. On the same day on which the general committee choose the members of an election-committee, the chairmen's panel choose from themselves a chairman for the committee, and communicate the name of the chairman selected to the general committee. The names of the chairman and members selected are thus communicated to the petitioners and sitting member or members, who may object to any of the members on any ground of disqualification specified in the 55th section of the act, but on no other ground. If any member is shown to be disqualified, the general committee select another; or if the chairman is disqualified, they send back his name to the chairmen's panel, who proceed to choose another chairman. The five members finally chosen are afterwards sworn at the table of the House 'well and truly to try the matter of the petitions referred to them, and a true judgment to give according to the evidence.'

Such is a general sketch of the present mode of constitution of election-committees. For other details the reader must refer to the act itself, or to Mr. May's 'Treatise on the Law, Privileges, Proceedings, and Usage of Parliament,' pp. 341-373. It is a matter of practice for the General Committee of Elections to take the four members of an election committee equally from the two sides of the House.

The second section of the act defines election-petitions, and specifies by whom they must be signed. Election-petitions are petitions complaining, 1, of an undue election; or, 2, that no return has been made to a writ on or before the day on which the writ was returnable; or, 3, if the writ be issued during any session or prorogation of Parliament, that no return has been made within fifty-two days after the date of the writ; or 4, that a return is not according to the requisition of the writ; or, 5, of special matters contained in the writ: and they must be signed by some person claiming therein to have had a right to vote at the election, or to have had a right to be returned, or alleging himself to have been a candidate at the election.

All election-committees are empowered to send for persons, papers, and records, and to examine any one who may have signed the petition, unless it shall appear that he is an interested witness, and to examine all witnesses upon oath, which is to be administered by the clerk attending the committee. Election-committees are the only committees of the House of Commons in which evidence is taken upon oath. Any one giving false evidence is made liable to the penalties of wilful and corrupt perjury.

Parties complaining of or defending a return are required to deliver in to the clerk of the General Committee of Elections lists of the voters intended to be objected to, with the several heads of objections, not later than six in the afternoon of the sixth day next before the day appointed for choosing the committee to try the petition; and the election-committee cannot enter into evidence against any vote, or upon any head of objection, not included in the lists.

The committee are required to decide 'whether the petitioners or the sitting members, or either of them, be duly returned or elected, or whether the election be void, or whether a new writ ought to issue.' Their decision on these points is final between the parties: and the House carries it into execution.

ELECTION OF MEMBERS OF PARLIAMENT. [PARLIAMENT, P. C.]

ELECTRIC TELEGRAPH. [TELEGRAPH, ELECTRIC, P. C. S.]

ELECTRICITY, ATMOSPHERIC. The similarity of lightning to the spark obtained by friction from an electrical apparatus was observed by the earliest experimenters in electricity; and in one of Franklin's letters, written apparently before the year 1750, the points of resemblance are distinctly stated. The first fruit of this discovery was the employment of thunder-rods for the protection of buildings and ships; and rods or wires projecting above the tops of edifices were soon extensively used by philosophers for the purpose of enabling them to ascertain the nature and intensity of the electricity in the atmosphere. Such means are not unattended by danger: and science has to record the death of Professor Richman, during a thunder-storm, while attending to the indications of the electrometer connected with an apparatus of that kind. [LIGHTNING, P. C.]

Franklin in America, M. de Romas in France, and Cavallo in England, each employed, for the purpose of bringing electricity from the atmosphere to the surface of the earth, a kite made of silk stretched on a frame, from the upper part of which projected a piece of pointed metal, and from which proceeded along the string a slender metallic wire. M. Buffon, M. Lemonnier, and others, planted vertically in the ground poles, from 30 to 40 feet in height, carrying at the top a pointed piece of tin or iron, from which descended a metallic wire. M. Mézèas in France, Mr. Ronayne in Ireland, and Mr. Crosse in England, employed long wires in horizontal positions, which were insulated by being stretched between two glass pillars, each on the top of a pole planted in the ground. The wire used by Mr. Crosse is 1800 feet long, and is above 100 feet from the ground.

The numerous experiments made by Cavallo serve to prove that the electric fluid always exists in the atmosphere, but in very different quantities at different times, and that it is more abundant in the higher regions than near the earth. The same philosopher found, also, that it is more intense in frosty than in warm weather, and that fogs are accompanied by a great quantity of electricity, except when they become rain; in this case, little electricity is perceptible, the rain conducting to the earth the electricity of the air above. In high winds, also, the intensity of the atmospherical electricity is generally diminished, probably because the strata of air containing different quantities of the fluid are brought successively to the ground, and thus there is produced a nearly uniform distribution of the fluid between the earth and atmosphere. It may be easily conceived that, in stormy weather, the variations of the atmospherical electricity will be very irregular; for currents of air in the upper regions, driving the strata of clouds in different directions, the electrical actions between the clouds and the atmosphere below must be extremely complex.

M. de Saussure has observed that, during summer and winter, by night as well as by day, when the atmosphere is free from clouds, the electricity of the air is positive; and Mr. Read (*Phil. Trans.*, 1794) has shown that out of 404 observations made in one year, the air was positively electrical in 241, negatively in 156, and that the electricity was insensible in 7 observations only. It seems probable, in fact, that the negative electricity which may be observed in a pure atmosphere is caused by the discharge of its positive electricity into the earth or a cloud, when one or the other of these is in a contrary state. Mr. Ronayne, however, states (*Phil. Trans.*, 1772) that, in Ireland, the electricity of the atmosphere is positive in winter when the air is clear: he observes that it diminishes in frosty or foggy weather, and that he could detect no electricity in the air during the summer except when a fog came on; the electricity was then positive, but it was less intense than during the winter fogs. It was an observation of Saussure that electricity is strongest in the open air; and that it is weak in streets, in houses, and under trees. In close rooms and hospitals, the electricity of the air has been always found to be negative; such also is the electricity of the atmosphere when it is vitiated by exhalations from lime, paint, and decaying vegetables

All observations concur in showing diurnal variations in the intensity of atmospherical electricity, but there is some uncertainty concerning the precise times at which the intensities are the greatest and the least. Cavallo observed that, in dry weather, the electricity was weakest at sunrise; that it attained the maximum of strength in the day-time, and continued in that state till sunset, when the intensity diminished; he conceived that this diminution was much more rapid as the air became more humid; and he observed that, in winter, when a dry wind prevailed, if the sky were free from clouds, the electricity became very strong after sunset. M. de Saussure observed, at Geneva (1785) that, during winter, the intensity of atmospherical electricity attained its first maximum at 9 A.M.; that it diminished till 6 P.M., when it was in a minimum state; it afterwards increased, and attained its second maximum at 8 P.M.; after which it continued to diminish till it was again a minimum at 6 on the following morning. The same philosopher found that, in summer, the diurnal variations were less perceptible: on a dry warm day he found the electricity increase from sunrise, when it was almost insensible, till 3 or 4 P.M., when it became a maximum; it appeared then to diminish till the dew fell, when it became stronger, but it was scarcely sensible during the night. Lastly, the experiments of Mr. Read exhibit two maxima and two minima in twenty-four hours. The atmospherical electricity seemed strongest at 2 or 3 hours after sunrise, and again about sunset; it was weakest at noon and at 4 P.M.

The experiments of Mr. Crosse show also that, in the ordinary state of the atmosphere, the electricity is positive, and that it increases in proportion to the elevation above the earth's surface; the same philosopher observes that it is most intense at sunrise and sunset, and weakest at noon and during the night. He finds that the approach of a thundercloud produces a change in the electricity of the atmosphere, rendering it positive if it were before negative; and the contrary: whatever be the nature of the change which takes place, the intensity of the electricity increases to a certain degree; it then diminishes and disappears, and is succeeded by an opposite electricity: this gradually increases till it becomes of higher intensity than the former kind, and then it decreases till it vanishes: it is again succeeded by the first kind. These changes are often found to take place several times successively. Fogs, rain, snow, &c. also change the electricity from positive to negative, again from negative to positive, and so on; the change taking place every three or four minutes. A cold rain, in large drops, is frequently accompanied by intense electricity; and during a driving fog or rain the electricity is occasionally as strong as during a thunder-storm. A warm small rain is weakly electrified; and a weak positive electricity generally prevails during cloudy weather. Mr. Crosse finds also that the electricity of the air is very weak during the north-east winds, which in winter and spring times produce extreme cold and dryness.

The intensity of atmospherical electricity has been observed to undergo annual changes: it increases from July to November inclusive; so that the greatest intensity occurs in winter, and the least in summer.

Any of the different kinds of electrometer may be employed to determine the nature and intensity of atmospherical electricity. [Electrometer, P. C.] The instrument proposed by M. Colladon of Geneva is formed of the wire employed as a galvanic multiplier; it consists of numerous coils well insulated from one another, and one end communicates with the earth while the other extends into the atmosphere. The energy and direction of the electric current is indicated by the deviation of a magnetized needle from the zero point of a scale.

The aurora borealis, and many other meteoric appearances have been ascribed to the electricity of the atmosphere. [Aurora Borealis, P. C.]

ELECTRICITY, CONDENSER OF. [Condenser of Electricity, P. C. S.]

ELECTRICITY, DISTRIBUTION OF. [Distribution of Electricity, P. C. S.]

ELECTRO-METALLURGY. When a science, or the practical application of a science, is in rapid progress, it is difficult to embody the results in an alphabetical work like a Cyclopædia, since the subject may grow to increased importance immediately after a description has been given at a particular time. Such is the case with the arts depending on electric agency. When the articles Electricity, Electro-Chemistry, and Galvanism, were published in P. C., little progress had been made in transferring from the lecture-room to the workshop or the studio the wonderful power to which they relate; and although at a subsequent period these matters were to some extent entered on in the two articles Voltagraphy and Voltaism, P. C., it is still desirable to give here an account of a branch of art which has become very important within the last two or three years.

The object to be attained is, the deposition of a thin metallic layer on the surface of some other body prepared for its reception; the outer layer being intended generally (but not always) for one of three purposes—the decoration, the protection, or the imitation of that which lies beneath. The mode of proceeding assumes different forms, according to the purpose in view. The names *Electrotype*, *Galvanotype*, *Voltatype*, *Voltagraphy*, *Galvano-Plastics*, *Electro-Plating and Gilding*, all have been applied in a somewhat confused manner to different modifications of the art; but we agree with Mr. Smee, that it would be convenient to adopt the term *Electro-Metallurgy* as a general one, including all or most of the varieties.

Surface-Deposit, in Electro-Plating.—In the common manufacture of table-plate the articles are either made of pure gold or silver, or have a surface of these costly materials laid upon a foundation of cheaper metal; and it is as an improved mode of applying the gold or silver that the electro process has been chiefly introduced. There have been long in use various methods of applying a surface of gold to a cheaper metal. For instance, polished steel or copper used formerly to be gilt in France by the following means:—The metal being heated, a thin leaf of gold was laid on it and burnished down; a second heating, a second application of gold, and a second burnishing succeeded; and these alternations were repeated until a sufficient body of gold had been applied. Another method, that of 'water-gilding' (as it is most inappropriately named), consists in coating the cheaper metal with an amalgam of mercury and gold, dissipating the mercury by means of heat, and leaving a bright golden surface. [Button, P. C.; Gilding, P. C.] A later mode has been by cleaning the metal article in an alkaline liquor, and boiling it in a chemical solution of gold, by which a thin film of the precious metal becomes deposited on the foundation beneath. But in the most usual mode of preparing silver plate the processes are rather mechanical than chemical:—A long bar or ingot of mixed metal (copper and brass) with a thinner ingot of silver laid upon it, is drawn through a rolling-mill, by which the two are elongated and pressed together as a thin sheet; and out of the sheet so prepared articles of table-plate are made by stamping, punching, hammering, and other mechanical processes.

The electro process differs from all of the above. In the first place, a designer sketches the pattern for the article, and from this pattern a modeller prepares a model made of flesh-coloured wax, firm in substance, but capable of being easily fashioned by means of small bone or hard-wood tools. From this model the workers in metal operate, by casting, or stamping, or hammering, according to the shape of the vessel to be produced. The metal employed (at the large establishment of Messrs. Elkington, at Birmingham, one of the chief in this department) is an alloy of copper, nickel, and zinc, hard, white, and fusible only at a high temperature. If the article is to be produced by stamping or by brazing, the alloy is rolled into thin sheets, which are worked up into form by the stamping-press or the hammer. [Chasing of Metals, P. C. S.] But when the article is to be cast (which the more elaborate patterns generally are) the operations are as follow:—From the wax model is made a mould of lead, by casting in the usual way, and from this mould is produced a cast, in molten brass, which is of course an exact copy of the wax model. This brass cast, called the 'pattern,' is carefully examined, and worked up by chasing-tools to the proper fineness and delicacy of detail. From this brass pattern is made a sand mould; and in this sand mould the article itself is cast in the alloy or white metal; so that there are thus several alternations in wax, lead, brass, sand, and alloy, three of which are in the character of casts, and two in that of moulds.

When all the mechanical processes necessary to the manufacture are finished, whether casting, stamping, or hammering, the article is cleaned, ground, and polished, in every part, to prepare it for the reception of the silver. It is then dipped into a vessel containing a chemical solution of phosphorus, as a medium for connecting the silver with the alloy beneath, and is from thence transferred to the tank or trough subjected to the galvanic agency. The tank is a vessel in which several manufactured articles may be placed at once, by suspension from rods placed across it. In the tank is a chemical solution of silver; and the wires of a galvanic battery are so arranged that the current, in completing its circuit, must necessarily pass through the solution. The result of this action is, that the solution is decomposed, and a fine film of metallic silver becomes deposited on the surfaces of all the articles suspended in the tank; the thickness of the deposited layer being determined conjointly by the duration of the immersion, the strength of the solution, and the strength of the current. In the progress of the operation the solution becomes exhausted of its silver; and, to keep up the supply, plates of pure silver are suspended in it; the silver dissolves in the liquid as rapidly as the deposition on the articles takes place, atom for atom.

When the manufactured articles are taken out of the tank they present a remarkably dead appearance; this is removed, first, by friction with 'scratch-brushes' of brass wire, and then by burnishing with hard smooth pieces of blood-stone.

If the article—whether a piece of table-plate, a button, or a trinket—is to be coated with gold instead of silver, a process generally similar to the above is followed; the nature of the solution in the tank being the chief object of difference. Indeed many other metals can be deposited in a similar way; but gold and silver are the two to which attention is principally directed.

Solid-deposit, in electro-plating. A far more remarkable department of electro-plating than the above is that in which the whole substance of the manufactured article is produced by deposition from the liquid in the tank; an operation constituting perhaps the most striking example of electricity applied to the arts.

In effecting this object, the design is first modelled in wax; a mould in lead is taken from the model; a cast in brass is taken from the mould; and this cast is worked up by the chaser—just as in the former instance. But instead of making a mould in sand from the pattern, the mould is formed in a melted composition of glue and treacle, which has, when cold, sufficient elasticity to enable the pattern to be removed from it with facility, however much 'undercut' the device may be. From this elastic mould a cast is taken, in a peculiar waxen composition; and this cast, when further prepared, is suspended in a tank containing a chemical solution of copper. Galvanic agency is then resorted to, to deposit a layer of copper (by decomposing the solution) on the surface of the model, and this layer is made of such a thickness that when the waxen model is melted out from within it, the copper may be able to retain its shape unsupported. The result of the numerous copyings is, that the *inside* of the copper shell represents a mould of the *outside* of the article to be manufactured. The exterior of the copper is protected by a resisting composition, and it is then suspended in a tank containing a solution of silver (or gold, as the case may be); the galvanic current causes the deposition of the gold or silver on the inside of the copper mould; deposition on the outside being prevented by the resisting composition. When a sufficient thickness of the precious metal is thus obtained, the copper mould is exposed to the action of an acid which gradually eats it away without injuring the gold or silver beneath. The result is, that after the use of the wax model, the lead mould, the brass pattern, the glue mould, the composition model, and the copper shell, there is produced a vessel or ornamental article of absolutely pure silver or gold, presenting the same pattern as the original wax model, and derived from the metal which had formed part of a chemical solution.

It might naturally be supposed that the particles of metal brought together in this singular way from a liquid would be deficient in that coherence which is one of the features of the metallic state. But such is not the case. The manufactured articles have a sonorous 'ring,' and a power of bearing planishing with the hammer, which show that the mutual cohesion of the particles is considerable.

Electro-deposit, as a protection or as an ornament. The deposition of a thin metallic layer on a body prepared for its reception being thus rendered very practicable, the applications of the method—some actually practised and some only suggested—have become very numerous. It is in most cases as a protection, as an ornament, or as a copy or type, that these applications are intended.

As a protection, Mr. Dent has applied electro-gilding to chronometer-springs. At the Plymouth meeting of the British Association (1841) Mr. Dent stated that the common process of blueing' the steel balance-springs of chronometers very much affects the elastic force of the spring; and he therefore proposed the employment of electro-gilding instead of blueing, as being an efficient protector from the ill effects of damp and saline atmospheres. Professor Christie at the same time stated that this plan of Mr. Dent's had suggested to him the advantage of protecting magnetic bars and needles by the same means, to prevent the disturbing effect often exerted by the oxidation of the surface of these delicate instruments.

Medallions are sometimes coated with copper as a means of preservation or of beautifying. The medallion is first coated with black-lead, and then exposed to a solution of copper (in the state of sulphate or some other salt), the metal of which is precipitated on the medallion by a galvanic current. Fruit, small twigs, leaves, seeds, and other vegetable specimens, may be similarly coated with copper; either for ornament or for the purpose of illustrating the size and form of the object. Apples and pears are similarly capable of being coated, by being either brushed over with powdered black lead or steeped in a liquid preparation of phosphorus, and then immersed in the tank. Indeed this method is capable of producing very beautiful results. The writer has seen three sprigs of holly, taken from the same branch, completely coated in the course of a few minutes, the one with copper, the second with silver, and the third with gold, all absolutely pure, and conforming to the most minute and delicate features of the plant. Insects too, such as butterflies, may be thus coated with a metallic film; and it is a striking proof of the equability with which the particles of metal arrange themselves, that the exquisite framework of the insect's wings is exhibited almost as distinctly as in the natural state. Mr. Smee gives similar examples. He says ('Elements of Electro-metallurgy,' p. 222), 'The beauty of electro-coppered leaves, branches, and similar objects is surprising. I have a case of these specimens placed on a black ground, which no one would take to be productions of art. . . . When I state that the numerous hairs covering the leaves of a *melastoma*, and even the delicate hairs of the *salvia*, are all perfectly covered, the botanist must at once admit that these specimens have rather the minuteness of nature than the imperfections of art.'

In the preservation of all such fruits and vegetables, as apples, pears, gourds, grapes, cucumbers, and potatoes, by electro-coppering, a pin is inserted before the immersion, and on this pin being afterwards removed, the hole left by it furnishes an outlet for the sap and moisture from within; and it is found that in many cases the inside dries up completely without deranging the shape of the copper envelope.

Ornamental baskets, whether made of wicker or of wire, are coated in a similar manner. So likewise are lace and other articles made of woven fibres. Indeed, should a taste for productions of this kind spring up, the means are at hand for extending the art almost indefinitely; for by a preliminary steeping in a solution of phosphorus, or some other chemical agent, almost any substance may be brought into a state to receive a deposition of metal in a delicate film; and this film may be of copper, silver, gold, platina, or nickel. Porcelain and earthenware might without much difficulty be brought under similar operations.

Electro-deposit, as a means of Copying. The details given under Voltagraphy, P. C., belong to the present section of our subject; by a reference to that article it will be seen that the obtaining of an exact copy, type, or counterpart of any device, whether it relate to the fine arts or to the manufacturing arts, is the object in view; and a few other particulars, in addition to those there given, will suffice.

The electro-process has been recommended not only for copying engravings, but for making the copper-plate itself on which an engraving is to be executed. The copper-plates prepared for engravers generally contain a small portion of other metals, which render both the engraving and the etching somewhat uncertain: by the substitution, therefore, of plates produced by electro-deposition, in which the copper is quite uncontaminated with other metals, an advantage is anticipated. To produce these plates, a copper-plate is prepared in the usual way and suspended in a copper solution, by which a film of any desired thickness may be produced; and by a previous adjustment of the plate, the new portion may be separated from the old in the form of a distinct plate, susceptible of after-preparation for the engraver. Or, the copper-plate, instead of being made by deposition upon another plate of the same material, may be produced on a flat surface of wax or plaster properly prepared.

In the copying of engraved plates, as described in Voltagraphy, P. C., the principle involved is nothing more than that in making a smooth plate; for the invisibly minute particles of metal fall into all the little cavities or depressions in either case, and if these cavities happen to form a definite pattern or device, as in an engraving, a copy of this device is obtained, the original being in intaglio, and the copy in cameo or relief. Whether or not it would ever become advantageous to employ the same method for obtaining stereotype plates for printer's type, or for wood-cuts, the practicability of it, as a question of electro-metallurgy, is clear. Mr. Smee thinks (p. 276) that the method may be adopted for such subjects as the 'arms of the sovereign, where many persons design a separate block to print.' The design is cut in wood, and this wood-block, after being prepared with black-lead, is immersed in a copper solution, so that an intaglio copper mould may be produced by deposition; this mould may be used to make copper reverses, which are at once ready for the printer; or it may be used as a die to form clichée casts. Mr. Smee's volume contains three specimens, varied in the following way: 1, A device was engraved on a wood-block; a copper reverse was taken from this by the electro-process; a clichée (metal alloy) cast was obtained from the copper in the manner described in Chasing of Metals, P. C. S.; and the printing was conducted from the clichée. 2, The device was engraved on the wood; a clichée mould was taken from this; an electro-coppered cast was taken from the clichée, and the printing was conducted from the cast. 3, The device was engraved on the wood; a mould from this was taken in plaster; an electro-cast was taken from the mould, and the printing was conducted from the copper.

The copying of coins, medals, seals, and plaster casts, has been sufficiently illustrated by the above details and by those contained in the article before quoted; and in numerous other instances of the kind it is easy to see that the same principle is at work, slightly modified in the details. It has been proposed to obtain duplicate copies of monumental brasses by such means, for antiquarian and historical purposes. A cast is to be taken from the brass in plaster, and from this cast, when baked, soaked in tallow, and black-leaded, an electro-copper impression may be obtained. By taking an impression from an embossed surface, with a sufficient thickness of metal, it has been suggested that stamps or dies for wafers and such like articles might be easily produced. By increasing the thickness of the metal in an electro-coppered specimen of fruit, and by removing the contents, the copper might form a mould for obtaining casts of the fruit. Various suggestions have been from time to time thrown out respecting the application of electro-metallurgy in many cases which occur to the dentist, the surgeon, the mineralogist, the architect; but it is unnecessary to particularise these. We may however mention that M. Peyré, of Versailles, communicated to the Académie des Sciences, two or three years ago, a notice of a method which he proposed to adopt for the multiplication of accurate graduated instruments: it is well known that the graduation of sextants and other astronomical and geodesical instruments is a most difficult and expensive process; and M. Peyré conceives that the electrotype process might be the means of producing numerous copies of such, all taken from one specimen originally graduated by hand. Mr. Heineken ('Mech. Mag.' No. 972) states that the same plan had been suggested by him in 1840, and he also suggests that the electro-process might be successfully used for producing tools for regrinding or polishing specula, as the tool might thus be made from the speculum itself; as also tools for grinding lenses.

The production of copper busts, made entirely by deposition from solution, is an example of what we have before termed 'solid deposit.' The first specimen of this kind, we believe, was a small bust of Dr. Dalton, exhibited by Mr. Cheverton at one of Mr. Walker's Conversazioni in 1841; since which time, others have been produced elsewhere. In such works of art a bust is prepared of some fusible or friable material, upon which a copper film is formed by electro-deposition; and on the removal of the bust or core from within, the copper shell forms a mould, within which a copper bust may be formed by a second deposition. It is stated that the Bavarian sculptor, Stigelmayer, has devised a mode of coating colossal plaster statues with copper by the electro-process; and that he can complete such a process in the short space of two or three hours.

Galvanic Etching and Engraving. It is mentioned in 'Voltagraphy,' that Daguerreotype pictures are capable of being copied in electrotype. This art, which forms the connecting link between two notable discoveries of modern times—light painting and electro-engraving—depends on an intimate chemical action which takes place at the surface of the Daguerreotype silver plate after the application of mercurial vapour to it. [Photogenic Drawings, P. C.] Mr. Grove, who described the method before the Electrical Society in 1841, explained that he used dilute hydrochloric acid in the galvanic trough; and that this acid, by acting unequally upon different parts of the Daguerreotype plate, according to the extent to which the light and the mercury had before acted, bit it away in the manner of an etching, so as to produce deep lines in the shaded parts and fainter ones in the light tints.

This is, therefore, a kind of etching by galvanism; and Mr. Smee has suggested the employment of a plan somewhat similar for etching in general. In this process, instead of a film of copper being added to the plate by deposition from the solution, a film is abstracted from the plate in the parts which constitute the lines of the device: in the other processes the plate is made the negative pole of the battery, whereas here it is the positive pole. In common etching, the plate is coated with a composition of asphalte, wax, and pitch; and on the surface so produced, when hardened, is sketched the design, by scratching away the composition by means of a sharp point or needle. The plate is afterwards exposed to the action of dilute nitric acid, by which the copper is eaten into at the exposed parts, but left untouched at the parts covered by the composition. In the galvanic method, the plate is coated with composition and etched with the needle in the usual way; but instead of being immersed in a vessel of nitric acid, it is dipped into a galvanic trough of sulphate of copper, through which a current is passed. The copper leaves the etched parts of the plate and becomes dissolved in the sulphate, a piece of copper being placed so as to receive an additional film from the solution as fast as particles of copper are thrown off from the etched plate. As a plate etched in the common way is treated with the acid three or four times, to produce different grades of tint; so is likewise the plate etched by the galvanic method. Mr. Smee says that 'the advantages of galvanism for etching are, the absence of poisonous nitrous fumes, which are evolved in the ordinary process; the greater uniformity of action which takes place than when acids are used; and the rapidity of biting, which may be regulated to the greatest nicety. The lines may be of any depth, and are sharper and cleaner than when acid is used; and lastly, no bubbles are evolved, which the engraver well knows are apt to tear up the ground, or to cause unequal action' (p. 289).

The terms *Electrotint* and *Glyphography* have been applied to two methods of etching by galvanism, in which the device is produced in rather a peculiar way. The methods are adapted, one for plate-printing, in which the design is in intaglio; and the other for surface-printing, as in common typography.

For the former of these two methods, a paint or pigment is used, possessing the properties of working freely, laying on without spreading, and resisting the action of sulphate of copper: a composition of white wax, lard, lamp-black, olive oil, and turpentine, is said to answer well for the purpose. The plate employed is not of copper, but of some mixed metal presenting a white surface, such as one of the modern kinds of German silver. Brushes made of fitch, hog's hair, camel's hair, and sable-hair, cut at the ends to various shapes, are employed; as also points of wood, ivory, and metal. The artist sketches his design on the dull white surface of the plate, and then paints the subject in full by means of the brushes and composition. All the parts which are to be white in the impression are left uncovered by the paint, either by handling the brush so as to avoid them, or removing the paint from them by a cork stump or other means; the kind of stroke and the thickness of the paint are made to depend on the depth of the shade in the picture. In a pamphlet on the subject of Electrotint, by Mr. Sampson, instructions are given as to the different modes of 'pencilling' or 'handling' necessary to produce the required effects. When the picture is finished, it is coated with black-lead, and exposed to the electro-coppering process, by which a plate is produced fit for working in the copper-plate press, having the lines of the device marked in intaglio or sunken.

In the surface-printing method, the paint or composition is so laid on as to cause a series of hollows in the electrotype deposit sufficiently deep to prevent being inked by the printer's inking roller; in other words, all those parts which are to be black in the impression are left untouched on the plate—a plan directly the reverse of the former. In order to aid the artist in producing the required effect, he uses a white paint on a black ground; the metal plate may be blackened by hydro-sulphuret of ammonia, or by other agents; and a white paint may be formed from a mixture of sulphate of lead, white wax, lard, and olive oil. The mode of pencilling is entirely different from that adopted in the former case, and, as would appear, more difficult; for the artist has to avoid with his pencil all the parts which are to form the device or inked part in the impression. When the plate is finished it is coated with black-lead, and immersed in the sulphate of copper; whereby a plate is produced fitted for surface-printing.

Minor improvements have been introduced in these curious branches of art; and specimens of pictures produced by these means have been recently given in the illustrated newspapers. Opinions may perhaps differ as to the ultimate success of the method, artistically and commercially; but its ingenuity certainly claims for it a fair trial.

ELECTRO-PLATING AND GILDING. [Electro-Metallurgy, P. C. S.]

ELECTROTINT. [Electro-Metallurgy, P. C. S.]

ELECTROTYPE. [Electro-Metallurgy, P. C. S.]

ELEO'CHARIS, a genus of plants belonging to the natural order Cyperaceæ, and the tribe Scirpeæ. It has fertile glumes, the lowermost layer with 1 or 2 of the lowest empty; 3-6 bristles. The nut compressed, crowned with the persistent dilated base of the style. There are three species of this genus, known by the name of Spike-Rushes, found in Great Britain.

E. palustris has a creeping root, and the stem clothed with membranous obtusely truncate sheaths: it grows in marshy places, forming sometimes a large proportion of the peat found in bogs. *E. multicaulis* has slightly creeping roots, with the stem clothed with obliquely truncate rather acute sheaths. *E. acicularis* has a fibrous root, and numerous slender erect stems, and very small spikes. It is found in damp places upon heaths.

(Babington, *Manual.*)

ELEPHA'NTOPUS (from ἐλέφας, an elephant, and πούς, a foot, on account of the shape of its radical leaves), a genus of plants belonging to the natural order Compositæ, the suborder Corymbiferæ, the tribe Vernoniaceæ, the subtribe Vernonieæ, and the division Elephantopeæ. It has heads containing 3-4-5 florets, equal flowered, closely collected into a cluster, surrounded by leaves; the involucre compressed in 2 rows, the leaflets dry, oblong, alternately flat and folded, the inner usually 3-nerved; the receptacle naked; the corolla palmate, with a 5-cleft limb, which has acuminate segments and 1 recess deeper than the others; the filaments smooth, the branches of the style half subulate; the achenium rather compressed, many ribbed, oblong, hairy; the pappus in 1 row consisting of several straight paleæ, dilated at the base, but otherwise very narrow, acuminate, equal, and serrated.

E. scaber has a hairy dichotomous stem, the radical leaves scabrous, cuneate, and very much narrowed at the base, those of the stem lanceolate. This plant is common in almost all parts of India, in dry elevated positions. It has a stem a foot high, with the heads of pale red flowers on long stalks. The roots are fibrous. Both the roots and the leaves are reputed to have active medical properties. The natives on the Malabar coast use a decoction of them in cases of dysuria. There are other species natives of South America and the West Indies.

(Lindley, *Flora Medica*; Loudon, *Encyclopædia of Plants.*)

ELIMINATION. This word is from *eliminare*, to drive out of doors, and it is used in mathematics to signify the formation of an equation or equations which do not contain a certain quantity, by means of given equations which do contain that quantity. Thus in so simple a case as $x = y, x = z$, if by means of these two equations we deduce the obvious result $y = z$, we have eliminated x, or formed a third equation in which x is not found. Elimination is an essential part of very many mathematical processes: and in the present article we can only attempt to give a few general notions, such as may help a student to connect different portions of his algebraical reading.

If the solution of equations were perfect, so also would be elimination. Having 10 independent equations for instance, each containing x, y, and z, if we could choose any three, and from these three find x, y, and z, we might substitute these values in the remaining seven equations, and thus form seven equations independent of x, y, and z. The general rule is that from m equations can be formed $m-n$ equations with n quantities eliminated. But not only must the equations be independent of each other, but no two or more must be capable of what we may call simultaneous elimination. Suppose, for instance, x and y never enter into a set of equations except in functions of, say, $x^2 + y^2$. If then we make $x^2 + y^2 = p$ and substitute, we have a set of equations not containing either x or y, but containing p. If by means of one of these we eliminate p from the rest, the process which does this, applied to the original equations, would allow of our eliminating both x and y by one equation only.

As to equations which are not purely algebraical, or which contain more than powers or roots, or combinations of them, we cannot pretend to say that there is any organized method of elimination existing, except that of solution. For example, we can eliminate x between the equations $x = \log\ (x + y)$, and $\sin\ (x + y) = \epsilon^y + x$, because it so happens that we can find y from the first, as in $y = \epsilon^x - x$: and this value of y may be substituted in the second. But if the first equation had been $x + 2y = \log\ (x + y)$, we could not have found either quantity in *finite* terms of the other, from either equation. In such a case, we must have recourse to infinite series: with these instruments, elimination is always theoretically possible. But whether the results produced will be convergent, and otherwise convenient for use, must depend upon the circumstances of each case. When, however, elimination is spoken of, elimination in finite terms is generally understood.

Let us now take simple algebraical equations, and suppose a pair of them, containing x and y, as $xy^2 - x^2y - 2 = 0$, $y^2 + x^2y - 6 = 0$. Let these be $P = 0$, $Q = 0$, and proceed as in finding the most complicated common divisor of P and Q. And first, let it appear that there is a common divisor R, and let $P = RA$, $Q = RB$; so that A and B have not any common algebraical divisor. These equations may then be both satisfied by making $R = 0$, which being only one equation between x and y, admits of an infinite number of solutions. But they may also be satisfied by $A = 0$, $B = 0$, the method of treating which falls under the next case.

Secondly, let there be no algebraical common divisor. Then, if we take y as the principal letter, there will at last be a remainder which is a function of x only: let this be X. Now it is easily proved that when P and Q vanish, X must vanish also; that is, no values of y can make both P and Q vanish, except in combination with values of x, which make X vanish. All the required values of x, then, satisfy $X = 0$. But is the converse true, and are all the roots of $X = 0$ capable of combination with values of y, so as to satisfy both equations? This question will require some consideration.

In the preceding process, when y is made the principal letter, we have generally this alternative, either to introduce fractional functions of x into the result, or else to employ multipliers beforehand to avoid it: these multipliers will be functions of x. Let us allow of fractional functions of x, and suppose the process to be as follows:—

$$\begin{array}{llll} P\,)\,Q\,(\,M_1 & & & \\ & N_1\,)\,P\,(\,M_2 & & \\ & & N_2\,)\,N_1\,(\,M_3 & \\ & & & X \end{array}$$

We have then

$$\begin{aligned} Q &= M_1\,P + N_1 \\ P &= M_2\,N_1 + N_2 \\ N_1 &= M_3\,N_2 + X \end{aligned}$$

Take a value of x which makes X vanish, and with this value of x, find a value of y which makes P vanish. We have then $Q = N_1 = M_3N_2 = -M_3M_2N_1$, or $N_1\ (1 + M_2M_3) = 0$. If then $1 + M_2M_3$ should not happen to vanish, we must have $N_1 = 0$, or $Q = 0$; that is, a root of $X = 0$, combined with a value of y which makes $P = 0$, also makes $Q = 0$. But if it should happen that $1 + M_2M_3 = 0$ is satisfied by the values of x and y, we have not this assurance that $Q = 0$. Again, if M_1, M_2, or M_3, be made infinite by the value of x, the whole process fails. All we can say then is, that though $X = 0$ must contain among its roots all the values of x required, it may possibly contain other values.

Next, suppose we introduce a multiplier to avoid fractions. Let it be convenient to begin with QZ and P, instead of Q and P. Then when QZ and P both vanish, X vanishes; but we can now only say that the roots of $X = 0$ may, with proper values of y, satisfy one or the other of the systems $Q = 0$, $P = 0$, or $Z = 0$, $P = 0$.

We shall take the following example, to show how comparatively complicated the results of a very simple instance may be. Let the equations be

$$P=xy^2-x^2y-2=0,\ Q=y^2+x^2y-6=0$$

Multiply Q by x, to prepare for division without fractions, and divide by P: the remainder is $x^2\ (x^2+1)\ y-(6x-2)$. Multiply P by $x^2\ (x^2+1)^2$ for a similar reason, and divide by the remainder. The second remainder, X, is

$$2x^7+6x^6+2x^5+6x^4-36x^3+24x-4$$

One of the roots of this is $x=1$, with which it will be found that $y=2$ satisfies the equations $P=0$, $Q=0$. And in this instance it does happen that all the seven roots of X are capable, each with its proper values of y, of satisfying the given pair of equations.

If we take the principal letter to be x, the problem of ordinary algebraical elimination is reduced to eliminating x from two such equations as $ax^m+bx^{m-1}\ \ldots=0$, and $px_m+qx^{m-1}+\ldots=0$, where a, p, &c. are functions of the other letters. The mode which we have always adopted as most convenient in practice is as follows:—Suppose the equations to be

$$ax^3+bx^2+cx+e=0$$
$$px^3+qx^2+rx+s=0$$

Multiply by p and a, and subtract, which gives an equation of the form

$$Ax^2+Bx+C=0$$

Multiply by s and e, subtract, and divide by x, which gives another equation of the form

$$Px^2+Qx+R=0$$

Repeat the same sort of process, making the first terms destroy each other, and then the last; we are thus led to two equations of the first degree, from which x may be at once eliminated. The same method will do when the equations are of different degrees, but in that case it is more convenient to bring down the higher to the lower, first, in the following manner:—Suppose the equations to be $ax^7+bx^6+cx^5+ex^4+\ldots=0$, and $px^4+qx^3+\ldots=0$. Multiply by p and by ax^3, and subtract, which gives a new equation of the form $Ax^6+Bx^5+\ldots=0$. Multiply by p and by Ax^2 (using the lower of the given equations) and subtract; and continue this process until a second equation of the fourth degree is found: after which proceed with the first and last terms as before.

The problem may be reduced to that of elimination between purely linear equations, as follows:—Suppose it required to eliminate x between $ax^2+bx+c=0$, and $px^3+qx^2+rx+s=0$. Multiply both these equations by x, and we have then four equations involving the first four powers of x. Multiply again by x, which gives six equations involving the first five powers of x. Let these five powers be considered as five distinct quantities, x_1, x_2, x_3, &c., and eliminate these five quantities between the six linear equations, which are

$$\begin{array}{ll} ax_2+bx_1+c=0 & px_3+qx_2+rx_1+s=0 \\ ax_3+bx_2+cx_1=0 & px_4+qx_3+rx_2+sx_1=0 \\ ax_4+bx_3+cx_2=0 & px_5+qx_4+rx_3+sx_2=0 \end{array}$$

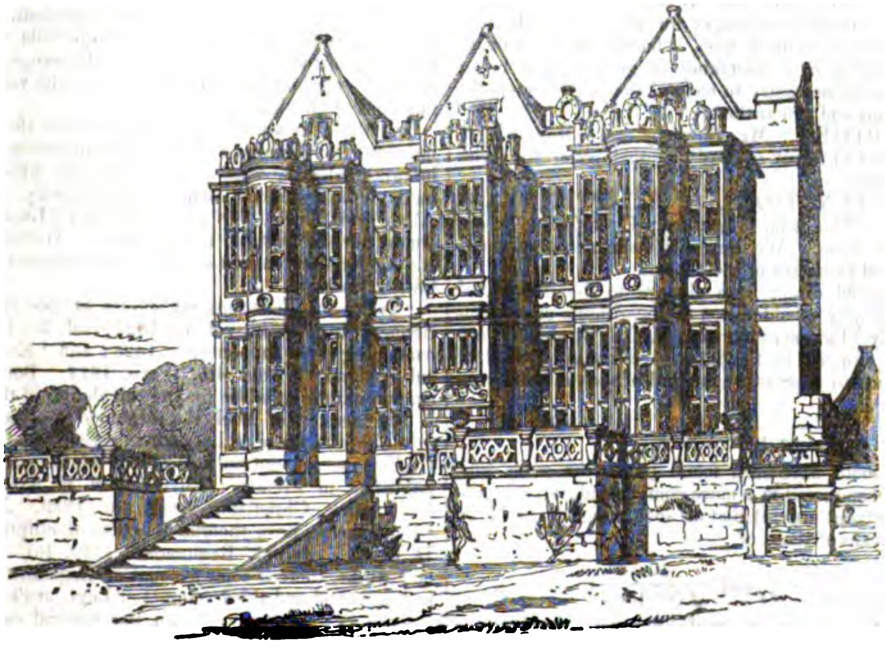
Since two equations are introduced at each new step and only one new power, there must be a step at which the number of equations becomes equal to the number of powers, after which, at the next step, the number of equations will be in excess by one, which is what is wanted for elimination. It is also worth notice that if we were to stop at the step at which the number of equations is the same as that of powers and find the powers as independent quantities, we might then eliminate between the first and second power, and produce the result in the form $A^2-B=0$.

On this subject see Dr. Peacock's *Algebra*, vol. ii. cap. 44; or Mr. Sylvester's remarkable papers, *Phil. Mag.* Dec. 1839, Feb. 1840, June, 1841; also *Cambridge Mathematical Journal*, vol. ii. pp. 232, 276, vol. iii. p. 183, vol. iv. p. 9.

ELIZABETHAN ARCHITECTURE. By this name we distinguish that transition style which prevailed in England from about the middle of the 16th, to the end of the first quarter of the 17th century, and was accordingly in its meridian during the long reign of Elizabeth. If it were worth while to disturb a name already fixed, it might with equal or even greater propriety be termed the *English Renaissance*, it being a style formed out of the continental Renaissance engrafted upon our own Tudor and old English domestic styles; and it was, we may observe, applied exclusively to domestic, or at least secular buildings, in which respect it was very differently circumstanced from the Gothic style, which was almost as exclusively ecclesiastical in character and purpose. The age of Elizabethan architecture was that of palace-building, not church-building; and a style developed itself which was eminently palatial in many of its qualities—certainly not deficient in stateliness—one very important ingredient, nor more deficient in picturesqueness. By no means do we pretend to assert that stateliness and picturesqueness invariably mark all the productions in that style, because many of them possess neither the one quality nor the other; yet such is the case with regard to all styles; a style being only a particular language of architecture, and the merely making use of it does not confer the power of employing it with mastery or even with good taste; otherwise we should not have so much flat and vulgar architectural prose under the name of the Classical, Italian, and Gothic styles. Very few architectural writers however have admitted the claims of Elizabethan to be considered a style: those who have spoken of it as requiring some historical mention, have done little more than enumerate some examples of it, while others have condemned it in the most unqualified manner. If the censurers of Elizabethan had taken the pains, they might perhaps have made out a tolerably fair case against the style—at least what would have looked so, though in reality founded upon one-sided argument; whereas they do not even make any show of criticism at all. To object that Elizabethan is neither Gothic nor Italian is childish, for if it was, it would not constitute a style by itself; to set it aside disdainfully as an impure style is not much wiser, because all transition styles are of necessity more or less impure, consisting as they do of elements that have not yet been brought into consistency; to denounce it as illegitimate, without first convincing us that it is worthless, is sheer extravagance: in art the successful is always the legitimate. A style is not to be judged by unworthy specimens or commonplace productions in it, but according to what it is when treated with taste, and according to the scope it holds out to those who are capable of so treating it. There certainly is a great deal of mere dross in Elizabethan buildings; and it is that which, while on the one hand it has caused it to be condemned as essentially corrupt, has on the other obtained for it the favour of those who fancy that its seeming waywardness and utter rejection of all positive rules render it particularly easy for imitation, and that its merest conceits put together any how will constitute 'genuine Elizabethan,' and of course something excellent as such. Both its detractors and its admirers are equally one-sided: the latter are as obstinately blind to its worst vices and defects as the others are to its merits and capabilities; they mistake the faults and blemishes of particular buildings for characteristics of the style itself. Historical interest it certainly possesses, nor is it deficient in artistic merit: accordingly it has of late years engaged the attention of architectural draftsmen and designers, and has been made the subject of several graphic publications (such as Nash's admirable 'Old English Mansions,' C. J. Richardson's 'Architectural Remains of the Reigns of Elizabeth and James I.,' Hall's 'Baronial Halls,' Shaw's 'Elizabethan Architecture,' &c.); and it has also been occasionally adopted in practice with more or less success, especially for internal decoration, with which, however, the affectation of antiquarianism on the one hand, and of mere fashion on the other, have had quite as much to do as true taste. The style itself, indeed, is by no means one for either indiscriminate or servile copying, for even the very best examples present something exceptionable, and what, though we tolerate it in them because they are genuine and authenticated records of the style, becomes intolerable at second-hand in what we know to be of modern construction. In the hands of an artist capable of treating it with both freedom and feeling—of seizing upon and bringing out all its better qualities, and not afraid of discarding or reforming its baser ones, very much may yet be made of Elizabethan; and there surely need be no scrupulousness about tampering with a style which is in a manner outlawed by the majority of architectural teachers. In one respect it will not bear any great liberty to be taken with it, since it does not admit of being simplified—that is, not by the usual process of paring down—of omitting embellishment, and attenuating such members as are retained. Deprived of vigour and richness, many of the forms become not only spiritless but uncouth; and on the other hand, embellishment, without regard to other essential characteristics, may be made to look like tawdry ornament. Strange as it may sound to many, one great difficulty attending this style arises from there being nothing like a system of rules for it—no standard examples, for many of the very best examples differ so very much from one another, that they are rather apt to bewilder by the choice they afford. Hence merely to say that a building—more especially a modern one—is in the Elizabethan style, is saying nothing—is rather telling us what it is not than what it really is. We have things of the most opposite character imaginable passing under that name; there are, for instance, two shop-fronts in the metropolis, one at the corner of the Quadrant in Regent-street, the other at that of Berners-street and Oxford-street, which seem to have been expressly intended to show with how much good and with how much bad taste our English Renaissance may be applied; for while the former offers a well-composed and elegant design, the other is an uncouth and incoherent jumble of tawdry fragments, without any artistic combination.

Notwithstanding the attention directed of late towards the Elizabethan style, there is yet no work which gives anything like either a satisfactory history, or synopsis, or analysis of it. Of the publications before mentioned, and similar ones, some consist only of pictorial views, without any letterpress, while those which are more professedly architectural are only miscellaneous collections of studies from particular buildings or parts of buildings and their decorations, without arrangement of any kind,—valuable as materials, but too fragmentary to afford any clear and comprehensive insight into the style generally, with its numerous and complex modifications. It cannot be expected that, within our limits, we should attempt to draw up such a systematic scheme as we conceive to be a desideratum; still we may do something to open the way for others, leaving them to expand our hints into a connected and well-digested treatise.

It is equally unjust and indiscreet to speak of Elizabethan architecture, as is usually done, as being marked by the introduction of the Grecian orders, those employed in it having nothing whatever in common with the orders of antiquity but that sort of resemblance which renders us all the more sensible of the prodigious difference between the respective styles. Considered as classical or antique, they can be regarded only as grotesque parodies, since the application of them in all the varieties of the Renaissance style is as contrary to the practice of the antients as their character is dissimilar. The orders are employed merely as decoration, and then only for the separate stories of an edifice, or for distinct compartments of a front. Hence they are invariably microstyle, and are still further reduced in height by being placed on tall pedestals, and look all the smaller owing to the spacious proportions of the windows between them. In fact they are to be regarded only as accessories and decorative filling-up; for they have scarcely aught of even the apparent character of columniation. In point of design too they retain little of the orders after which they are named: with the exception of one or two distinctive marks, such as the Doric triglyphs, and the forms of the respective capitals, they are all assimilated in character, the Doric being frequently quite as slender and as much embellished or more so than the Corinthian. Pedestals are mostly panneled and filled in with ornament, the pannels themselves being multiplied in a variety of patterns. The shafts of columns are frequently enriched with one or more bands (either sculptured or plain), and the lower part of the shafts is often covered with arabesque carving. Pilasters are similarly treated—sometimes banded, sometimes panneled, and frequently filled in with arabesques or other ornaments, among which raised facetted blocks are very common ones. Entablatures are almost invariably made to break over columns; and are so crowded with mouldings and other carvings, as to have the look of being all cornice. Orders are usually applied only to parts of a front; for instance, the centre, which is marked out as a lofty frontispiece or portal ornamented with several tiers of columns, and thus not only distinguished from the rest, but in many instances rendered quite distinct from it, all besides being comparatively genuine Tudor, without any intermixture of foreign elements. Even where such is not the case, the Tudor physiognomy manifests itself in windows and bays, which last are almost as peculiar to our English architecture of the period as small circular towers and turrets with conical or spire-like roofs are to that of Flanders and France. Although square-headed, and without tracery of any kind, the windows retain a good deal of the latest Gothic or perpendicular character, being divided by mullions and transoms into numerous compartments after the manner of panneling, a mode that freely admits of a window being made of any extent; and not only are single windows sometimes exceedingly spacious, but are put so closely together as to render the whole of a front nearly all window. This fashion, which however is only an occasional variety of the style, may be exemplified by what is called 'the Duke's House,' at Bradford, Wilts, the front of which is made up entirely of windows and bays, in a manner that would be too monotonous, were not the plan-line broken by semicircular projections being thrown out, as smaller bays, from the larger ones. Thus the design acquires a pleasing playfulness of form; and it is besides not only marked by perfect regularity of composition, but also by a certain compactness, the windows not having the appearance of being intended for separate openings squeezed together for want of more space. The parapets upon the bays, consisting of fanciful open-work, enhance the general richness of effect, and both they and the parapetted terrace serve to indicate what are pleasing peculiarities in the style. But the building here given by way of specimen affords no example of the characteristic Elizabethan gable, a feature so singularly diversified, that to exhibit only the leading varieties of it would require a series of cuts, beginning with the simplest and proceeding to the most complex forms. In the absence of such illustrations, we can only say that almost every imaginable combination of curves, both



[The Duke's House, Bradford, Wiltshire.]

concave and convex, with straight lines and angles, are to be met with in gables. Differently shaped gables often occur in the same building, and produce very great effect of outline, which is further increased by embellished parapets, with balls and other ornaments upon them, by small domes on turrets, and by chimney-shafts, all which, mingled together in glorious confusion, often give an air of picturesque magnificence to what are otherwise rather plain and homely structures, and impart animation to what would else be lumpish masses. In like manner porches and balustraded terraces often give character to the lower part of a building, while the upper may be comparatively flat and uninteresting. The style is excellently well adapted for brick and stone, such contrast of colour seeming natural to it, and serving to bring out the several parts more distinctly. We hardly need observe that the brick ought invariably to be red, and of superior quality and execution; for white or yellow bricks are so far from producing a similar effect, that they have both an insipid and mean appearance, the building seeming at a distance to be of stone, and when approached discovered to be of an inferior material. The brickwork itself is often variegated by the intermixture of darker bricks so disposed as to form a regular pattern on the walls, generally consisting of intersecting diagonal lines. There are also many instances of brick alone being employed, the ornamental members being formed of moulded bricks, and though the effect is comparatively sombre, it is by no means unpleasing.

To the internal characteristics of the Elizabethan style belong spacious bay-windows; long and ample galleries [GALLERY, P. C. S.], but generally of low proportions; massive and elaborately sculptured chimney-pieces [CHIMNEY-PIECE, P. C. S.]; screens of similar character, either with open arches or doors; wainscoted and panneled walls; ceilings highly enriched, and sometimes arched, and entirely covered with scroll-work foliage; and wide staircases with richly carved balustrades. [STAIRCASE, P. C.] The prevailing character is that of heaviness and stateliness; on which account it is ill-suited for literal imitation at the present day, especially for houses upon a moderate scale, or for small rooms. In external architecture many of the defects of detail are merged in the picturesque impressiveness of the whole; but a similar degree of capriciousness and heaviness brought near to the eye within a room, is apt to strike chiefly as too rudely grotesque and ponderous. Besides which it is an expensive style for internal finishings; for though it will very well bear to be greatly refined upon, it hardly admits of being simplified, decoration even partaking of gorgeousness being almost indispensably necessary to conceal the native uncouthness of both forms and proportions.

ELLIPSOLITHES. Mr. Sowerby gave this title to some (compressed?) forms of fossil Cephalopoda, from the mountain limestone.

ELLIPTIC FUNCTIONS, or ELLIPTIC TRANSCENDANTS. This is no subject for a Cyclopædia, except in a very limited sense. We can only undertake here to describe the general character of the subject.

If we had passed direct from algebra to the differential calculus, without any consideration of logarithmic or trigonometrical quantity [TRANSCENDENTAL, P. C.], we should have found ourselves stopped in the integral calculus by want of language in which to express the integral of such a function as

$$\frac{dx}{\sqrt{(a + bx + cx^2)}}.$$

It would no doubt have been found (since the same difficulty has been conquered in a more complicated form in the subject of the present article) that all such integrals could be expressed by means of those of

$$\frac{dx}{\sqrt{(a^2 - x^2)}} \text{ and } \frac{dx}{\sqrt{(a^2 + x^2)}};$$

and the connection of the former of these with the arc of a circle, and of the latter with logarithms, the properties of the functions called sines and cosines, tables of their values, with a complete system of trigonometrical formulæ, would speedily have followed. From this mode of arriving at a new set of transcendentals we are saved by having the science of trigonometry already prepared on a geometrical basis, in connection with the properties of the circle. But we have no such preparation founded on the ellipse, a curve which is an extension of the circle. Nor is there any connection between the arc of an ellipse and the eccentric anomaly, the angle which is the extended representative of the angle at the centre in the circle, except by means of a definite integral. In fact, a being the semi-axis major, e the eccentricity, ϕ the eccentric anomaly, and s the arc, we have

$$s = a\int \sqrt{(1 - e^2 \cos^2 \phi)} \,.\, d\phi.$$

The integral calculus is, as yet at least, the only manner in which the arc of an ellipse can be approached: accordingly, a large class of integrals, closely related to, and containing among them, the expression for the arc of an ellipse, have received the name of elliptic functions.

By an elliptic function is meant any integral of the form

$$\int \frac{\mathrm{P}\, dx}{\sqrt{(a + \beta x + \gamma x^2 + \delta x^3 + \epsilon x^4)}},$$

in which P is a rational function of x. This can be shown to depend for its determination upon the form

$$\int \frac{\mathrm{Q}\, d\phi}{\sqrt{(1 - e^2 \sin^2 \phi)}},$$

in which Q is a rational function of $\sin^2 \phi$, and e is less than unity. This again can be shown to depend upon

$$\int \frac{\mathrm{A} + \mathrm{B} \sin^2 \phi}{1 + n \sin^2 \phi} \cdot \frac{d\phi}{\sqrt{(1 - e^2 \sin^2 \phi}},$$

which in every case depends upon one or more of the three following forms:—

$$\int \frac{d\phi}{\sqrt{(1 - e^2 \sin^2 \phi}}, \quad \int \sqrt{(1 - e^2 \sin^2 \phi)} \,.\, d\phi$$

$$\int \frac{1}{1 + n \sin^2 \phi} \cdot \frac{d\phi}{\sqrt{(1 - e^2 \sin^2 \phi)}},$$

which are called functions of the first, second, and third species. Every elliptic function represents the arc of some algebraical curve.

The earliest researches into the integrals connected with the arcs of an ellipse or hyperbola are those of Maclaurin, in his treatise on Fluxions, and of D'Alembert, in the Berlin Memoirs for 1746. Fagnani, in 1750, showed how two arcs of an ellipse might be assigned in an infinite number of ways, which should have for their difference an algebraical expression. Euler, in 1761, showed how to assign the complete integral of certain differential equations of which the terms are separately nothing but elliptic functions. Landen, in 1755, showed that every arc of an hyperbola can be obtained by means of two arcs of an ellipse. Lagrange, in 1785, gave a general method for approximating to the values of elliptic functions of all kinds.

But those to whom it is due that the theory of elliptic functions has become a distinct and important branch of the integral calculus, with general formulæ which bid fair to make it an extended form of trigonometry, are Legendre, Abel, and Jacobi. Of these, the first [LEGENDRE, P. C.] almost devoted his life to the subject. His various memoirs, and his latest extensions of them, are contained in the two following works.

'Traité des Fonctions elliptiques et des Intégrales Eulériennes,' 4to., Paris, vol. i., 1825; vol. ii., 1826; vol. iii., containing three supplements, 1828; and 'Exercices du Calcul Intégral,' 3 vols. 4to., Paris, 1811. Both these works contain extensive tables for the calculation of the functions.

The memoirs of Abel, the substance of some of which are in the third volume of Legendre, were originally published in Crelle's journal, and are now collected in his works, which were published in French, 'Œuvres de N. H. Abel,' collected by B. Holmboe, Christiania, 2 vols. 4to., 1839. Jacobi's work is 'Fundamenta nova theoriæ functionum ellipticarum, auctore D. C. G. I. Jacobi,' Regiomonti, 1829, 4to. As to elementary works, there is some account of Legendre's first memoirs in the second and third volumes of Leybourn's 'Mathematical Repository:' several works on the integral calculus, that of Mr. Hymers in particular, contain the first elements. There is a work on the subject expressly by M. Verhulst, printed in Belgium; and there is an article on elliptic functions and definite integrals in the 'Encyclopædia Metropolitana.'

ELLIPTIC POLARIZATION, in the undulatory theory, is the name given to a supposed rotation of the particles of ether in the peripheries of ellipses when a pencil of plane polarized light is made to suffer reflexions in the interior of glass, or at the surfaces of polished metals.

Let, for example, a pencil of light be polarized in some plane by reflexion from the surface of glass at the proper polarizing angle; and let it be made to enter an oblique parallelopiped or rhomboid of glass perpendicularly to one of its ends, the inclinations of two opposite sides of the rhomboid to the ends being equal to the polarizing angle: the pencil of light will then suffer two reflexions, one from each of two opposite sides of the glass, and it will emerge perpendicularly to the opposite end. Now, if the sides of the rhomboid are so disposed that the plane in which the two reflexions take place in it are coincident with, or at right angles to the plane in which the pencil of light is polarized, no effect is produced on the pencil; but if the parallelopiped be turned on an axis perpendicular to its two ends till the plane in which the two reflexions take place is inclined to the plane of the original polarization in an angle equal to 45°, 135°, 225°, or 315°, the emergent pencil will be found to be circularly polarized. [CIRCULAR POLARIZATION, P. C. S.] If the inclination of the planes be any other angle than one of these, excluding also the angles 0°, 90°, 180°, 270°, the pencil will be elliptically polarized.

Thus, if y and z be rectangular co-ordinates of a particle of ether, the former in the plane of the two reflexions and the other perpendicular to it; and if the plane of the reflexions be inclined at an angle represented by α to the plane of polarization; then the general equation for a vibration (supposed to take place in a plane perpendicular to the plane of polarization), being $a \sin. p\,(vt-x)$, the resolved vibrations perpendicular and parallel to the plane of reflexion would be, respectively,

$$z=a \cos.\ \alpha \sin.\ p\,(vt-x)$$

and

$$y=a \sin.\ \alpha \sin.\ p\,(vt-x).$$

But the phase in the latter being conceived to be accelerated by a quarter of a vibration, or 90°, when compared with the other (*Airy's Tracts*, *Und. Theo.* art. 135), the last equation becomes

$$y=a \sin.\ \alpha \sin.\ \{p\,(vt-x)+90^\circ\} \text{ or } y=a \sin.\ \alpha \cos.\ p\,(vt-x):$$

hence is obtained

$$y^2 a^2 \cos.^2\alpha + x^2 a^2 \sin.^2 \alpha = a^4 \sin.^2\alpha \cos.^2\alpha,$$

which is the equation to an ellipse, and proves that the particles of ether are in the peripheries of ellipses. When $\alpha=45^\circ$, 135°, &c. we have

$$y^2+z^2=\tfrac{1}{2}\,a^2,$$

which is the equation to a circle.

If polarized light, after having suffered two reflexions in the glass parallelopiped, be made to suffer two additional reflexions in a similar parallelopiped, similarly situated, the emergent pencil will be restored to a state of plane polarization; but the new plane of polarization will be perpendicular to the former when the inclination of that former plane to the plane of reflexion is 45°, 135°, &c. This is explained (Airy's *Tracts*, art. 142), by assuming that the vibrations in the plane of the reflected rays are accelerated 90° by the first parallelopiped, and another 90° by the second, while no acceleration takes place perpendicularly to that plane. If the inclination be any angle between those, and be represented by α, the like restoration takes place, and the two planes of polarization will be inclined to one another in an angle equal to 2α.

Sir David Brewster discovered that, when a pencil of plane polarized light is reflected once from the surface of polished metal, it acquires properties similar to those which arise from two reflexions of the light within glass. First, only a partial polarization takes place in it when the metal is so disposed that the plane of the incident and reflected pencil is coincident with, or perpendicular to the plane in which the pencil was originally polarized. Again, let a pencil of light polarized in any plane be reflected from a plate of polished steel so disposed that the plane of the incident and reflected pencils may be inclined 45°, 135°, 225°, or 315° to the plane of original polarization, the angles of incidence and reflexion from the steel being 75°; then that which is called an elliptic polarization takes place: if a second plate of steel be disposed so as to reflect the pencil a second time at an angle of incidence equal to 75°, and the plane in which the two reflexions take place be coincident with, or perpendicular to one another, the pencil so reflected will be restored to a state of plane polarization as when it suffered four reflexions in passing through two parallelopipeds of glass.

But, if the second plate be disposed so that the plane in which the two reflexions take place may make any other angles than those above mentioned with the original plane of polarization, the angles of incidence and reflexion at which the plane polarization is restored, instead of being 75°, will differ with the different angles of inclination. Now, in circularly polarized light, the angles of incidence and reflexion at which the pencil is restored to plane polarized light being constantly the same, they may be compared to the constant radius of a circle; and the varying angles of restoration just mentioned being found to correspond nearly to the varying semidiameters of an ellipse, Sir David Brewster proposed (*Phil. Trans.*, 1830, p. 287), without regard to the theoretical existence of elliptical vibrations produced by the combinations of two rectilineal vibrations of unequal amplitudes, to give the name of elliptic polarization to the phenomena presented by light reflected, in the manner above indicated, from metals.

In circular polarization, if the original plane of polarization make an angle represented by + 45° with the plane of the reflexions, the inclination of the plane of restored polarization always makes an angle represented by — 45° with the same plane of reflexion; but this does not hold good in the elliptic polarization: the angle between the original planes of polarization and reflexion being + 45°, the angles between the same plane of reflexion and that of restored polarization will be as follow:—for silver, — 39° 48′; for gold, — 35°; for brass, — 32°; for copper, — 29°; for mercury, — 26°; for platinum, — 22°; and for steel, — 17°. Representing any given angle between the original planes of polarization and reflexion by ω, and the angle of restoration for any one of the metals when, as above, $\omega = +\,45^\circ$, by θ; then, if the angle of restoration corresponding to a given value of ω be represented by α, Sir David Brewster found from experiment that

$$\tan.\ \alpha = \tan.\ \theta \tan.\ \omega.$$

It has been stated that light plane polarized at an angle equal to + 45° with the plane of reflexion is elliptically polarized by one reflexion from steel at 75°, and is restored to plane polarized light in a plane making an angle — 17° with the plane of reflexion: now it is evident that a third reflexion at 75° will again polarize the light elliptically, and that a fourth reflexion will again restore the pencil to a state of plane polarization; and so on, all the reflexions being in one plane. Therefore, substituting — 17°, for ω in the above formula, θ remaining equal to —17°, the value of α becomes + 5° 20′; again, substituting + 5° 20′ for ω, the value of α is — 1° 40′; and, after two more reflexions, the value of α nearly vanishes; that is, after eight reflexions in one plane from steel, the elliptic polarization ceases and the pencil of light is plane polarized in the plane of reflexion. A greater number of reflexions are however necessary when the other metals are used.

In what has been said the several consecutive reflexions are supposed to have been in one plane; but if the metal plate from which the second reflexion is produced be turned round on the first reflected pencil so as to change the plane of reflexion, the original angle of incidence from steel being 75° as before; the angle of reflexion at which the elliptically polarized pencil is restored changes also: when the two planes of reflexion are coincident, or at right angles to one another, the angle of reflexion for the restored pencil is 75° as above; but, if the inclination of the planes is 45° or 225°, the angle of reflexion becomes 78°: if the inclination is 135° or 315°, the angle of reflexion is 68°.

By taking the complements of the angles of reflexion for different angles of inclination, and considering them as radii, Sir D. Brewster has found that they appertain to a curve which is nearly an ellipse whose major and minor axes are situated, one at 45° on the right, and the other at 45° on the left of the plane of the first reflexion. He finds also that, with steel, the major axis is to the minor axis as 22 to 12.

It has been proved that, in particular states of the incident pencil, elliptic polarization may take place in an ether whose particles are symmetrically disposed; and that, in an ether whose particles are unsymmetrically distributed, elliptic polarization is a necessary result. See *General View of the Undulatory Theory*, by Professor Powell, 1841.

ELLISTON, ROBERT WILLIAM, was born in Bloomsbury, London, on the 7th of April, 1774. His father was a watchmaker, one of whose brothers was Master of Sidney Sussex College, Cambridge. Young Elliston was placed at St. Paul's school, where he distinguished himself by recitations: but, when he was the fourth boy, he ran away from school, became for a few weeks a lottery-clerk at Bath, and in that town, in April, 1791, appeared on the stage for the first time, personating a very humble character in Richard the

Third. He then obtained an engagement in the company of Tate Wilkinson, at York; but, soon becoming tired of playing petty parts, he obtained through his uncle a reconciliation with his family, and returned home. But the truant disposition was invincible. In the season of 1793 he played regularly at Bath, undertaking characters of all sorts: and in 1796 he married Miss Rundall, a teacher of dancing there. In June of that year he made his first appearance on a London stage, playing at the Haymarket, in the same evening, the part of Octavian, and that of Vapour in the farce of 'My Grandmother.' After occasional appearances in that theatre, and a temporary engagement at Covent-Garden, he became in 1803, under Mr. Colman, principal actor and acting manager of the Haymarket. Next year he succeeded John Kemble at Drury Lane; but, after the burning of the theatre, he quarrelled with Thomas Sheridan and left the company. He now took on his own account the small house then occupied as the Circus, to which he gave the name of the Surrey Theatre. There he and his company performed some of Shakspeare's plays and several operas, altering them so as to evade the licence of the patent theatres; and in 1805 he published his only literary effort, 'The Venetian Outlaw,' a drama in three acts, adapted from the French.

On the re-opening of Drury Lane theatre, Elliston, again a leading actor in its company, delivered Byron's address and performed Hamlet. In 1819 he became the lessee of that theatre, at a rent of 10,200*l.*: and he held this lease till his bankruptcy in 1826. From the date of that event he sunk into a subordinate position. After speculating in the Olympic theatre, he became again manager of the Surrey; and there, till near the close of his life, he continued occasionally to perform. He died of apoplexy on the 7th of July, 1831.

Elliston has been asserted, not without some show of reason, to have been the very best comedian of our time. Others surpassed him in particular excellences: but none united so many of the merits essential to eminent success in the highest walk of comic acting. So, likewise, he rose higher perhaps in tragedy than any other actor who was distinguished for excellence in comedy: he was admirable in those tragic parts which do not pass altogether out of the sphere of ordinary life. The weaknesses and eccentricities of his own character have furnished to Charles Lamb and others the themes for an infinite fund of good-humoured raillery. His predominant failing was inordinate self-esteem. He was vain of himself as an actor, vainer of himself as a manager: and in both phases his vanity was continually breaking out in incidents which, while they were irresistibly diverting, exhibited a humorous whimsicality, and a fervid sincerity of self-deceiving imagination, making him one of the most curious objects upon which a kindly observer of human oddities could exercise his scrutiny.

E'LYMUS, a genus of grasses belonging to the tribe Hordeineæ. It has 2 glumes, both on the same side of the spikelet, without awns or setæ, with 2 or more perfect flowers, and the spikelets 2 or 3 together. Several species of this genus have been described. Two only are natives of Great Britain.

E. arenarius, upright Lyme grass, has an upright close spike; the rachis flat, not winged; the glumes lanceolate, downy, not longer than the spikelets. It is a coarse grass, common on sandy sea-shores; and, with other grasses, it sends down long fibrous roots amongst the sand in such a way as to prevent its moving about with the winds. On some parts of the coast immense sandbanks are formed by this grass and others, binding down the sands which are thrown up by occasional and successive high tides. Although this grass, according to Sir H. Davy, yields a large quantity of sugar, it is not eaten by any of our domestic animals.

E. geniculatus, pendulous Lyme grass, has a lax spike bent downwards; the rachis winged; the glumes awl-shaped, glabrous, longer than the spikelets. The stem is 3 or 4 feet high, and the spike 1 or 2 feet long, bent down in a remarkable manner at the second or third spikelet. It has been found near Gravesend. Most of the remaining species are natives of America, both North and South.

(Babington, *Manual of British Botany*: Loudon, *Encyclopædia of Plants*.)

EMBLEMENTS. The executors of a tenant in fee or in tail are also entitled to the emblements as against the heir or heir in tail, but not as against a doweress or a devisee of tenant or fee, for the devise of the land carries with it the crops. [Emblements, P. C.]

E'MBLICA, a genus of plants belonging to the natural order Euphorbiaceæ. It has monœcious flowers; the calyx 6-parted; 3 stamens combined; 3 styles dichotomous; the fruit fleshy, tricoccous, 6-seeded.

E. officinalis is a native of most parts of India. It is a tree having a crooked trunk, with branches thinly scattered in every direction; the male branches spreading and drooping. The leaves are alternate, spreading, 1 or 2 feet long and about 1½ or 2 inches broad: the stipules small, withering; the flowers minute, of a greenish colour; the fruit a drupe, fleshy, globular, smooth, 6-striated: the nut obovate, obtusely triangular, 3-celled; the seeds 2 in each cell. The bark of this tree is astringent, and is used in India as a remedy for diarrhœa. The fruit is acid, and tastes astringent, and when eaten acts as a mild purgative This plant is the *Phyllanthus Emblica* of Linnæus; and *Myrobalanus Emblica* of Bauhin.

(Lindley, *Flora Medica*.)

EMBOSSING is the art of producing raised figures or patterns upon wood, metal, paper, cloth, or other materials, by means of pressure, either applied as a sudden blow, as in a stamping-press, or in a more gradual manner, as by an ordinary screw or hydraulic press, or by revolving cylinders. The pattern is usually produced by forcing the face of the material to be embossed against an engraved die in which the design is cut or otherwise formed in intaglio; and sometimes, when the article to be embossed is in the form of a thin sheet, a counterpart to the die, often made of lead or other soft metal stamped by the die itself, is applied at the back to aid the process. In many cases heat is employed during the operation with great effect.

The embossing of cloth for book-covers—an important branch of this art—and the process of stamping the covers themselves, are noticed under Book-Binding, P. C. S. p. 221; and in Dr. Ure's 'Dictionary of Arts' under the title 'Embossing of Cloth,' is a full description, illustrated with engravings, of a machine for both embossing and printing silk, cotton, or woollen cloth, paper, or other fabrics, in one or more colours by one operation, by means of three distinct metal cylinders or rollers, either of which may be employed for embossing or printing, or for performing both operations simultaneously. These cylinders are arranged round, and pressed with adequate force against, a central or bed cylinder of paper [Calendering, P. C. S. p. 268] round which the fabric to be embossed is caused to pass. A soft cloth, or felt, is applied round the surface of the paper cylinder to answer the purpose of what a printer technically styles blanketing, and a smooth iron roller is provided to roll in contact with the paper cylinder, so as to remove any impression which it may receive, through the fabric operated upon and the blanketing, from the embossing roller. In embossing paper, however, this impression upon the bed-roller may be of advantage, as a counterpart to the embossing roller; and, in such cases, where it will not produce inconvenience in any other operation of the machine, it may be allowed to remain. Whenever this is done, the relative diameters of the bed-roller and the embossing roller must be exactly proportioned to each other, in order to ensure perfect register, or coincidence between the sunk pattern on the small metal roller and the raised pattern on the larger bed-roller, during every part of their cycle of revolutions. The embossing and printing rollers are made hollow for the admission of steam or red-hot iron heaters, and they are furnished with apparatus for applying colour to their engraved surfaces in the same manner as the cylinders of an ordinary calico-printing machine. Dr. Ure remarks, that for embossing velvets, plain cloths, and papers, the surface of the embossing roller must be cut so as to leave the pattern or device elevated: such pattern being, consequently, impressed into, not raised upon, the surface of the fabric, while for woollens the device must be excavated, or executed in recess or intaglio. The patterns produced by the former kind of roller, though commonly called embossing, do not strictly accord with the definition above given, which conveys what appears to be considered the strict sense of the word.

A very curious process of embossing wood, communicated by Mr. Straker to the Society of Arts in 1824, and described in the forty-second volume of their 'Transactions,' p. 58, claims special notice for its ingenuity. Mr. Straker observes, that raised figures on wood, such as are employed in picture frames and other articles of ornamental work, are usually produced either by means of carving, which is an expensive operation, or by applying to the plain surface of the wood ornaments cast or moulded in plaster of Paris or some similar composition, a plan which is not always available. His invention, which he proposes to employ either alone or in conjunction with ordinary carving, depends upon the fact, that if a depression be made upon the surface of wood by a blunt instrument which will compress its substance without actually taking away any portion of it, such depressed part will again rise to its original level if the wood be subsequently immersed in water. He therefore proposes to draw the required pattern upon the surface of a piece of wood previously cut to the required shape, and then to apply a blunt steel tool, burnisher, or die to all those parts of the pattern which are intended to be in relief, so as to form depressions in the surface of a depth equal to their required prominence. In doing this, care must be taken, by the very cautious driving of the instruments, to avoid breaking the grain of the wood. The whole is then to be planed or filed down to a uniform surface, after which the wood is steeped in hot or cold water, by the action of which the parts previously depressed will rise to their former height, and consequently form an embossed pattern which may be finished by the ordinary operations of the carver. [Carving, P. C. p. 331.]

Very beautiful ornaments of embossed leather, available in lieu of carving for architectural decorations, medallions, picture-frames, cabinet-work, and similar purposes, have been recently produced by a process patented in 1839 by M. Claude Schroth, and thus noticed by Dr. Ure in the 'Supplement' to his 'Dictionary of Arts,' with a reference to the twenty-second volume of 'Newton's Journal'. for a full detail of the process. 'The dies,' he states, 'are made of type-metal, or of the fusible alloy with bismuth, called D'Arcet's. The leather is beaten soft in water, then wrung, pressed, rolled, and fulled as it were, by working it with the hands till it becomes thicker and quite supple. In this state it is laid on the mould, and forced into all its cavities by means of a wooden, bone, or copper tool. In other cases the embossing is performed by the force of a press. The leather, when it has become dry, is easily taken off the mould, however deeply it may be inserted into its crevices, by virtue of its elasticity.' The elasticity which thus enables the leather to be removed from a mould which is undercut is also important as a means of preserving the ornaments from injury by fracture. The most exquisite delicacy and sharpness characterize the ornaments thus formed, which may be made, at moderate expense, to rival the most delicate carvings of Grinling Gibbons in beauty, while, from the nature of the material, they are far less liable to injury.

EMBROIDERY. This term, according to Miss Lambert's 'Handbook of Needlework,' a volume which, in addition to its practical information, contains much curious and well selected historical matter, 'as employed in the writings of the antient historians, has reference to all kinds of ornamental work done with the needle, thus comprehending within its meaning every description of decorative needlework, including tapestry, and some descriptions of weaving.' 'At the present day,' our authoress adds, 'the term is much more limited, relating to one kind of needlework only, which however embraces an almost innumerable variety, both as to the materials employed and the mode of using them.' The word, she observes, appears to be derived from the French *broderie*, which some deduce by transposition from *bordure*, supposing the use of the term to arise from the circumstance that embroidery was formerly applied only or chiefly to the borders of stuffs; and, according to its present acceptation, it is 'the art of adding to the surface of woven textures a representation of any object we wish to depict, through the medium of the needle, threaded with the material in which the work is to be executed.'

In the article Tapestry, P. C., p. 42, some remarks will be found illustrative of the early history of embroidery; but on this subject and on the peculiar characteristics of the embroidery of various nations, much fuller information is contained in the work above referred to (pp. 156-190), and in the volume entitled 'The Art of Needlework,' edited by the Countess of Wilton (pp. 342-354). In the former work there is also a description of the mode of executing various kinds of embroidery, in some of which a very rich effect is produced by inserting pieces of cotton wool, or slips of parchment cut to suit the devices, between the fabric upon which the embroidery is executed and the threads of silk or other material of which the pattern is formed, so that the embroidery may be raised considerably above the surface. Gold and silver thread are often used in embroidery with good effect, and spangles or tinsel are occasionally mixed with the needlework. The fabric to be embroidered is usually stretched in a kind of frame or loom, and the pattern is drawn either upon its surface, or, if it be very transparent, upon a piece of paper applied underneath it.

Although embroidery has, until within a few years, been a purely handicraft employment, chiefly cultivated by females as a tasteful and elegant occupation or amusement, it has latterly assumed the character of a manufacture, a most ingenious machine for executing it having been invented by M. Heilmann of Mühlhausen. Of this admirable contrivance, which is said to enable a female to embroider any design with 80 or 140 needles as accurately and expeditiously as she formerly could do with one, a minute description, illustrated by an engraving, is given in Dr. Ure's 'Dictionary of Arts,' article 'Embroidering Machine,' from which it appears that the machine was exhibited in Paris at the national exposition of products of industry in 1834, where it excited much attention, and that within a very few years it had been brought into use in France, Germany, Switzerland, and Manchester. Complicated as it necessarily is, the price of a machine for working 130 needles was estimated at not more than 5000 francs, or 200*l*., and such a machine is capable of performing daily the work of fifteen expert embroiderers employed at the ordinary frame. It requires the labour of one grown person to superintend the work, and of two children to change the needles when their threads are used, and to watch continually for any irregularities of action which may need attention.

Referring to the above work for the details of the mechanism by which the several movements are accomplished, we may briefly explain the principle on which it acts. The needles, which are pointed at both ends, and have their eyes in the middle, so that they need not be turned round between each time of passing through the web, are passed backwards and forwards by the action of small pincers, of which there are two pair to each needle, one on each side of the web, each pair being alternately employed in pushing and pulling the needle through the web. As soon as the needles have passed completely through in either direction, a kind of carriage or framing, which carries the series of pincers by which they have been drawn through, begins to move along a railway so as to draw the needles to the full length of their threads, after which the carriage returns to its original position, and its pincers put the needles again through the web, to be received on the opposite side by the other set of pincers, which then retire with them in like manner. So far as the action of this part of the machine can affect the matter, the needles would continually pass through the same holes in the web; but to enable them to pass through it at different points in succession, according to the pattern required, the web itself, which is placed vertically in a frame furnished with rollers on which it can be wrapped as on the roller of a loom, is caused to assume a different position between each passage of the needles. This is done by connecting the frame with a kind of pantograph, the point or tracer of which can be moved at pleasure over every portion of a drawing or pattern, which represents, on a greatly enlarged scale, the flower or device to be embroidered. The operator brings the point of the pantograph successively to every point of the pattern device at which it is desired to plant a stitch, and by this means so moves the web-frame that the corresponding point of every flower, or place where a flower is to be worked, upon it, is brought opposite to the point of one of the needles. The mechanism by which the pincers are worked is then brought into action by means of handles and pedals, by which every needle of the series is put through the web, and drawn until its thread is brought home, after which the needles return to their original position, while by the working of the pantograph another point, or rather series of points, of the web is brought opposite to them ready for the return stitch. By such means every needle of the series produces a distinct and separate copy, on a small scale, of the pattern, the arrangement of the stitches being precisely according to the movements of the pantograph.

EMBRYON (ἔμβρυον, properly the young of an animal while still in the mother). In Botany the Embryon is that part of the seed in plants which in the course of its development becomes the young plant. In the articles Fœtus, Impregnation, Seed, Stigma, P. C., an account of the structure of this part of the plant has been given. Its origin, development, and functions have however been recently the object of investigation. In the early stages of the growth of the seed, it forms a mere projection from the side of the ovarium; this mass, which is composed of cellular tissues, is called the nucleus; as it develops itself, a distinct cavity is observed in its interior, which is called the sac of the embryo. After the contact of the pollen with the stigma, this sac disappears, and an embryo is found in its place. The principal points to which attention has been recently directed are, first, the determining cause of the growth of the embryo, and, second, the mode of its development. With regard to the first point, it is now well ascertained that the pollen, by means of its tubes, passes from the stamen to the pistil and at last coming in contact with the ovule, produces the growth of the embryo. But the question still arises as to whether the pollen-tube becomes the embryo, or a portion of matter formed under its influence in the embryo sac. Schleiden, who must be ranked amongst the greatest physiological observers of the present day, says that if the pollen-tubes be followed into the ovule, it will be found that usually one, and rarely more, penetrates the intercellular passages of the nucleus and reaches the embryo sac, which being forced forward, is pressed and indented, and by its folding in forms the embryo in the first stage of its development. A bag is thus formed consisting of a double membrane, the indented embryo-sac and the membrane of the pollen-tube itself. Schleiden infers the identity of the embryo and the pollen-tube from the three following circumstances:—1, The constantly equal diameter of the pollen-tube when it is exterior to the embryo-sac and of the embryo when it is just within it. 2, The invariable chemical similarity of their contents shown by the reaction produced by the application of water, oil of sweet almonds, iodine, sulphuric acid, and alkalies. The general contents of the grain of pollen are starch, and this either proceeds unchanged downwards through the pollen-tube, or else passes along after being changed by a chemical vital process into a transparent and colourless fluid, which becomes gradually more and more opaque; and is coagulable by the application of alcohol: out of this, by an organising process, the cells are produced which fill the end of the pollen-tube, extending in Orchis Morio far beyond the ovule, and thus forming the parenchymen of the embryo. 3, The identity of the embryo and the pollen-tube is further supported by the fact, that in such plants as bear several embryos, there is always precisely the same number of pollen-tubes present as we find embryos developed.

These views of Schleiden, with his conclusion that the pollen-tube should be regarded rather as the representative of the female than of the male in the animal kingdom, have been adopted by Professor Wydler of Berne, who did not however observe the folding-in of the embryo-sac described by Schleiden.

On the other hand, observations have been made in France, by MM. Mirbel and Spach, on another class of plants, in which they did not meet with the structure described by Schleiden, and consequently they object to the general application of his conclusions. They examined the development of the ovule of the Zea Mays (common maize). In this plant there is no true embryo-sac, but they found the commencement of the embryo, which they call the primary utricle, and which Schleiden described as the result of an involution of the sac, existing in the cavity of the nucleus. In this plant also, only one, and not two membranes, as described by Schleiden, existed in the embryo. They also found in other plants the primary utricle existing in the interior of the embryo-sac, and at a period anterior to the act of impregnation. They therefore conclude that the pollen-tube does not become the embryo, and that no involution of the embryo-sac takes place. Their conclusions are probably as much too general as those of Schleiden.

Mr. Griffiths, in a paper recently published in the Linnean Transactions, gives the result of a long series of investigations on the development of the ovulum in the genera Santalum, Osyris, Loranthus, and Viscum. From his observations on these plants, which differ from those investigated by Schleiden, and Mirbel and Spach, he has arrived at conclusions somewhat different from those of any of these observers, and he carefully refrains from drawing an inference from the facts which he has observed that would apply to the whole vegetable kingdom. 'The first process,' he says, 'in the development of the seed subsequently to the penetration or application of the *boyau* (the pollen-tube) to the embryo-sac would, in Santalum, Osyris, Loranthus, and Viscum, appear to consist of the formation of cellular tissue. This may be applied, I believe, to most if not to all instances. This cellular tissue appears to have two different origins; one, and this is the earliest in development, being perhaps referable to the embryo-sac, while the other appears directly referable to the anterior ends of the pollen-tubes.' Thus far he agrees with Schleiden, that the pollen-tube penetrates into the embryonous sac, and that the embryo is derived from its intruded extremity, his observations on Santalum and Loranthus confirming this fact, whilst Osyris is an exception confirmative of the rule. 'But none of my observations,' says Mr. Griffiths, 'have tended to confirm Schleiden's idea of the inflection of the embryo-sac before the pollen-tube; and it appears to me sufficiently obvious, that if such were the case the cylindrical bag (the primary utricle of Mirbel), constituting the embryo in its first stage of development, would consist of three membranes or layers, viz.: the first, or outer, of the ordinary and uninflected membrane of the sac; the second, of its inflected portion; the third, that of the pollen-tube itself.' He also expresses his conviction that the primordial or primary utricle of MM. Mirbel and Spach is the sac of the embryo, which no doubt often and perhaps generally exists before fecundation.

Dr. Giraud, who is one of the latest observers on this subject, has published a paper in the same volume of the Linnean Transactions. He made a series of observations upon the ovulum of the Tropæolum majus, and conducted his researches with a perfect knowledge of previous investigations, except those of Mr. Griffiths, which, having been made in India, were not published in England till after those of Dr. Giraud. He concludes from his observations on the Tropæolum majus, 'that in this plant the primary utricle and the future embryo never have any structural connection with the extremity of the pollen-tube at their first origin, or at any subsequent period of their development, as is sufficiently obvious from the fact that the pollen-tube is never brought into contact with the embryo-sac. As the primary utricle makes its appearance before impregnation has occurred, it cannot be possible that the organ has ever formed the extremity of the pollen tube, as is believed by Schleiden and Wydler. Moreover, as the primary utricle takes its origin wholly within the embryo-sac, and at the earliest period of its formation is not in contact with that membrane, it cannot have been formed by the pollen-tube pressing before it a fold of the embryo-sac in its passage into the cavity of that structure, as Schleiden has maintained.' It is very obvious from the facts above stated that botanists are not yet in a position to give a general expression for the origin and mode of development of the embryo in the vegetable kingdom.

The function performed by the embryo during its growth, is attended with different effects from those of the ordinary growth of the tissues of the plant, and it has been generally described as a different process, under the name of germination. When a seed is placed in a moist situation sufficiently warm, and with access to air, the following phenomena, according to the researches of De Saussure, and the more recent ones of Boussingault, take place:—1, absorption of oxygen from the atmosphere; 2, a disengagement of carbonic acid; 3, a disengagement of ammonia; 4, conversion of starch into dextrine, gum, sugar, &c.; 5, increase in bulk—growth of the embryo.

All these phenomena were supposed to be connected with the growth of the embryo, and the absorption of oxygen and the disengagement of carbonic acid gas were regarded as an act of life and as necessary to the process of germination. From this point of view germination and vegetation, the growth of the plant, were stated to be antagonising processes; the one being a respiratory, an oxidating process; the other a decomposing, a deoxidating process. At the same time the albumen of the seed was regarded as the sole source of nutriment for the growing tissues of the young plant. [GERMINATION, P. C.] In a paper read at the meeting of the British Association, July, 1845, Dr. Lankester proposed a new theory of the phenomena of germination. It is obvious that the only essential process of germination is the growth of the young plant or embryo. The process of development of the embryo from primitive cytoblasts, is precisely the same as that of every other part of the plant, and from an identity of structure Dr. Lankester inferred there must be an identity of function. But the ordinary theory of germination gives a different function to the tissues of the embryo from that of the other parts of the plant. This Dr. Lankester considers unnecessary, and attributes the absorption of oxygen, and the disengagement of the carbonic acid gas and ammonia, to the result of the decomposition of the starch and protein contained in the perisperm of the seed, whilst the growing cells of the embryo appropriate the carbonic acid and ammonia with water, just in the same way as all other cells in the vegetable kingdom. The facts by which this theory is supported, and which are not explained by the old theory are, as follows:—

1. In many plants there is little or no perisperm or albu-

been developed, and the conditions required for germination are those of vegetation.

2. Many plants with horny and hardened perisperms, as the Phytelephas macrocarpa, the Phœnix dactylifera, and species of Bactris, Cocos, and Astrocaryum germinate, without consuming any appreciable quantity of the perisperm.

3. The quantity of carbonic acid obtained by De Saussure varied not according to the number, but according to the mass of the seeds, proving that it arose from the decomposition of the starch as a chemical process, and not from the growth of the embryo as a process of life.

4. De Saussure found that the relation between the oxygen consumed and the carbonic acid gas given out was different in different plants, but this relation ought to be constant if the theory of oxidation or combustion during germination be correct.

5. Boussingault observed that the changes supposed to be peculiar to germination went on in the perisperm after the young plant had developed its radicle and plumule, and was capable of an independent existence.

6. The changes which take place in the chemical composition of the perisperm of the seed during germination can be artificially produced by mixing starch and protein (diastase) together, and exposing them to the action of the atmosphere.

This theory modifies the view which is mostly taken of the use of the albumen. It does not appear to be deposited entirely for the use of the young plant, but in many cases is merely an organ of support, and bears the same relation to the embryo that the wood of a branch does to the buds which grow upon it.

Another point of interest with regard to the function of the embryo has been lately discussed, and that is, the influence of electricity on its development. A series of careful experiments have been lately conducted by Mr. Edward Solly. In a paper recently published, he says, 'Out of a series of 55 experiments on different seeds, 20 appeared in favour of electricity, 10 against it, and 25 showed no effect whatever; and on carefully counting the whole number of seeds up in the entire series, there were found 1250 of the electrified, and 1253 of the non-electrified seeds up.' From these and other experiments there can be little doubt that the asserted influence of electricity on the germination and growth of plants has been admitted on insufficient evidence, and that we have no proof at present that electricity under any of its forms, when artificially employed, exerts any influence on the growth and nutrition of plants.

(Lindley, *Introduction to Botany*, 3rd edition; Giraud, *On Vegetable Embryology; Annals of Nat. Hist.*, 1840; *Linn. Transact.*, vol. xix. part 2; Griffiths, *On the Ovulum of Loranthus*, &c.; *Linn. Transact.*, vol. xix. part 3; *Report of Brit. Assoc.; Gardener's Chronicle*, July, 1845; Meyen, *Pflanzen Physiologie*, band iii.; Boussingault, *Rural Economy*, translated by Law.)

EMPHYTEUSIS (ἐμφύτευσις). The term expresses in the Roman law a perpetual right to the enjoyment of land, on condition of paying annually a fixed sum (canon, pensio) to another person who was considered the owner of the land. This relationship of occupier and owner was founded on contract, which in the later empire received the name of contractus emphyteuticarius. The occupier was called emphyteuta.

The title of the emphyteuta depended on his paying what he had contracted to pay, and also all the taxes to which the property was liable. If he neglected to pay these dues for three years he might be ejected out of the land by the owner, without having any compensation for his improvements. He could alienate the land after giving notice to the owner, who might however, if he pleased, take the land at the price of the emphyteuta. If he did not, then the emphyteuta could sell it to any person who was able to answer all the demands to which the land was subject by virtue of the contract. In each case the owner was bound to receive the purchaser as his emphyteuta, and confirm his title in due form, for which he could claim a payment not exceeding a fiftieth part of the price at which the land was sold.

The relation between the emphyteuta and the owner originated, as already stated, in contract. The owner could also make an emphyteusis by his will.

This kind of contract is first mentioned in the case of Agri Vectigales, that is, lands which were leased by the Roman state, by towns, and by other corporations both civil and ecclesiastical. This Ager Vectigalis, which seems to be first distinctly mentioned about the time of Hadrian, appears to have been formed after the analogy of the old Ager Publicus. The Digest is the oldest extant authority in which the term Emphyteusis occurs. The use and enjoyment expressed by the word emphyteusis were always carefully distinguished from ownership; the emphyteuta was a perpetual lessee who paid a perpetual rent to the owner.

The subject of the emphyteusis is discussed *Dig.* 6, tit. 3; *Cod.* 4, tit. 66; Mühlenbruch, *Doctrina Pandectarum*; Savigny, *Das Recht des Besitzes*, p. 99, &c. 5th ed.

EMPYE'MA (ἐμπύνημα, from ἐν, 'in,' and πῦον, 'pus,' a word which signifies an internal collection of pus). Although this term was restricted by the antients to purulent collections in the thorax, it is now employed to signify all collections of fluid in the pleura which do not arise from an obstruction to the circulating system, and are not of a gaseous nature. In a natural state the pleura, like other serous membranes, secretes a clear fluid, which is removed by absorption as quickly as it is formed. But from the existence of inflammation or the presence of foreign bodies, other fluids often accumulate. The most common of these are serum, blood, pus, and fibrinous matter. Any of them may be present alone, or may be mixed in varying proportions. It is however almost impossible to ascertain by any external means the nature of the fluid which has accumulated. Dr. Townsend relates two cases of empyema: in the one, a case of two months' standing, produced by the bursting of a tubercular abscess in the lungs; on the fluid being removed, it presented all the characters of pus; in another case, arising from the same cause, a perfectly transparent and colourless fluid was found. It is therefore not only difficult to discover the nature of the fluid, but the same exciting cause may give rise to the presence of different kinds of fluid.

Whatever may be the nature of the fluid in the lungs, it always exists in conjunction with a peculiar state of the pleura. This membrane is covered over to a greater or less extent with a fibrinous secretion, which, in this and other cases becoming organised, constitutes what are known by the name of false membranes. This fibrinous matter is sometimes deposited in so large quantities on the pleura, which covers the lungs, that even after the fluid is removed, the lungs, which have been compressed, cannot expand, and consequently the parietes of the chest fall in and occupy the vacant space, and contraction of the chest is produced. The false membranes thus produced are liable to various diseases, and they may inflame, ulcerate, or become ossified, and thus produce various secondary diseases. Sometimes the false membranes extend from one side of the cavity of the pleura to the other, and a case is related by Dr. Townsend of a person 'in whom the effusion was divided by these partitions into three compartments, so perfectly distinct from each other, that had the operation of paracentesis been performed during life, that compartment only could have been evacuated into which the incision had been made; so that in order to draw off the entire effusion it would have been necessary to perform three several operations'

The worst effect of the presence of fluid in the pleura is exerted on the lung. By its pressure the lung becomes incapable of expanding for the admission of air. Its position is generally by the side of the spinal column, but through the deposition of the fibrinous matter the pleura of the lungs and of the ribs often contract adhesions, and in this manner the lungs may be forced to occupy very varied positions in the cavity of the thorax. When the effusion is extensive the lung becomes flattened and flaccid, its surface is corrugated, and its tissue becomes soft, pliant, and dense, exhibits no crepitation, and is almost entirely deprived of blood. It does not often inflame in this state, but frequently becomes the seat of the deposition of tuberculous matter.

Empyema is always attended with inflammation acute or chronic of the pleura [PLEURITIS, P. C.], although the bursting of an abscess or the wounding of a blood-vessel may assist in producing the accumulated fluid contents of the pleura; at the same time it frequently happens that the inflammatory symptoms are of so mild and insidious a nature that they are entirely overlooked. This was more frequently the case previous to the use of percussion and auscultation than at the present day. It is in fact impossible by general symptoms alone to infer the presence of empyema. The following symptoms however, taken with the physical signs, may be regarded as characteristic:—Difficult respiration, increased by motion, exertion, and lying on the sound side; fulness and oppression at the chest; enlargement of the diseased side; protrusion of the intercostal spaces, with an obscure sense of fluctuation and œdema of the integuments; dulness of sound on percussion, and absence of the respiratory murmur on the diseased side, which remains perfectly motionless; noisy respiration in the opposite lung with violent action of the respiratory muscles; displacement of the heart; protrusion of the abdomen; a harassing short cough, small rapid pulse, and the other symptoms of hectic fever. To these symptoms some would add ægophony, a sound on speaking like the bleating of a goat, but this only occurs when there is a thin stratum of fluid in the pleura, and it is absent when the empyema is extensive. The intensity of all these symptoms is proportionate to the quantity of fluid effused, the duration of the disease, and the constitutional strength of the patient. The difficulty of breathing is in proportion to the quantity of the fluid which presses on the lungs. The inability to lie on the sound side arises from the pressure of the fluid upon the sound lung when a person lies so that its weight comes directly upon it. The cough is not a constant symptom, and may be entirely absent where there is no inflammation of the lungs or bronchiæ. The hectic symptoms will vary according to the strength of the individual and the duration of the disease. Night-sweats do not occur in conjunction with the other hectic symptoms in empyema, unless the lung is in a state of tuberculous ulceration.

There are few diseases with which empyema is likely to be confounded. Its general symptoms resemble those of tubercular phthisis, but the history of the disease, and more particularly the stethoscopic signs will point out the distinction. In phthisis there is no displacement of the heart; absence of the respiratory murmur is usually found at the upper part of the lung, and is followed by mucous râle, pectoriloquy, &c. Hepatization of the lungs has been referred to as likely to be confounded with empyema, but this is so rare a disease in a chronic form, as to render it unnecessary to point out the distinction between the two diseases here. The same remark applies also to tumors in the sac of the pleura, which, although they have been recorded, are too rare to need a description. Enlargement of the liver, with that organ pressing upon the diaphragm and lungs, might produce the same symptoms as in empyema, but a careful examination in connection with hepatic symptoms would soon indicate the diagnosis.

The treatment of empyema may be of two kinds, medical and surgical. The general principles on which the first should be conducted are those which would be applied in pleuritis [Pleuritis, P. C.] It however often happens that the resources of medicine fail, and that no other chance of relief can be offered the patient than that of drawing off the effused fluid by means of an operation. This is called the operation of empyema, or paracentesis thoracis. This operation, although in modern times it has got much into disrepute, was performed by Hippocrates (Hipp., 'De Morbis,' lib. ii. 576; Galen, 'Comment.,' Aph. 27) and the older practitioners of surgery, with apparently much success. It has recently been recommended, especially by Laennec, in cases of empyema which do not offer a chance of being cured by medical treatment. In such cases, where all other remedial means have been tried, there seems an increasing conviction that this operation may be had recourse to with every chance of benefit; and cases have now been recorded, both in the practice of the French and English hospitals, in which a large proportion of those operated on have recovered. Another class of cases in which paracentesis has been recommended, are those in which the empyema is dependent on acute inflammation of the pleura, and in which the fluid accumulates so rapidly as to threaten suffocation unless removed.

In the performance of paracentesis, the most eligible spot for the operation is between 'the fifth and sixth, or the sixth and seventh true ribs, at the point just in front of the indigitations of the serratus magnus, or midway the anterior and lateral parts of the chest.' Some surgeons however recommend that it should be done between the third and fourth ribs on the left side, and the fourth and fifth on the right, as they suppose there is danger of wounding the liver or diaphragm by operating lower down. The integuments should be drawn on one side, if it be intended that the wound should close after the operation, and the incision through them should be about two and a half inches long. The intercostal muscles will thus be exposed, and should then be cautiously divided: and when the pleura which lines the ribs is exposed, a small puncture should be carefully made in it. In dividing the intercostal muscles, the knife should be kept close to the upper edge of the lower rib, in order to avoid the risk of wounding the intercostal artery, which runs in a groove upon the lower edge of the upper rib. The size of the opening into the pleura must be regulated by the nature of the effused matter. A canula, supplied with a stopper, should then be introduced and kept in the wound, so that the whole or a part of the fluid may be drawn off.

(*Cyclopædia of Practical Medicine*, article 'Empyema;' Cooper, *Dictionary of Surgery; First Lines of Surgery*.)

ENAMELLING. [Enamels, P. C., p. 384.] To what is stated on the subject under the above head we may add a few words upon the process which has been extensively practised of late years of enamelling the interior of cast-iron and other hollow articles, such as saucepans and other culinary and domestic utensils. The superior cleanliness of such articles, and the security which they afford against any metallic taint, render them peculiarly valuable for some delicate operations in cookery and confectionary, and for the preparing of pharmaceutical decoctions, extracts, &c.

A patent was obtained in 1799 for two modes of performing this process, by Dr. Hickling, of whose specification Dr. Ure gives an abstract in the 'Supplement' to his 'Dictionary of Arts,' &c.; but though the manufacture of enamelled wares was carried on for some time under this patent, it was at length given up, for want, it is said, of due encouragement. Dr. Ure, to whose work we are indebted for the materials of this notice, also describes a process patented by Messrs. Thomas and Charles Clarke, in 1839, for applying an enamel lining less liable to crack or split off with the action of fire than that commonly used. According to their specification the vessels were to be first thoroughly cleansed by exposing them for three or four hours to the action of dilute sulphuric acid, and then boiling them for a short time in pure water. The first enamel composition is then applied. It consists of 100 lbs. of calcined ground flints, and 50 lbs. of borax, also calcined, and finely ground with the flint. This mixture is fused and gradually cooled, after which it is to be ground in water with the addition of one-eighth of its weight of potter's clay, until the mixture forms a mass of a pasty consistence, 'which will' (how is not stated) 'leave or form a coat on the inner surface of the vessel about one-sixth of an inch thick.' This coat is set by placing the vessel in a warm room, after which, while it is yet moist, the second or glazing composition is sifted finely and evenly over it in the form of a dry powder. This glazing composition consists of 125 lbs. of white glass (without lead), 25 lbs. of borax, and 20 lbs. of soda (crystals), all pulverized together, vitrified by fusion, ground, cooled in water, and dried. To 45 lbs. of this mixture 1 lb. of soda is added, the whole being then mixed together in hot water, and when dry, pounded to prepare it for sifting on the vessel as above stated. The vessel is then dried in a stove at a temperature of 212° Fahr., and subsequently heated gradually in a kiln or muffle resembling that used for glazing china, until the glass is fused or fluxed. Sometimes the glass-powder is again dusted over the fused glass, and fluxed a second time in the kiln. Some other manufacturers, having produced enamelled saucepans of excellent quality, were sued by the Messrs. Clarke for an invasion of their patent rights; but the patentees were nonsuited in the Court of Exchequer. From the evidence on the trial it appeared that the process of cleansing with sulphuric acid was abandoned by the patentees, and that a good enamelled iron saucepan might be made by Dr. Hickling's specification of 1799. 'In fact,' observes Dr. Ure, 'the formulæ by which a good enamel may be compounded are almost innumerable, so that a patent for such a purpose seems to be untenable, or at least most easily evaded.' Many enamels used for this purpose possess deleterious properties, owing to the presence of lead, which was found in some of the earlier wares made under Clarke's patent, before the use of glass containing lead was avoided; and litharge, or oxide of lead, has been found in abundance in some enamelled saucepans imported from Germany. Now, however, the use of lead in this kind of ware, which is extensively manufactured in Peiz, Gleiwitz, &c., is prohibited by an edict of the Prussian government. Dr. Ure concludes his article with minute directions for constructing an oven or muffle for lining or coating metals with enamel, and for compounding both the enamel body and the glaze.

ENAREA, a country in Africa, south of Abyssinia, which was visited by the Portuguese Antonio Fernandes, in the seventeenth century. Modern travellers have not yet penetrated so far inland, but they have collected information respecting it; according to which, this country is situated between 6° and 8° N. lat., and between 33° and 37° E. long. It is described as more elevated than all the countries which surround it; which is very probable, as it extends over the watershed of the rivers which flow northward and join the Abaï, or western branch of the Nile, and those which run southward to the large but little-known river called Goshop. In the centre of the country is a group of very high mountains called Kheresa; on its northern declivity originate the river Kibbe, which joins the Abaï above the Melka Furi Ford [Abyssinia, P. C. S.] and the Maleg river, which also falls into the Abaï, but much farther downward. The rivers which originate on the southern declivity of the Kheresa mountains fall into the Goshop. A great portion of the country is covered with forests, in which several kinds of trees are found which bear edible fruits, and one of them is used for dyeing black. But the most remarkable of these trees is the coffee-tree, which is indigenous, and met with in such abundance, that the wood is used as fuel. According to a tradition prevalent in Arabia, according to Niebuhr [Coffea, P. C., p. 321], this tree was brought to that country from Abyssinia: but as no extensive plantations of coffee have been found in Abyssinia by modern travellers, it is very probable that it has been transplanted from Enarea to Arabia, or perhaps from Kaffa, a neighbouring country lying farther to the south, where it is also found in an indigenous state and in great quantity, though less so than in Enarea. In these countries it attains a height varying between 12 and 14 feet. Elephants, giraffes, and buffaloes are stated to abound, as well as some other kinds of wild beasts. The civet (Viverra civetta) is so numerous that civet forms an important article of exportation. Gold is also exported; but it is not known if it is collected in the country, or brought to it from some more distant part of Africa. The capital of Enarea is Sakka, which appears to be a considerable place not far from the banks of the river Kibbe, and is visited by caravans which come from Basso and Gondar in Abyssinia. These Abyssinian merchants bring to Sakka rock-salt, which, under the name of Amolé, constitutes the currency of the country; beads of different kinds, several kinds of dried cotton-goods, copper, daggers, knives, guns, and kitchen utensils. They export from Enarea coffee, musk, slaves, gold, and the skins of lions, panthers, black leopards, and antelopes; also ivory and horses. The inhabitants of Enarea belong to the widely-spread nation of the Galla; and their language is so similar to that which is spoken by the tribes of the Galla subject to Shoa, that they understand one another without difficulty. A small portion of the population and the royal family have been converted to the Islam by the Mohammedan merchants who visit their country, and who have introduced their creed into every part of the interior of Africa. But the larger number of the inhabitants are still heathens. It is said that among them a small number of Abyssinian Christians are found.

(*Monatsberichte über die Verhandlungen der Gesellschaft für Erdkunde zu Berlin*; Isenberg's and Krapf's *Travels in Abyssinia*.)

ENCAUSTIC TILES AND PAVEMENTS. [Tiles and Pavements, P. C. S.]

EN'CHODUS, a genus of fossil Cycloid fishes, from the chalk. (Agassiz.)

ENDOCARP. [Pistil, P. C. S.]

ENDOGENITES, the name for certain fossil plant-stems, as E. erosa, from Tilgate. (Mantell.)

ENDOWMENT. [Dower, P. C.; Vicarage, P. C.]

ENEMY. [Alien, P. C.]

ENFRANCHISEMENT. [Copyhold, P. C. S.]

ENGRAVINGS. [Copyright, P. C. and P. C. S.]

ENLARGEMENT OF OBJECTS. The mind forms a judgment of the apparent magnitudes of visible objects chiefly from the angles subtended at the eye by their principal linear dimensions; but many circumstances render that judgment erroneous, and create illusions respecting apparent magnitude of which it is important to be aware.

When objects are near a spectator the forms and colours of their parts usually afford distinct perceptions of them; and since, in proportion as the objects are more remote, the quantity of light reflected from them to the eye diminishes, the perceptions both of outline and colour diminish in intensity. Hence, indistinctness of form and colour being in the mind associated with remoteness, when from any cause an object appears indistinct, and at the same time to subtend at the eye an angle equal to that under which it is usually seen at a given distance, the imagined remoteness gives rise to a perception of increased magnitude. It is thus that a well-known object, as a man, seen by night or through a fog, appears to be much greater than it would be if seen at an equal distance by daylight or in an atmosphere free from vapour. For a like reason, the image of a familiar object, as a man in dull-coloured clothing, when seen at a distance against a bright sky, seems greater than in other circumstances it would be at an equal distance; for the sensibility of the eye being diminished by the surrounding brightness, the object is obscurely seen.

The parts of space about a spectator extending indefinitely in every direction from the surface of the earth, and the human eye being incapable of appreciating differences between the distances of objects when those distances become great, it follows that, like as a long straight wall seen at a small distance from its front appears to be a circular arc, the figure of the sky must be, apparently, a portion of the concave surface of a sphere. Now, a series of objects beyond one another give indications of distance, and this a spectator may obtain on looking along nearly level ground towards the horizon; while the absence of intermediate objects between him and the part of the heavens above his head, whether the sky be unclouded or completely overcast, will lead him to imagine that the summit of the celestial vault is comparatively near him. Thus the apparent figure of the vault is a segment less than a hemisphere; the ratio of the vertical height to the semidiameter of the base being about as 1 to 3 or 4. It follows that a plane imagined to touch the surface of the visible heavens near the horizon would make with the latter an acute angle; and, if we form our estimate of the magnitudes of the sun and moon, or of the distances between stars, by their projections upon the face of the sky, it is evident that the projected disks or spaces will appear greater near the horizon than near the zenith, particularly in directions tending towards the zenith. This is conceived to be, in part, the cause of the apparent enlargement of the sun and moon, and of the distances between stars when viewed near the horizon, and the illusion is strengthened by the false judgment which is made of magnitude on account of the perception of a great distance horizontally. Some part of the effect, moreover, may be due to the diminution of the brightness of the celestial bodies on account of the light lost by the rays passing through the denser part of the atmosphere and the vapours in the horizon: small stress should however be laid on this circumstance, since, on looking at the sun or moon in the horizon through a tube which allows nothing but the celestial body to be seen, the illusion vanishes, though the diminution of tint remains. The apparent magnitudes in the horizon, when measured by a micrometer, are rather less than they are when observed near the zenith.

The visible magnitudes of luminous objects, as the sun, the moon, or the planets, are probably at all times greater than the geometrical magnitudes, on account of the imperfection of the eye: if a spectator who is very short-sighted look at the full moon, he will observe that the visible image is made up of a great number of moons surrounding, and partly overlaying one which appears to be in the centre, so that the diameter of the compounded image is more than double the simple diameter of the moon. A single image of the moon is apparently restored when such spectator places before the eye a concave lens of a certain curvature; but an enlargement of the disk still exists to a certain degree, probably, ever for those eyes which are considered as in the most natural state.

An apparent diminution of the magnitudes of objects with which we are familiar takes place when they are seen in situations which lead us to consider them as nearer to us than they really are, and this may be exemplified by what is known to occur when men, horses, &c. in a street are seen from the top of a high building, or when a man standing on a high building is seen from the ground. The error of judgment may be rectified by frequently viewing such objects in the like circumstances, for it will at length be found that they appear in such situations as large as when viewed at equal distances on level ground. [Magnitude, P. C.]

ENTO'BIA, a genus of fossil Annelida. (Portlock.)

ENTOMOCO'NCHUS, a genus of fossil Crustacea, from the mountain limestone of Ireland. (M'Coy.)

EOCENE. The lowest of three great divisions of tertiary strata is thus termed by Mr. Lyell.

EPHEDRA (the Greek name of the Equisetum, which this genus closely resembles), a genus of plants belonging to the natural order Gnetaceæ. The species are diœcious; the male flowers are arranged in the form of a catkin, having a bifid calyx, and 7 stamens, 4 of the anthers of which are inferior, 2 superior; the female flowers have a quintuple calyx 2-parted, 2 ovaries, and 2 seeds covered over by the berried calyx. The species are not numerous, and are found in Europe, Asia, Africa, and America.

E. distachya has the sheaths of the joints 2-toothed, blunt, the catkins 2, opposite, stalked, the peduncles shorter than the catkins. It is a native of France and some parts of Germany, and abounds in the southern parts of Europe, and from thence eastwards to Persia and India. The berries, which consist of the fleshy calyx covering the ovarium, ripen in July and August. They have a sweetish taste, and contain a mucilaginous juice.

E. monostachya has the sheaths of the joints the same as the last, but the catkins either solitary or opposite, and the peduncles longer than the catkins. This plant is found in Hungary and Siberia, and in these countries the fruit is eaten as a great luxury.

E. altissima has clustered catkins and spreading branches, and is a native of Barbary. There is an American species found on the borders of Lake Michigan in the country of the Chippeway Indians. It bears a large fruit.

(Burnett, *Outlines of Botany*; Loudon, *Encyclopædia of Plants.*)

EPHE'MERA (ἐφήμερα, living for a day), a genus of Neuropterous insects belonging to the family of *Subulicornes* of Latreille. They have long, soft, tapering bodies, terminating in two or three long setæ. Their wings are placed nearly or quite perpendicularly. Their antennæ are very small and three-pointed. In the larva state they live in wet places or under water, and enjoy an existence of two or three years; but when they attain their final stage of metamorphosis and perfect form, they are among the most fleeting of living creatures, existing often only a few hours, and propagating their species before they die. In this state they sometimes appear suddenly in myriads, during fine summer evenings, by the waterside, where they may be seen flitting about and balancing themselves in the air, in the manner of gad-flies.

(Westwood, *Introduction to Entomology*, vol. ii.)

EPHRAEM or EPHRAIM ('Εφραίμ), an ecclesiastical writer of the fourth century of our æra, was probably born in the town of Nisibis, though some state that he was born at Edessa. The time at which he attained the height of his fame is about A.D. 370. In his early youth he entered the monastic life, and in seclusion he carried on his philosophical studies with zeal and success. But at a later period he seems to have become tired of solitary life, and feeling a strong desire to benefit others by the talent and knowledge which he possessed, he went to Edessa, whither the most distinguished Syrians came to receive his instruction. He soon became deacon of the church at Edessa, but declined accepting any higher ecclesiastical office, and when he was elected bishop and received the intelligence of it, he rushed forth into the market-place and acted in such a manner that the people thought he was out of his senses. He then absconded, until another had been appointed to the office of bishop in his place. He now went to Caesarea in Cappadocia, to see Basilius the Great, who formed the highest opinion of his learning and piety. Ephraem spent the greater part of his life in writing and preaching on devotional and moral subjects, and especially against the Arian heresy; but he was equally energetic whenever there was any occasion to show by his acts that he really was the benevolent man that he appeared to be. This was especially manifest at the time when Edessa was suffering from famine: he gave his assistance everywhere; he called upon the rich to help the poor, and he himself undertook the care of seeing that the poor received what was intended for them. He was looked up to with admiration and reverence by his contemporaries, who distinguished him by the honourable designation of 'the prophet of the Syrians!' He died about A.D. 378, having ordered in his will that no one should praise him, according to the common practice, in a funeral oration, that his body should not be wrapped up in costly robes, and that no monument should be erected on his tomb. An interesting life of Ephraem, though not free from marvellous stories, is contained in the 'Acta Sanctorum' (tom. i. Febr. p. 49, &c.; comp. Nyssenus, *Opera*, tom. ii. c. 60; Sozomen, iii. 16; Hieronymus, *De Scriptor.* c. 115; Photius, *Biblioth. Cod.* 196; and some other sources collected by G. Vossius, in the first volume of his edition of the works of Ephraem.

Ephraem was one of the most prolific writers of his time; he knew no other language than the Syriac, and was considered to surpass all his contemporaries in the elegance and power of his oratory. Nearly all his works were translated into Greek in his own lifetime, and their popularity was so great that in some churches they were publicly read after the Scriptures. The Greek Church, down to this day, regards him as a saint. According to Photius he wrote upwards of a thousand orations, besides many hymns, poems, and treatises on a variety of theological, philosophical, and moral subjects, which are still highly esteemed by theologians. Nearly all his works are extant, either in Syriac or in Greek and Arabic translations The first collection of them that was published, though it is not complete, and only in a Latin translation, is that of G. Vossius, in three vols. folio (Rome, 1586-97; reprinted at Cologne, 1603, and at Antwerp, 1619). The publication of this Latin translation created a strong desire to see all the works of Ephraem, if not in the original Syriac, at least in the Greek translations which were made in the author's lifetime. This arduous task was undertaken by Assemani, who intended to publish the Greek in three folio volumes, and the Syriac in three others. The first three volumes, edited by Assemani himself, appeared at Rome in 1732-46; and the last three, containing the Syriac, were edited by father Benedetti and Stefano Assemani. The Prolegomena to this edition contain everything worth knowing respecting the life and writings of Ephraem.

(Cave, *Historia Literaria*, vol. i. p. 188, &c.; Fabricius, *Biblioth. Græc.* vol. viii. p. 217, &c., ed. Harles.)

EPILO'BIUM. [WILLOW-HERB, P. C.]

EPIME'DIUM, a genus of plants belonging to the natural order Berberaceæ or Berberideæ. It has a calyx of 4 deciduous sepals; 4 petals; 4 cup-shaped nectaries; the capsule pod-like, many seeded. The species are herbs with creeping perennial roots and annual stems.

E. alpinum, Alpine Barrenwort, has no root-leaves, and the leaves of the stem twice ternate. It is a native of France and other parts of Europe in subalpine coppices and woods. It has been found growing in Great Britain in Cumberland and Yorkshire, but Mr. Babington remarks that it has very slender claims to be considered a native of England or Scotland. The flowers are red with yellow nectaries. The stem is about four inches high.

E. pinnatum is a native of Persia, and *E. hexandrum* of the north-west of America. The first species is easily cultivated and will grow in any common garden soil, and may be propagated by dividing the root.

(Babington, *Manual of British Botany.*)

EPIPACTIS, a genus of plants belonging to the natural order Orchidaceæ or Orchideæ, and to the tribe Limodoreæ or Arethuseæ. It has the perianth patent, the lip interrupted, the basal division concave, the terminal one larger, with 2 projecting plates at its base above; the stigma nearly square; the rostellum short, terminated by a globose appendage; the anthers terminal, erect, sessile, 2-celled, the cells without septa; the column short; the germen straight on a twisted stalk. There are two species of this genus found wild in Great Britain.

E. latifolia has ovate clasping leaves, the lower bracts longer than the flowers, the terminal division of the lip entire, with a minute point. Babington observes that there are four or more very different plants included under this species inhabiting various parts of Great Britain. These are, (a) *E. latifolia*, with the terminal division of the lip roundish, cordate, obtuse, with a small recurved point. (b) *E. media*, with the terminal division of the lip triangular-cordate, acute, as long as the lanceolate sepals and petals. (c) *E. purpurata*, with the terminal division of the lip triangular-cordate, acute, shorter than the ovate-lanceolate sepals and petals. (d) *E. ovalis*, with the terminal division of the lip transversely oval and acute.

E. palustris has lanceolate leaves, bracts shorter than the somewhat drooping flowers, the terminal division of the lip roundish, obtuse, crenate, as long as the perianth. It is found in Great Britain in moist places, and is not a rare plant.

These plants will thrive in the borders on common garden soil, and will also grow in pots with a mixture of loam and peat; they require but little water when not vegetating, and may be propagated by division of the roots.

(Babington, *Manual of British Botany*; Loudon, *Encyclopædia of Plants.*)

EPIPHA'NIUS ('Επιφάνιος), a Greek ecclesiastical writer, was born in a village near Eleutheropolis in Palestine, and lived during the latter half of the fourth century after Christ. We still possess two biographies of him, written by his disciples Joannes and Polybius, but both are so full of fables that little reliance can be placed upon them, and we shall here only mention those particulars which appear to be well established. He is said to have been born of Jewish parents; but this statement, as well as what we read about his education and conversion, is more or less of a fabulous nature. When yet a youth he went to Egypt, where he was ensnared by some women to join the sect of the Gnostics, but he discovered his position soon enough and escaped; and after having studied the principles and the conduct of the Egyptian ascetics, he returned at the age of twenty to Palestine, where, for some time, he was instructed by Hilarion, the father of the Palestine monks. Afterwards he built a monastery near his native village, and was for a time at the head of it, but in A.D. 368 he was made bishop of Constantia (formerly called Salamis) in Cyprus, the metropolis of the whole island. During his residence there he acquired great celebrity by his teaching, his writings, and the simplicity of his life. In A.D. 382 he was invited to Rome to give his vote in the case of Paulinus, bishop of Antioch. A few years after his return to Cyprus he became involved in a bitter and long protracted controversy with Joannes, bishop of Jerusalem. The quarrel was carried on with such vehemence, that once while Epiphanius was preaching at Jerusalem against the views of Origen, Joannes and his party received him with shouts of laughter and indecent gestures, and at length stopped the preacher in his sermon. Similar scenes frequently occurred, and the longer the enmity lasted the bitterer it grew: Epiphanius accused Joannes of entertaining the heretical opinions of Arius and Origen, and Joannes retorted with other accusations against the private character of his opponent. Many letters and defences were written by both parties, and their friends did all they could to bring about a reconciliation, but in vain; for Joannes entertained a morbid hatred of Epiphanius, until after the lapse of several years he found that he was in the wrong, and was silenced by shame. But fresh contentions arose in another quarter. Theophilus, bishop of Alexandria, who had expelled some monks from Egypt, on the ground of their favouring the views of Origen, contrived to win Epiphanius over to his side. The monks took refuge at Constantinople, where they were received with distinction by Chrysostom. Epiphanius forthwith convoked a meeting of the Cyprian bishops, got them to condemn Origen and his works, and sent letters in all directions to announce the condemnation. Soon after he was prevailed upon by Theophilus to go to Constantinople; but he refused to have any interview or communication with Chrysostom, unless he would sanction the condemnation of Origen and expel the Egyptian monks. However, Epiphanius was soon obliged to quit Constantinople without having effected anything, for he was severely attacked by Chrysostom for attempting to interfere with his episcopal rights, and the empress Eudoxia too was not favorably disposed towards Epiphanius. On parting, the two bishops are said to have taken leave by wishing each other all kinds of evils, and the deity, say the writers of the time, granted their wishes; for Chrysostom was deposed soon after, and Epiphanius died on board the ship which was to carry him to Cyprus, in A.D. 402. He was then nearly one hundred years old, and had been Bishop of Constantia for thirty-five years.

Epiphanius is described as a man of very great piety, and adorned with all the virtues of a Christian: the opinion of his sanctity was so great in Cyprus, that a church was built there in honour of him, as early as A.D. 647. He wrote and spoke with equal facility Hebrew, Syriac, Egyptian, Greek, and Latin, and was especially versed in the history of the church, though he seems to have been a very credulous historian, and careless in his chronology. Photius says that he was very weak in conducting a controversy, and his language is such as might be expected of a man who paid no attention to elegance and refinement,—it is plain and homely in the highest degree. (Lives of Joannes and Polybius in Patavius's edition of Epiphanius, vol. ii. p. 318, &c.; Socrates, *Hist. Eccles.* vi. 10; Sozomen, viii. 14; Hieronym. *Opera*, vol. ii. p. 309, *De Scriptor.* 114.)

Epiphanius was the author of a considerable number of works, many of which have come down to us, but some of them are lost. Among those still extant there are several which are of a doubtful nature, and are ascribed by most ecclesiastical historians to a person of a much later date, who may have borne the name of Epiphanius, and so have caused the confusion. The most important among the extant works are 1, 'Ancoratus' ('Αγκυρωτός), that is, the anchor of faith against the heresies of the time, especially the Macedonian. Epiphanius's main object is to establish the Catholic doctrine of the Trinity and of the Holy Ghost. 2, 'Panaria' (Πανάρια), that is, a repository of remedies against the eighty heresies which he enumerates. It consists of three books, and was commenced in A.D. 374, at the request of Acacius and Paulus. Photius (*Bibl Cod.* 122) states that this work contains a more full and useful account of all the heresies than any other, and that it contains everything that earlier writers had said against those heresies, together with many useful observations of Epiphanius. The author himself published an abridgment of this work under the title of 'Ανακεφαλαίωσις, which is still extant. The first edition of these and a few other works appeared at Basel, 1544, fol. A Latin translation had been published at Basel in 1543, fol., and was afterwards often reprinted with some additions which are not in the first edition. The best edition of all the works of Epiphanius (the Greek original with a Latin translation) is that by Dionysius Petavius, Paris, 1622, 2 vols. fol., which was reprinted with some additions at Cologne, 1682, 2 vols. fol.

(Cave, *Historia Literaria*, vol. i. p. 184, &c.; Fabricius, *Biblioth. Graec.* viii. p. 255, &c.)

EPIPHE'GUS (from ἐπί, upon, and φηγός, the beech, because the plant is parasitical on the roots of the beech), a genus of plants belonging to the natural order Orobanchaceæ. It has the sterile flowers perfect, and the fertile flowers imperfect; the calyx short, 4-toothed; the perfect corolla 2-lipped; the upper lip emarginate, the lower 3-toothed; the imperfect corolla slender, 4-toothed, deciduous; the stamens as long as the corolla; the filaments smooth; the anthers 2-lobed, acute at the base, valveless, dehiscent in the middle; the stigma capitate, and somewhat emarginate; the capsule gibbous compressed, half 2-valved with four diverging placentæ. There is but one species, the *E. virginiana*. It is found parasitical on the roots of beech-trees in the southern States of the American union, where it is called 'Beech drops.' It is the *Orobanche virginiana* of Linnæus. It is a smooth fleshy branching plant, growing from six to eighteen inches high, and clothed with small scales instead of leaves. The corolla is purple streaked with white. The capsule dilates after it opens into the shape of a cup. There is in North America a quack medicine called 'Martin's Cancer Powder,' which consists of equal parts of this plant and white arsenic. It is said by some writers to have a really beneficial effect.

(Lindley, *Flora Medica*; Don, *Gardener's Dictionary.*)

EPISTAXIS (from ἐπίσταξις, a dropping, bleeding of the nose) is the term used by most nosologists to indicate bleeding from the nose, which essentially consists in an effusion of blood externally from the pituitary membrane. There are few parts of the body more liable to hæmorrhage than the lining membrane of the nose. The blood-vessels which supply this membrane are branches of the common carotid arteries, and the blood is returned from the membrane by veins which join the external jugular veins. Blood may flow from the nose under very varying circumstances; sometimes when the system is in a state of plethora, and at others when in a state of debility. When it occurs in plethoric persons it is usually preceded by pain in the head, vertigo, or drowsiness, frightful dreams, increased heat of one side of the face, injection of the eyes, flashes of light before the eyes, increased beating of the temporal arteries, deafness, &c. These symptoms will be present, more or less intense, according to the general condition of the sufferer. This active form of the hæmorrhage comes on in the course of many diseases, as the inflammatory forms of fever, inflammation of the brain, lungs, &c. Where the bleeding comes on in a state of debility it is called passive, and may make its appearance without any premonitory symptoms. This form comes on in the course of low and malignant fevers, and various diseases which come on in a cachectic state of the body.

Bleeding at the nose, when it occurs alone, most frequently comes on in children. After ten or twelve years of age it is oftener seen in boys than girls. It is frequently hereditary, and whole families exist who are liable on slight causes to bleed at the nose. It may be brought on by whatever increases the flow of blood to, or retards the flow of blood from, the head. Thus, mental excitement, anger, shame, protracted study, stooping, sneezing, deep sighing, hallooing, singing, coughing, tumors on the veins, tight neckcloths, &c., may all be exciting causes of the bleeding. Whatever causes absolute or relative plethora, as too free living, the suppression of accustomed discharges, whatever interferes with the free circulation of the blood, as tight clothes, whatever determines the blood to the surface of the body, as diminished pressure of the atmosphere, as in ascending mountains, a highly heated atmosphere, &c., will also produce it.

Bleeding at the nose is not in itself a dangerous disease. It may however come on in states of the body when the system is already exhausted, and be the forerunner of a fatal result. But in inflammatory diseases, and where the person is plethoric, it is frequently a relief to the system, and is followed by a diminution of painful symptoms. In persons, however, after middle age, and who are inclined to plethora, this symptom should be looked upon as indicative of congestion, which may proceed further, and the warning should be regarded, and a diminution in the indulgences of the table insisted on.

In the treatment of bleeding from the nose regard must be had to the state, age, &c. of the patient. When it occurs in children, and in the great majority of simple cases, all that is required is to make the patient assume the sitting posture, and hold the head backwards; cold should be applied to the face, and a piece of cold metal placed between the nape of the neck and the clothes. Acid drinks may be given at the same time. When the person is plethoric and has suffered much pain in the head, singing in the ears, &c., previously, it will not be adviseable to stop the bleeding until these symptoms are relieved. This may be followed by the exhibition of purgatives; and bleeding from the arm should be had recourse to if the head symptoms continue. When the bleeding follows the stoppage of any natural discharge, this latter should be restored. Cupping on the nape of the neck, or even dry cupping, may be recommended in these cases. But in the passive states of the system it is frequently desirable to avert the bleeding without loss of time. Under these circumstances astringents should be applied immediately to the pituitary membrane. A solution of the acetate of lead, of the sulphate of zinc, of iron, of copper, or of alum, may be injected up the nostrils, or a dossil of lint wetted with the solution thrust up the nostril. The various preparations of tannin, as catechu, kino, &c., may be employed in the same manner. These astringents may also be administered internally with small doses of opium. One of the most effectual means however of arresting hæmorrhage from the nose is plugging the posterior nares, which may be done by introducing a piece of sponge or lint upon a ligature into the mouth, and carrying it through the nares to the nostril in front. This generally exercises sufficient pressure to arrest the bleeding.

(Copland, *Dictionary of Medicine; Cyclopædia of Practical Medicine*, article Epistaxis.)

EPROUVETTE is an apparatus consisting of a gun or mortar suspended from a horizontal axis for the purpose of determining the strength of gunpowder by the recoil of the piece when a charge is fired in it. Mr. Robins (*New Principles of Gunnery*) first proposed the employment of such a machine, but Dr. Hutton, of Woolwich, afterwards considerably improved its construction.

The gun or mortar is fixed, near its centre of gravity, to the lower extremity of an iron rod, which may be about seven feet six inches long, and its base is attached by a short brace to an arm which projects from the rod, an adjusting screw being provided for the purpose of keeping the axis of the bore perpendicular to the same rod. Sometimes however a frame of iron, like the letter A, serves to suspend the gun, which is then fixed, at two places, in collars at the lower extremities of the frame. To the upper part of the rod or frame is attached a horizontal axle of steel, about which the gun is to vibrate; and each extremity of this axle rests in a socket at or near the top of the frame which constitutes the stand or support of the gun and its suspending apparatus.

From the lower side of the gun projects downwards a rod or style of iron, which is pointed at its lower extremity, the point being in a line drawn from the middle of the horizontal axis of suspension through the centre of gravity of the gun. Under the latter, and resting on the ground, is a block of wood in the upper surface of which is cut a groove, in a vertical plane, in the form of a portion of a circle whose centre is at the middle of the axis of suspension; and this groove being filled with soft wax, the point of the rod projecting below the gun, in the recoil of the latter, scratches on the wax a circular arc: the measure of this arc gives, of course, the angle of the recoil.

Instead of this pointed rod and grooved block, a quadrant of brass of any convenient radius, as twelve inches, is fixed in a vertical position to the rod or frame which carries the gun, the horizontal axis of suspension passing through its centre; the quadrant, whose arc is graduated, vibrates with the gun, and an index at the extremity of a bar on that axis remains at rest till the gun has recoiled as far as the force of the fired gunpowder can impel it; when, by a contrivance, it is enabled to return with the quadrant, showing, by the degree in coincidence with it, the extent of the recoil.

In the Eprouvette constructed by Dr. Hutton, the quadrant had on it three graduated arcs: one of these showed the degrees in the angle of recoil; another showed by inspection the length of the chord: and the third showed in like manner the length of the versed sine of the arc of recoil.

In using the instrument, the gun or mortar is charged with a given quantity of powder, which is introduced without a cartridge; and is fired, when exactly in a horizontal position, by means of a piece of quick match: the extent of the arc of recoil is then to be measured or read.

The velocity acquired by a body on describing half a vibration in a circular arc varies (by mechanics) with the square root of the vertical height, or with the chord of the half vibration: hence, if by the explosions of equal charges of different kinds of powder in a suspended gun, the latter be made to recoil from a vertical position through arcs or angles which are measured in degrees, the velocity resulting from the force which produced the recoil being equal to that which the gun would have acquired in descending by gravity from the upper extremity to the lowest point of the arc; it follows that the chords of those arcs or angles will express the relative velocities produced by the different kinds of powder. Again, by mechanics, the forces are as the squares of the velocities; and these, when produced by a body descending on circular arcs, are as the versed sines of the arcs; therefore the angles of recoil, or the half vibrations, being found from the experiments, their versed sines will express the relative forces of the different kinds of powder.

A gun suspended in the manner above described has been employed, instead of the ballistic pendulum, to determine, by its recoil, the initial velocity of the shot fired from it with a given charge of powder. [BALLISTIC PENDULUM, P. C.]

EQUALITY, APPROACH TO. As a general rule, that which may be stated as absolutely true when an equation is true, may be stated as nearly true when that equation is only nearly true. Usage of words however is apt to lead to mistake when it is equality, and nearness to equality, which are in question: A and B are absolutely equal when either of the following equations is true; one of them being of course a consequence of the other:

$$A-B=0 \qquad \frac{A}{B}=1$$

and it is usual to say that a *small* quantity is *nearly nothing*, or *near to nothing*. In strictness, we might as well say that a large quantity is near to infinity, as that a small quantity is near to nothing: both infinity and nothing are limiting terms, except only as to the latter, when obtained by subtraction. [INFINITE, P. C.] Nevertheless we can hardly hope to abolish the common idea of small quantities being next to nothing: we must therefore guard those who accept this phraseology from the mistake to which it very frequently leads.

It is not true that quantities are necessarily nearly equal when their difference is near to nothing (meaning small). If by small we here understand small with respect to the quantities themselves, it is true; but not otherwise. If $A-B$ be a small fraction of A, let it be mA, where m is a small fraction of unity; then $A-B=mA$ gives

$$\frac{B}{A}=1-m$$

or B and A are in the ratio of $1-m$ to 1, nearly that of 1 to 1. But if A and B be both small, their difference is small: and yet that difference may be itself many times greater than the smaller of the two quantities from which it was obtained. If the bulk of the sun be unity, the earth and moon are both small fractions; but not nearly equal. When therefore we want to think of approach to equality, we must rely on approach to

$$\frac{A}{B}=1, \text{ not to } A-B=0$$

We are here merely guarding a phrase, not explaining principles at length. In the articles INFINITE; LIMIT; FRACTIONS, VANISHING, P. C., will be found the elementary notions, proper attention to which will secure the beginner from error.

When a person, for any common purpose, speaks of a small quantity as next to nothing, he compares it with the whole mass from which it is taken, and he always means by small that which is a small fraction of an important quantity. The terms small and great being purely relative, may have many meanings in different circumstances; but with that we have here nothing to do. Whatever *small* may mean, we have no right to say that quantities of small difference are nearly equal, except only when the relative word small may be properly used in relation to the quantities themselves.

This last caution is the more necessary to the young mathematician, from his frequently meeting with the words small and great in an absolute sense. Though this absolute use of the words is only an abbreviation [INFINITE, P. C.], he may, without care, now and then forget that it is so.

EQUATION, BINOMIAL. A binomial equation is an algebraical equation of two terms. Its form is therefore $ax^n+bx^m=0$, all the consideration of which may easily be reduced to that of one or other of the forms $x^n \pm a^n=0$ (n being integer), at least if we confine ourselves to equations in which the data are all real quantities. All that is necessary is given in the article ROOT, P. C., so that we shall here confine ourselves to such statement of the mode of resolving $x^n \pm a^n$ into factors as may be useful for reference.

First, as to x^n-a^n. Of this $x-a$ is always a factor, and if n be even, $x+a$ is also a factor. The remaining factors are all of the form

$$x^2-2\cos\theta.\ ax+a^2$$

in which θ may be either the quantity $\frac{2\pi}{n}$ or any multiple of it less than $\frac{1}{2}n$. Thus whether n be 10 or 9, we go as far as four times $2\pi \div n$, since 4 is the integer next less than the half either of 10 or 9. According, if $\frac{2\pi}{n}=\nu$, and if k be the integer next less than the half of n, we have

$$\begin{aligned} x^n-a^n = & \ (x-a) \\ & \times(x+a, \text{ if } n \text{ be even}) \\ & \times(x^2-2\cos\nu.\ ax+a^2) \\ & \times(x^2-2\cos 2\nu.\ ax+a^2) \\ & \times\ \ldots\ldots\ldots \\ \text{up to } & \times(x^2-2\cos k\nu.\ ax+a^2) \end{aligned}$$

Next, as to x^n+a^n. Of this $x+a$ is a factor if n be odd: and the remaining factors are of the above form, θ being $\frac{\pi}{n}$ or any *odd* multiple of it which does not equal n. Thus whether n be 10 or 11, we go as far as 9 times $\pi \div n$, since 9 is the last odd integer which does not equal either 10 or 11. If then $\nu=\pi\div n$, and k be the last odd number which does not equal n, we have

$$\begin{aligned} x^n+a^n = & \ (x+a, \text{ if } n \text{ be odd}) \\ & \times(x^2-2a\cos\nu.\ ax+a^2) \\ & \times(x^2-2a\cos 3\nu.\ ax+a^2) \\ & \times(x^2-2a\cos 5\nu.\ ax+a^2) \\ & \times\ \ldots\ldots\ldots \\ \text{up to } & \times(x^2-2a\cos k\nu.\ ax+a^2) \end{aligned}$$

Closely connected with the binomial equation is the trinomial equation—

$$x^{2n}\pm 2\cos\lambda.\ a^n x^n+a^{2n}=0$$

the left hand side of which is thus reduced:—

For $x^{2n}-2\cos\lambda.\ a^n x^n+a^{2n}$ the factors are—

$$x^2-2\cos\frac{\lambda}{n}.\ ax+a^2$$

$$x^2-2\cos\frac{\lambda+2\pi}{n}.\ ax+a^2$$

$$x^2-2\cos\frac{\lambda+4\pi}{n}.\ ax+a^2$$

and so on up to

$$x^2-2\cos\frac{\lambda+\overline{2n-2}\pi}{n}.\ ax+a^2$$

For $x^{2n}+2\cos\lambda.\ a^n x^n+a^{2n}$ the factors are—

$$x^2-2\cos\frac{\lambda+\pi}{n}.\ ax+a^2$$

$$x^2-2\cos\frac{\lambda+3\pi}{n}.\ ax+a^2$$

$$x^2-2\cos\frac{\lambda+5\pi}{n}.\ ax+a^2$$

and so on up to

$$x^2-2\cos\frac{\lambda+\overline{2n-1}\pi}{n}.\ ax+a^2$$

For the *algebraical* solution of binomial equations, see the works of Gauss or Legendre on the theory of numbers, or Murphy's *Theory of Equations* (L. U. K.).

EQUATION, PERSONAL. It is a fact which has now been for some years established, and which might reasonably have been suspected, that different persons, attempting to observe the precise moment of a phenomenon, by means of a clock which beats seconds, do not agree exactly in their results, but differ generally in one and the same way, one of the observers being almost always a little before the other in the moment which he assigns to the phenomenon. If this had not been the case, if one of the observers had been about as often before the other as behind him, the difference could only have been considered as simple casualty. But, looking upon the constant occurrence of a difference of one kind between two observers, it becomes obvious that the cause is in the organs of the men themselves; and that physical constitution, temperament, habit, &c., make differences between one person and another.

Personal equation is a name given to the quantity of time by which a person is in the habit of noting a phenomenon wrongly; and it may be called positive or negative, according as he notes it after or before it really takes place. Thus if A and B are severally in the habit of noting events 3-tenths of a second after and 4-tenths of a second before they take place, their personal equations may be described as being $+0^s.3$ and $0^s.4$.

The absolute personal equation of any one is a thing undiscoverable; since we can only refer one human observer to another, and note the difference of their times of observing the same phenomenon. If we could cause a thousand persons to note a given definite phenomenon by one clock, and if we could take the mean of all their results, we might say that there is very strong reason to presume that the mean is the time which perfect organs would have noted: for we may think that the chances are much in favour of human imperfection being, in the mass, as much of one kind as of the opposite. But a little consideration will show that this reasoning is not to be relied on. It may be that the whole race has, by its constitution, a rather large personal equation of one or the other kind: for we can only see the differences, without knowing upon what quantities they are differences. This question is, however, practically immaterial; for any given amount of personal equation common to the whole race is equivalent to making all the clocks wrong by the same quantity. Suppose, for example, that every person suddenly received an addition of one second to his personal equation, or began to note phenomena a second later. The astronomers would then begin to find the clocks a second too fast, in comparing observation with prediction; as soon as the clocks had been rectified every thing would be as before.

The first notice we have of personal equation is in an announcement by Maskelyne, in the volume of Greenwich Observations for 1795. He tells us that he was obliged to part with one of his assistants, because the latter, who had till then always agreed with him in his observations, suddenly began, in August, 1794, to observe half a second later: and that in January, 1796, the difference amounted to 8-tenths of a second. Maskelyne inferred that his assistant had contracted some bad habit of observation: it is now very well known that age causes persons to observe later than they did before, though it is not usual for the habit to undergo such sudden changes as in the above case. In 1823 Mr. Bessel, at Königsberg, ascertained that he was in the habit of observing phenomena as much as $1^s.22$ before his assistant Mr. Argelander. The latter left his post to take charge of the observatory at Bonn; but, passing through Königsberg in 1832, Mr. Bessel took the opportunity to make some further comparisons with him; and it was found that the above quantity was reduced to $1^s.06$. Age had brought them nearer together. A close trial of the subject was made by MM. Quetelet and Sheepshanks, 1838-1841, in determining the longitude of Brussels by transmission of chronometers between that place and Greenwich. This method of course requires the most careful transit observations at both places, and the personal equation * becomes of considerable importance. It was necessary that some observer should compare himself with M. Quetelet at Brussels, and with the assistants at Greenwich. This was undertaken by Mr. Sheepshanks, and the result ascertained was, that he came, one observation with another, 45-hundredths of a second behind M. Quetelet, and 27, 35, and ·24 hundredths before MM. Main, Henry, and Ellis, severally. The result was that the longitude of Brussels was found to be three quarters of a second less than it would have been supposed to be if the difference of personal equations had been unknown. (See a memoir on the difference of the longitudes of Brussels and Greenwich, by MM. Quetelet and Sheepshanks, *Mém. de l'Acad. Roy. de Bruxelles*, vol. xvi.)

EQUATIONS, DIFFERENTIAL, and EQUATIONS OF DIFFERENCES. The plan we shall follow in this article is that of THEORY OF EQUATIONS, P. C., in which a synopsis of results is given, such as may be useful to the advanced student, as a guide to his reading, or for reference. We have not room either to teach the subject or to illustrate it by examples. We may refer to the following works:—Moigno, 'Leçons de Calcul Differentiel,' &c., vol. ii. Paris, 1844, 8vo.; De Morgan, 'Differential and Integral Calculus,' London, 1842, 8vo. (Lib. U. K.); various numbers of the 'Cambridge Mathematical Journal,' Cambridge, 1839-1845, 8vo., a work which has at this time (August, 1845) reached the end of the fourth volume and of the twenty-fourth number; Brooke, 'Synopsis of the .. Formulæ .. of Pure Mathematics,' Cambridge, 1829, 8vo.; Peacock, Herschel, and Babbage, 'Collection of Examples,' &c., Cambridge, 1820, 8vo.; Gregory, 'Examples of the Differential Calculus,' Cambridge, 1841, 8vo. We must confine ourselves to a selection from striking points, or our article would exceed all reasonable limits.

1. Let there be a function $\phi\,(x, y, a, b, c\ldots)$, or ϕ, containing the variables x and y and the n constants, $a, b, c, \ldots$ If we make $\phi = 0$, we tacitly require that y should be a function of x. If between $\phi\,(x, y\ldots) = 0$, and the result of complete differentiation, $\phi'\,(x, y, \ldots) = 0$, we eliminate one of the constants, we get a new equation containing x, y, y' (or $dy : dx$) and all the rest of the constants; and according as we eliminate one or another constant, we have one or another of as many such equations as there were constants. These are called differential equations of $\phi = 0$, and they are said to be of the *first order*.

2. The word *order* refers to the number of differentiations, the word *degree* to the highest power of the highest differential coefficient which enters. Thus $y''^4 + y'^5 = x$ is a differential equation of the second order and the fourth degree. Let the accents always denote complete differentiation with respect to x. For partial differentiation we shall save room by writing as follows:—ϕ'_x for $\frac{d\phi}{dx}$, ϕ'_y for $\frac{d\phi}{dy}$, &c.

3. If we eliminate two of the constants between $\phi = 0$, $\phi' = 0$, $\phi'' = 0$, we have a differential equation of the second order, and so on; there are altogether $\frac{1}{2}\,n\,(n-1)$ differential equations of the second order, if we have n constants. And generally, when there are n constants, there are as many differential equations of the mth degree as there are ways of taking m out of n things. Thus there is only one equation of the nth degree.

4. If there be a system of p equations between $p+1$ variables, so that p of the variables are functions of the remaining one, and if we differentiate each equation once, we can eliminate p constants, and form p equations of the first order. With p second differentiations, we can eliminate p other constants, and so on. And if there were $p+q$ variables, we should have similar systems with q independent variables.

5. Equations of differences are formed in a corresponding way by taking differences instead of differential coefficients. Thus, suppose u_x means u, a function of x, and $\phi\,(x, u_x, a) = 0$. Change x into $x + \Delta x$, usually into $x + 1$, and let u_x then become u_{x+1}, or $u_x + \Delta u_x$. If we eliminate a between $\phi\,(x, u_x, a) = 0$ and $\phi\,(x+1, u_{x+1}, a) = 0$, we have an equation of the form $\psi\,(x, u_x, u_{x+1}) = 0$, or $\psi\,(x, u_x, \Delta u_x) = 0$, as we please, and this is an equation of differences of the first order. But exactly the same equation would be obtained, if for a we had substituted any function of $\cos\,(2\pi x)$, or of $\cos\,(2\pi x \div \Delta x)$. On this point see INVARIABLE, P. C.

6. When there are more than two variables, say three, it is possible to form an equation in which an arbitrary function of a definite function of two of them shall be eliminated. Thus, if $\phi\,\{x, y, z, \psi\alpha\,(x, y)\} = 0$, in which z is a function of x and y and $\alpha\,(x, y)$ a given function; we differentiate with respect to x and y separately, and produce three equations involving $x, y, z, z'_x, z'_y, \psi\alpha\,(x, y)$ and $\psi'\alpha\,(x, y)$. From these three eliminate the two last, ψ and ψ', and we get an equation involving only x, y, z, z'_x, z'_y, in definite forms. This is called a partial differential equation.

7. The analogies between the constants of a common differential equation and the arbitrary functions of a partial one must not be relied on as capable of being carried all lengths. It is not, for instance, universally true that two arbitrary functions may be completely eliminated by differentiations of the second order.

We now consider common differential equations of the first order.

8. Let $y = \phi\,(x, c)$, and $y' = \phi'\,(x, c)$, and let elimination give $y' = \chi\,(x, y)$, the differential equation. There is another mode of arriving at the same result. Let $y = \phi\,(x, c)$ give $c = \Phi\,(x, y)$, or $0 = \Phi'_x + \Phi'_y \cdot y'$. The constant here disappears by mere differentiation, and $\chi\,(x, y)$ must be identical with $-\Phi'_x : \Phi'_y$.

9. The difficulty of returning to the primitive from the equation $y' = \chi\,(x, y)$ consists in that of reducing it to the form $\Phi'_x + \Phi'_y \cdot y' = 0$. Generally speaking, common factors are made to disappear, and the restoration of these factors is a problem of exactly the same difficulty as the solution of the equation.

10. The quantity $P + Qy'$, P and Q being functions of x and y, is integrable at once when $P'_y = Q'_x$. When this condition, which is usually called the criterion of integrability, is satisfied, the integral is

$$\int P dx + \int \left(Q - \frac{d}{dy} \int P dx \right) dy$$

in which y is constant in the first integration, and x in the second. Any arbitrary constant may be added. Either of the following forms are also integrals of $\psi\,(x, y) + \chi\,(x, y) \cdot y'$, if the criterion be satisfied.

$$\int_a^x \psi\,(x, y)\,dx + \int_b^y \chi\,(a, y)\,dy$$

$$\int_b^y \chi\,(x, y)\,dy + \int_a^x \psi\,(x, b)\,dx$$

11. The equation $y' = \chi\,(x, y)$ can have no other primitive with an arbitrary constant, except $y = \phi\,(x, c)$ from which it was derived. But it may have another solution which has not an arbitrary constant, or even more than one: these are called singular solutions. A singular solution makes χ'_x and χ'_y infinite if y be substituted from it in terms of x. It also makes Φ'_x and Φ'_y infinite in the same manner.

12. The singular solution may also be found from the primitive $y = \phi\,(x, c)$, as follows. Eliminate c between $y = \phi\,(x, c)$ and $0 = \phi'_c\,(x, c)$, the result is the singular solution. This rule and the last are subject to exception when the singular solution takes the form $x =$ constant or $y =$ constant.

13. The geometrical character of a singular solution is as follows. If $y = \phi\,(x, c)$ be the equation of a family of curves, that is, of one curve for each value of c, the differential equation $y' = \chi\,(x, y)$ also belongs to every member of that family. The singular solution is the equation of the curve which touches every one of the family of curves.

14. The equation $y = y'x + \phi\,(y')$ is historically remarkable as having led to the theory of singular solutions: it is called *Clairaut's form*. The complete primitive is $y = cx + \phi c$, belonging to a family of straight lines: the singular solution is found by eliminating c between this and $x + \phi' c = 0$.

15. It is not often that the factor which makes an equation integrable can be recovered in any general form. As soon as the solution is obtained, it can always be found: but the only use of it is to find the solution. There is always an infinite number of such factors, any one of which will do. When in $P + Qy'$, the criterion $P'_y - Q'_x$ is not $= 0$, yet if it be a function of x only, and if $\int Q^{-1}\,(P'_y - Q'_x)\,dx = V$, then $\varepsilon^V\,(P + Qy')$ is integrable

---

* It is usual to call the difference between two observers the personal equation; but this ought to be called the difference of their personal equations, or their *personal difference*. The personal equation of an observer is, properly speaking, the difference between him and the average of the human race.

16. The equation $y' + Py = Q$, in which P and Q are functions of x only, is always integrable. The factor of integration is $\varepsilon^{\int P dx}$, and the complete integral is

$$y = \varepsilon^{-\int P dx} \int Q \varepsilon^{\int P dx}\, dx + c \,.\, \varepsilon^{-\int P dx}$$

The equation $y' = Py + Qy^2$ is reduced to the preceding form by making $y = z^{-1}$; and $y' = Py + Qy^n$ by making $z = y^{1-n}$.

17. When P and Q are homogeneous functions of x and y, or when they are both of the form $x^n \phi\,(y : x)$, with the same value of n, the integrating factor is $(Px + Qy)^{-1}$. But generally the following method is more convenient. Having

$$\phi\,(x : y) + \psi\,(x : y)\,.\,y' = 0$$

assume $y : x = u$, from whence

$$\frac{dx}{x} = -\frac{\psi u du}{\phi u + u\psi u}$$

to which common integration can be applied. The equation is now reduced to one in which the variables are said to be separated.

18. It is hardly necessary to say that the variables can be immediately separated in $P + Qy' = 0$, whenever P and Q are both of the form $\phi x \times \psi y$.

19. It often happens that, when direct processes would require the previous solution of an equation of indefinite form, indirect processes will succeed in reducing the question of solution to one of elimination. Thus $x = f\,(y')$ is solved when y' is eliminated between this and

$$y = y' fy' - \int fy'\, dy' + c$$

and $y = fy'$ is solved when y' is eliminated between it and

$$x = x' f\left(\frac{1}{x'}\right) - \int f\left(\frac{1}{x'}\right) dx' + c$$

where x' means $1 : y'$.

20. The equation $y = x\, \phi y' + \psi y'$ can be reduced to elimination, thus. Let $y' = z$, then

$$\frac{dx}{dz} - \frac{\phi' z}{z - \phi z}\, x = \frac{\psi' z}{z - \phi z}$$

which is of the form integrated in § 16. Eliminate z between the result of this and $y = x\phi z + \psi z$.

21. The equation $y = \phi\,(x, y')$ can be reduced to a form of the first degree and elimination. Let $y' = z$, then $z = P + Qz'$, where P and Q are $\phi'_x\,(x, z)$ and $\phi'_z\,(x, z)$. If this equation can be integrated, we eliminate z between the result and $y = \phi\,(x, z)$. The form $x = \phi\,(y, y')$ may be treated in a similar manner. Or generally, let the equation be $\phi\,(x, y, y') = 0$, $\phi\,(x, y, z) = 0$, which gives by differentiation a form $P + Qz + Rz' = 0$. If from this we eliminate y, by substitution from the preceding, we have an equation of the first degree as to z', from which, if integration be possible, elimination will determine the relation between x and y.

22. Various substitutions will sometimes aid in the solution of an equation, as $y = ux$, $y = u^{-1}$, $y = u^m$, $y = \varepsilon^u$, and so on: sometimes, when a couple of expressions of the form $ax + by + c$, $a'x + b'y + c'$, occur, it will be convenient to introduce two new variables derived from equating the preceding to $Au + Bw$ and $A'u + B'w$. We have given the most effective general methods; the number of transformations* which have succeeded in particular cases is very large.

23. When the equation is of the first order, but of a higher degree, as

$$P_n y'^n + P_{n-1} y'^{n-1} + \ldots + P_1 y' + P_0 = 0,$$

the theoretical mode of proceeding, occasionally convenient enough in practice, is to find the n values of y', say $y' = \phi_1\,(x, y)$, $y' = \phi_2\,(x, y)$, &c. If these can be separately integrated, giving, say $\psi_1\,(x, y, c) = 0$, $\psi_2\,(x, y, c) = 0$, &c., then the complete primitive of the equation is

$$\psi_1\,(x, y, c) \times \psi_2\,(x, y, c) \times \ldots\ldots = 0.$$

24. When, in the last, P_n, P_{n-1}, &c. are all homogeneous functions of x and y of the same degree, proceed as follows. Reduce the equation to the form

$$y'^n + A_1\, y'^{n-1} + \ldots + A_n = 0.$$

in which A_1, &c. are of the form $\phi\,(y : x)$. Let $y = tx$ and find, in terms of t, the several values of y' or $t + xt'$, from the equation. Now $t + xt' = \phi t$, is an equation in which the variables can be separated. Solve each equation, and proceed as in the last.

25. The only equation of differences of the first order which can be generally treated, at present, is the form $\Delta u_x - P_x\, u_x = Q_x$, where P_x and Q_x are functions of x, or its corresponding form $u_{x+1} - P_x\, u_x = Q_x$. Supposing x to be an integer, which is what is usually required, let $\Sigma\, u_x$ denote $u_m + u_{m+1} + \ldots + u_{x-1}$, where m is an arbitrary integer chosen to start from. Accordingly $\Delta \Sigma u_x = u_x$. The solution of $u_{x+1} - P_x\, u_x = Q_x$ is

$$u_x = P_m\, P_{m+1} \ldots\ldots P_{x-1} \left\{ C + \Sigma \frac{Q_x}{P_m \ldots\ldots P_x} \right\}$$

26. Equations of differences in their most general form have solutions which appear to resemble the singular solutions of differential equations: but there are important points in which the resemblance fails. (' Differential Calculus,' *Library of Useful Knowledge*, p. 738.)

27. Let $y^{(n)}$ stand for the nth differential coefficient of y. The following expression

$$P_n\, y^{(n)} + P_{n-1}\, y^{(n-1)} + \ldots\ldots + P_0\, y$$

is absolutely integrable, independently of all relation between y and x, if

$$P_0 - P_1' + P_2'' - P_3''' + \ldots\ldots \quad = 0,$$

in which accents refer to complete differentiation with respect to x. And the integral is

$$P_n\, y^{(n-1)} + (P_{n-1} - P_n')\, y^{(n-2)}$$

$$+ (P_{n-2} - P'_{n-1} + P''_n)\, y^{(n-3)} + \ldots\ldots$$

One remarkable case is this;—each term $P_m\, y^{(m)}$ is absolutely integrable when P_m is a rational and integral function of x of a degree lower than the mth. Thus y^{i}, y^{iv}, $x^2 y^{\text{iv}}$, $x^3 y^{\text{iv}}$, are all integrable functions.

28. The equation $y^{(n)} = \phi x$ is not only completely integrable, but it may easily have all its intermediate differential equations found. For instance, suppose $y^{\text{v}} = \phi x$. Multiply this successively by $1, x, x^2, x^3, x^4$, and, by the last section, we have five integrable equations, leading to the five differential equations of the fourth order which belong to $y^{\text{v}} = \phi x$. Treat the first result in the same manner with $1, x, x^2, x^3$, the second with $1, x, x^2$, the third with $1, x$, and the fourth with 1, and we have the 10 equations of the third order. Proceed in the same way with the results, taking care never to let any multiplication enter which raises the coefficient as high as the order of differentiation which it accompanies, and then will appear successively 10 equations of the second order, 5 of the first, and finally the original primitive.

29. The following theorems will sometimes be of use. Let P_n stand for $\int x^n \phi x dx$. Then the nth integral of ϕx, or $\int dx)^n \phi x$, is the following series divided by $1.2.3 \ldots (n-1)$

$$x^{n-1} P_0 - (n-1) x^{n-2} P_1 + (n-1)\frac{n-2}{2} x^{n-3} P_2 - \ldots$$

$$\text{and } (m+1) \int x^m P_n dx = x^{m+1} P_n - P_{m+n+1}$$

If the integrations in the last section be made by this last rule as they arise, the results will be given in terms of P_0, P_1, &c., and there will be no difficulty about the constants, which in the ordinary mode may appear to enter in too great numbers.

30. There are very few cases of equations of higher orders than the first which can be integrated in general terms. The equation $y'' = \phi y$ gives

$$y'^2 = c + 2 \int \phi y dy$$

which is integrable. Again, $y'' + Qy'^2 = R$, Q and R being functions of y, gives

---

* The student must not be discouraged by finding that he does not succeed in solving cases which require detached artifices in the same manner as the writer of the elementary work before him. The art of solving equations is made evident: the art of constructing equations which can be solved is behind the curtain. There are few or no mathematical works with many examples to the writers of which the proverb may not be applied, that 'those who hide know where to find.'

$$x=\int\frac{\mathrm{W}dy}{\sqrt{(2\int \mathrm{RW}^2dy)}}\text{ where log. W}=\int\mathrm{Q}dy$$

and, by a change of the independent variable, $y''+\mathrm{P}y'+\mathrm{Q}y'^3=0$ gives, if P and Q be functions of x

$$y=\int\frac{\mathrm{W}dx}{\sqrt{(2\int \mathrm{QW}^2dx)}}\text{ where log. W}=-\int\mathrm{P}dx$$

31. The term *linear* equation is generally applied to one of the forms

$$y^{(n)}+\mathrm{P}_1y^{(n-1)}+\ldots+\mathrm{P}_ny=0$$

in which P_1 &c. are functions of x only. If a solution be found which has not n distinct arbitrary constants, it is not the most complete solution, but is called a *particular** solution. It is a most important property of the linear equation that if n distinct particular solutions can be found, say $y=\mathrm{Y}_1$, $y=\mathrm{Y}_2$, &c. then the complete solution is

$$y=\mathrm{C}_1\mathrm{Y}_1+\mathrm{C}_2\mathrm{Y}_2+\ldots\ldots+\mathrm{C}_n\mathrm{Y}_n$$

where C_1, C_2, &c. are any arbitrary constants.

32. The most remarkable case is that in which the coefficients are constants, as in $y^{(n)}+a_1y^{(n-1)}+\ldots+a_ny=0$. If the equation $k^n+a_1k^{n-1}+\ldots+a_n=0$ have n unequal roots, α, β, γ, &c., the general solution is

$$y=\mathrm{A}\epsilon^{\alpha x}+\mathrm{B}\epsilon^{\beta x}+\mathrm{C}\epsilon^{\gamma x}\ldots\ldots\ldots$$

but if there should be, say m roots equal to α, the term which must belong to α in the solution is of the form

$$(\mathrm{A}_0+\mathrm{A}_1x+\ldots+\mathrm{A}_{m-1}x^{m-1})\,\epsilon^{\alpha x}$$

A pair of imaginary roots, $\mu\pm\nu\sqrt{-1}$, contributes to the solution the term

$$\epsilon^{\mu x}(\mathrm{K}\cos\nu x+\mathrm{L}\sin\nu x)$$

Letters introduced without specific mention mean arbitrary constants.

33. The most remarkable particular case of the preceding is

$$y''+a^2y=0\qquad y=\mathrm{K}\cos ax+\mathrm{L}\sin ax$$
$$=\mathrm{B}\cos(ax+\mathrm{A})$$

No one differential equation is of so much importance as this.

34. When the equation is linear in all but an independent term, as

$$y^{(n)}+\mathrm{P}_1y^{(n-1)}+\ldots.+\mathrm{P}_ny=\mathrm{X}$$

X being a function of x, its solution can be deduced from that of the linear form, in which $\mathrm{X}=0$, by a method the importance of which will justify some account of it in a separate article. [VARIATION OF PARAMETERS, P. C. S.] We give the following result of it: $y''+a^2y=\mathrm{X}$ gives

$$a\,y=\sin ax\int\mathrm{X}\cos ax\,dx-\cos ax\int\mathrm{X}\sin ax\,dx$$
$$+\mathrm{K}\cos ax+\mathrm{L}\sin ax$$

35. The completed linear form (take the second order for an instance), $\mathrm{P}_0y''+\mathrm{P}_1y'+\mathrm{P}_2y=\mathrm{X}$ can be integrated (§ 27) one step if both sides be multiplied by the factor M, which satisfies the purely linear equation

$$\mathrm{MP}_2-(\mathrm{MP}_1)'+(\mathrm{MP}_0)''=0$$

This is another differential equation of the same order, but the difficulty is much reduced by it. The general solution of the last is not wanted; any particular solution will do. That is, if a particular solution of every linear equation could be found, the general solution of every completed linear equation could be deduced. And it will generally happen that when one particular solution can be found, to make an integrating factor, enough of them can be found to give the complete solution of the subsidiary equation.

36. The form $\phi(y,y',y'')=0$, in which x is wanting, may be reduced to an equation of the first order, by making $y'=z$, when it becomes $\phi(y,z,zdz:dy)$. If z or y' be thence found in terms of y, the variables can be immediately separated: if y be found in terms of z, we eliminate z between $y=\psi z$ as found and $x=\int(\psi'zdz:z)$.

37. As an *à priori* mode of constructing linear equations and their solutions, note the following: If $\phi(x,y,y',\ldots.y^{(n)})$ have for its solution $y=\psi(x,a,b,c,\ldots)$ a,b,c, &c. being arbitrary constants, and if P_0, P_1, P_2, &c., be the differential coefficients of ϕ (with respect to y, y', y'', &c., considered as independent variables) with ψ substituted in them instead of y: then the solution of the linear equation

$$\mathrm{P}_0u+\mathrm{P}_1u'+\mathrm{P}_2u''+\ldots.\mathrm{P}_nu^{(n)}=0$$

is

$$u=\mathrm{A}\psi_a'+\mathrm{B}\psi_b'+\mathrm{C}\psi_c'+\ldots..$$

A, B, &c., being new arbitrary constants.

38. If to an equation of the nth order, all the n equations of the $(n-1)$th order can be found, each with an arbitrary constant, there is no occasion for any further integration. For if $y'\,y'',\ldots.y^{(n-1)}$ be eliminated between the n equations, the result will be the complete primitive.

39. The purely linear equation, or indeed any one which is homogeneous with respect to y, y', y'', &c., can be lowered one order by assuming $\log. y=\int zdx$, or $y=\epsilon^{\int zdx}$ (we have used the former as more convenient to print). If this be done with $\mathrm{P}_0y''+\mathrm{P}_1y'+\mathrm{P}_2y=0$, it gives

$$\mathrm{P}_0z'+\mathrm{P}_0z^2+\mathrm{P}_1z+\mathrm{P}_2=0.$$

40. In this way the solution of $y''=\phi x\,.\,y$ is connected with that of $z'+z^2=\phi x$. When $\phi x=ax^m$, it is called Riccati's equation, and it can be integrated in finite algebraical terms whenever $m=-4k:(2k\pm1)$, k being a positive integer.

41. If only a particular solution of $y''+\mathrm{P}y'+\mathrm{Q}y=0$ can be found, then the general solution of $y''+\mathrm{P}y'+\mathrm{Q}y+\mathrm{R}=0$ can be found from it. Let $y=\mathrm{Y}$ be the particular solution of the first, and let $\log.\mathrm{W}=\int\mathrm{P}dx$: the general solution of the second is

$$y=-\mathrm{Y}\int\frac{\int\mathrm{RYW}dx}{\mathrm{Y}^2\mathrm{W}}\,dx.$$

42. If $\phi(x,y,y',y'')=0$ would become homogeneous with respect to x and y, by considering y, y' and y'' as of the dimensions n, $n-1$, $n-2$, assume $y=x^nu$, $y'=x^{n-1}v$, $y''=x^{n-2}w$, which reduces the equation to the form $\psi(u,v,w)=0$. Then deduce

$$(w-\overline{n-1}\,v)\,du=(v-nu)\,dv.$$

and substitute for w its value in terms of u and v. If this equation of the first order can then be integrated, giving, say $\chi(u,v)=0$, we have to complete the process by integrating $\chi\left(yx^{-n},\,y'x^{-(n-1)}\right)=0$

43. To destroy the second term of $y''+\mathrm{P}y'+\mathrm{Q}y+\mathrm{R}=0$, proceed as follows. Let $\xi=\int\epsilon^{-\int\mathrm{P}dx}dx$, and find x in terms of ξ. Then we have

$$\frac{d^2y}{d\xi^2}+(\mathrm{Q}y+\mathrm{R})\,\frac{dx^2}{d\xi^2}=0$$

44. Any number of simultaneous equations which leave only one independent variable can be reduced to equations between two variables. For instance, let there be three equations between x, y, z, t, and differential coefficients of x, y, z, with respect to t. Now, looking upon x, x', &c., y, y', &c. (excluding z, z', &c.) as so many independent quantities, differentiate the four equations with respect to t. There are then introduced *two* new differential coefficients of x and y, and *three* new equations: or the number of equations gains one upon the number of quantities. Repeat the process, and the same thing happens again, and so on. Consequently a step must arrive at which the number of equations is made one more than the number of quantities. All the quantities can then be eliminated, and there results one equation between z, z', &c., and t. The same thing may be done with x and y. The process will also reduce the number of equations to as many as there are independent variables, whatever that number may be. The order of the result is the sum of the orders of the original equations.

45. In the simple case of $\mathrm{A}y'+\mathrm{B}z'+\mathrm{C}=0$, $\mathrm{P}y'+\mathrm{Q}z'+\mathrm{R}=0$, when A, P, &c., are functions of x, y, z, and z' is $dz:dx$, &c., we may proceed by eliminating y' and forming say $z'=\mathrm{M}$, a function of x, y, z. Hence $z''=\mathrm{M}'_x+\mathrm{M}'_y\,y'+\mathrm{M}'_z\,z'$ from which we may eliminate y and y' by the original equations, and thus produce an equation of the second order to determine z in terms of x. And the same for y in terms of x.

46. Let t be the independent variable, and let

$$x'=\mathrm{A}_1x+\mathrm{B}_1y+\mathrm{C}_1\qquad,\ y'=\mathrm{A}_2x+\mathrm{B}_2y+\mathrm{C}_2$$

A_1 &c. being functions of t only. Determine θ and z from

---

* The word particular is here opposed to general. Note this, because some writers have used *particular solution* to signify what is now generally called *singular solution*.

$$\theta' = A_2\theta^2 + (A_1 - B_2)\,\theta - B_1$$
$$z' = (A_1 + A_2\theta)\,z + C_1 + C_2\theta$$

θ will generally be a function of double value; let θ_1 and θ_2 be its two values, and z_1 and z_2 the corresponding two values of z. Finally, determine x and y from

$$x + \theta_1 y = z_1$$
$$x + \theta_2 y = z_2.$$

47. When the forms are

$$x'' = A_1 x + B_1 y + C_1 \quad , \quad y'' = A_2 x + B_2 y + C_2$$

A_1 &c. being constants (a case which is often useful) determine the two values of θ from

$$B_1 + B_2\theta = (A_1 + A_2\theta)\,\theta$$

and the two values of z from

$$z'' = (A_1 + A_2\theta)\,z + C_1 + C_2\,\theta$$

and find x and y from $x + \theta_1 y = z_1 \quad , \quad x + \theta_2 y = z_2$

48. Also, when the simultaneous equations are linear, with constant coefficients, proceed as follows. Say there are four variables, x, y, z, t; and three equations. Assume $x = \varepsilon^{at}$, $y = b\varepsilon^{at}$, $z = c\varepsilon^{at}$, and substitute: the result will be, after division by ε^{at}, three equations of the form $\phi\,(a, b, c) = 0$, in which b and c only enter in the first degree. Hence the values of a can be found by an equation whose degree is the sum of the orders of the original equations, with one value of b and c for each value of a. Let the values be $a_1, a_2, b_1, b_2, c_1, c_2$, &c., then the complete solution is

$$x = C_1\varepsilon^{a_1 t} + C_2\varepsilon^{a_2 t} + \ldots.$$
$$y = C_1 b_1\varepsilon^{a_1 t} + C_2 b_2\varepsilon^{a_2 t} + \ldots.$$
$$z = C_1 c_1\varepsilon^{a_1 t} + C_2 c_2\varepsilon^{a_2 t} + \ldots.$$

C, &c. being arbitrary constants.

49. Whenever the solution of a differential equation depends upon that of an ordinary equation, and supposing the roots to be all different, the form of the solution is

$$x = C_1\,\phi\,(a_1 t) + C_2\,\phi\,(a_2 t) + \ldots.$$

the solution, though still a solution, ceases to be the complete solution when there are any sets of equal roots. If there be m roots equal to a, and if $\phi'\,x$, $\phi''\,x$, &c., be the successive differential coefficients of ϕx, this set of roots contributes to the value of x the terms

$$K\,\phi\,(at) + K_1\,\phi'(at)\,.\,t + \ldots\ldots + K_{m-1}\,\phi^{(m-1)}(at)\,.\,t^{m-1}$$

of which a particular case has been seen in § 32.

50. We now look at one equation with three variables, two of which are therefore independent. Let $Xdx + Ydy + Zdz = 0$ be the equation. This may have arisen direct from $\phi(x, y, z) = c$, without alteration or loss of factors, &c.: and this will be the case when $X'_y = Y'_x$, $Y'_z = Z'_y$, $Z'_x = X'_z$, and then only. To return to the primitive, integrate $Xdx + Ydy$ (§ 10) as if z were constant, and let the result be P. The integral of $Xdx + Ydy + Zdz$ is then

$$P + \int (Z - P'_z)\,dz$$

Or thus: when the criteria are satisfied, the integral (omitting the usual commas to save room) of

$$\phi\,(xyz)\,dx + \chi\,(xyz)\,dy + \psi\,(xyz)\,dz \quad \text{is}$$

$$\int_a^x \phi\,(xyz)\,dx + \int_b^y \chi\,(ayz)\,dy + \int_c^z \phi\,(abz)\,dz$$

in the first of which y and z are treated as constants, and z in the second.

51. If the criteria be not satisfied, a factor M may possibly exist, such that $MX\,dx + MY\,dy + MZ\,dz$ shall be integrable. But this cannot happen unless the following criterion be satisfied:

$$Z\,(X'_y - Y'_x) + X\,(Y'_z - Z'_y) + Y\,(Z'_x - X'_z) = 0$$

and the factor, when this is satisfied, must satisfy any two of the three equations.

$$M\,(X'_y - Y'_x) + XM'_y - YM'_x = 0$$
$$M\,(Y'_z - Z'_y) + YM'_z - ZM'_y = 0$$
$$M\,(Z'_x - X'_z) + ZM'_x - XM'_z = 0$$

But if the criterion be not satisfied, then there is no equation whatsoever between x, y, z, which always produces $Xdx + Ydy + Zdz = 0$.

52. The equation $Xdx + Ydy + Zdz = 0$, when produced from $\phi\,(x, y, z) = c$, is the equation of a family of surfaces, the individuals of which are defined by the different values of c. That is to say, any point of one of these surfaces being taken, and any other point infinitely near to it, the equation is satisfied by x, dx, &c., as derived from these points. But when the criterion is not satisfied, then $Xdx + Ydy + Zdz$ still belongs to any surface in the following limited sense. On any surface, and through any point of it, a curve may be drawn such that the equation Xdx + &c. is satisfied if the two contiguous points first named be taken *on that curve.*

53. When there are three variables and two equations, with two constants, as in $\phi\,(x, y, z, a, b) = 0$, $\psi\,(x, y, z, a, b) = 0$; the most ready theoretical mode of imagining the differential equations formed is the reduction to the form $a = \Phi\,(x, y, z)$, $b = \Psi\,(x, y, z)$, and differentiation. Two equations of the form $Pdx + Qdy + Rdz = 0$ are thus produced; from which, by combination, may be derived an infinite number of pairs of the same kind, answering to the infinite variety of pairs which can be produced from the primitive equations. This corresponds with the obvious geometrical fact that one curve may be the intersection of an infinite number of different pairs of surfaces.

54. A partial differential equation, such as $\phi\,(x, y, z, z'_x, z'_y) = 0$, belongs to an infinite number of surfaces distinguished by the forms of the arbitrary function which enters into the solution. The most general method of proceeding is as follows, which supposes that a particular solution is found having at least *two* new arbitrary constants. Let $f\,(x, y, z, a, b) = 0$ be such a solution, and call it a *primary* solution. Make $b = Fa$, where Fa is any function of a, at pleasure. Then the *general* solution is

$$f\,(x, y, z, a, Fa) = 0,$$

in which a is a function of x, y, z, determined from

$$f'_a(x, y, z, a, Fa) = 0.$$

The arbitrary character of Fa introduces an arbitrary function.

The geometrical meaning of this is as follows:—the primary solution, a and b being independent, is the equation of an infinite number of families of surfaces: when b is made $= Fa$, the equation is restricted to one of these families; and each case of the general solution, answering to one form of Fa, is the equation of the surface which touches every individual of the family throughout the extent of some curve. Every surface which comes under the general solution is then tangent to a whole family of primary solutions. But it must not be forgotten that every primary solution is also a case of the general solution, so that there is no primary solution but what is also tangent to a whole family of other primary solutions.

55. There is generally a surface which touches all the surfaces of the general solution, and is a singular solution of the partial differential equation, not contained in the general solution. It is found by substituting in $f\,(z, y, z, a, b) = 0$, values of a and b derived from

$$f'_a(x, y, z, a, b) = 0, \qquad f'_b(x, y, z, a, b) = 0.$$

We shall illustrate this subject in VARIATION OF PARAMETERS, P. C. S.

56. Let $Xu'_x + Yu'_y = U$, where X, &c. may be functions of x, y, and u. The integration entirely depends upon that of the following system of ordinary differential equations:—

$$\frac{dx}{X} = \frac{dy}{Y} = \frac{du}{U}$$

if these can be integrated, and the results reduced to the form $a = \alpha\,(x, y, u)$, $b = \beta\,(x, y, u)$, α and β being functional symbols, then the complete integral of the given equation is $\beta = f\alpha$, or

$$F\{\alpha(x, y, u),\ \beta\,(x, y, u)\} = 0$$

f and F being any functions whatever.

This may be extended to any number of variables. Thus if

$$Xu'_x + Yu'_y + Tu'_t = U,$$

let the solution of

$$\frac{dx}{X} = \frac{dy}{Y} = \frac{dt}{T} = \frac{du}{U}$$

be obtained in the form $a = P$, $b = Q$, $c = R$, where a, b, c, are the constants introduced by integration, and P, Q, R, are functions of x, y, z, independent of those new constants. The complete solution of the partial differential equation is $F(P, Q, R) = 0$, F being any function whatever.

57. The same mode holds when there are several equations with two more variables than equations, if the multipliers of differential coefficients be the same in all. Thus the system $Xu'_x + Yu'_y = U$, $Xv'_x + Yv'_y = V$, $Xw'_x + Yw'_y = W$, can be integrated if the system

$$\frac{dx}{X}=\frac{dy}{Y}=\frac{du}{U}=\frac{dv}{V}=\frac{dw}{W}$$

can be integrated in the form $a=P$, $b=Q$, $c=R$, $e=S$, described as before. The complete solution is the system

$$F_1(P, Q, R, S)=0,\ F_2(P, Q, R, S)=0,\ F_3(P, Q, R, S)=0$$

where F_1, &c. are symbols of any functions whatever.

58. Nearly all that can be done in this part of the subject depends upon cases of three variables and their connection with surfaces. The following notation is in universal use. Having z, a function of x and y, let z'_x and z'_y be denoted by p and q, and the second differential coefficients z''_{xx}, z''_{xy}, z''_{yy}, by r, s, and t.

59. Let $z=px+qy+f(p, q)$ be the equation. A primary solution is $z=ax+by+f(a, b)$. The general solution, deduced as in § 54, gives the equation of all developable surfaces, if f be arbitrary. The form $q=\phi p$, ϕ being a given function, has $z=ax+\phi a.y+b$ for a primary solution, and belongs to a particular class of developable surfaces. Both these equations and all developable surfaces, satisfy the equation $rt-s^2=0$.

60. For the method of dealing generally with the equation of the second degree, $Rr+Ss+Tt=V$, see 'Differential Calculus,' Library of Useful Knowledge, p. 719. It would hardly yield a short account for a work of reference.

61. Let $r=a^2t$. Of this very important equation the complete solution is

$$z=\phi(y+ax)+\psi(y-ax),$$

ϕ and ψ being any functions.

62. Let $z=\phi\,(p, q)$. Solve the common differential equation $y=\phi\,(ay', y)$, giving, say $y=\psi\,(x, b)$. Then $z=\psi\,(y+ax, b)$ is a primary solution of the given equation.

63. Let $\phi\,(p, x)=\psi\,(q, y)$. Let $\phi\,(p, x)=a$, $\psi\,(q, x)=a$, give $p=\Phi\,(x, a)$ $q=\Psi\,(x, a)$. Then eliminate a from

$$z=\int\left\{\Phi(x,a)\,.\,dx+\Psi(y,a)\,.\,dy\right\}+\chi a$$

$$0=\frac{d}{da}\int\left\{\Phi(x,a)\,.\,dx+\Psi(y,a)\,.\,dy\right\}+\chi' a$$

χa being any function whatever of a.

64. Linear equations of differences with constant coefficients, such as

$$u_{x+3}+au_{x+2}+bu_{x+1}+cu_x=0$$

may be solved in a manner corresponding to linear differential equations by assuming $u_x=m^x$ and obtaining its particular solutions by means of $m^3+am^2+bm+c=0$. But what we have to say on these will be referred to another article.

We have not touched on the application of the calculus of operations, nor on that of definite integrals, subjects which are now of very great importance. On these points see OPERATION, P. C. S., INTEGRALS, DEFINITE, P. C. S. See also FUNCTION, ARBITRARY, P. C. S.

It must be noticed that a great portion of the most important part of the subject of differential equations cannot enter in any work on pure mathematics. The physical subjects of gravitation, heat, electricity, &c., depend so much on certain differential equations that, by common consent, the details are referred to works on these subjects, and do not appear separately.

EQUISE'TUM (from 'Equus,' a horse, and 'Seta,' a hair or bristle, from the character of the leaves), a genus of plants, the type and only genus of the order Equisetaceæ. The species are leafless branched plants, with a striated fistular stem, articulations sheathed at the base; the sporules are surrounded by elastic clavate filaments, and inclosed in thecæ arising from the peltate scales of terminal cones; the vernation is straight, and the cuticle abounds in silex.

E. hyemale, Dutch Rush, has a simple stem, very rough, with from 14-20 slender furrows; the sheaths close, whitish, but the top and bottom black; the teeth slender, black, deciduous. This plant is a native of England, Scotland, and Ireland, as well as the continent of Europe. It is almost unknown in the middle and southern English counties, and is only sparingly distributed anywhere. It was recommended as a medicine by the ancients, and the earlier herbalists quoted them as authorities for its virtues; but it is not now used in medicine. It appears, however, to possess tannin, and to act as an astringent. It is supposed to be injurious to cows, and is said to cause their teeth to drop out, but horses eat it with impunity. This plant, more than any other species, is used for the purposes of polishing. Lightfoot says, that in Northumberland the milk-maids scour their pails with it. It is also used for the purposes of polishing wood, bone, ivory, and various metals, particularly brass, and is brought into this country from Holland, where it grows abundantly in large quantities, and is sold in the shops of London under the name of Dutch Rush. Mr. Newman thinks, however, that the Equisetum brought from Holland is a different species from the British E. hyemale. The stems of this plant contain large quantities of silex, and in the ash left after burning it forms as much as 97 per cent. Under the microscope, the silex appears in the form of minute crystals, forming a longitudinal series of elevations on the stem. The quantity of silex is so great that the vegetable matter may be burned away and yet the plant retain its form.

E. Mackaii has a simple, or very slightly branched, very rough stem, with 8-12 furrows, the sheath close, ultimately wholly black: teeth slender, persistent. This plant occurs in the north of Ireland, and is named by Mr. Newman after its discoverer Mr. I. T. Mackay, author of the 'Flora Hibernica.' Sir Wm. Hooker has referred this plant to the *E. elongatum* of Willdenow; but Babington has adopted Newman's species.

E. variegatum has a simple stem, or very slightly branched, very rough, with 5-9 furrows, the sheaths slightly enlarged upwards, green below, black above; the teeth obtuse, each tipped with a deciduous bristle. The stem is about a foot high. It is found on sands near the sea, or in wet places in mountain valleys in Great Britain.

E. palustre has the stem with 6-8 deep furrows, branched throughout; the sheaths loose, pale, with acute wedge-shaped teeth tipped with brown, and membranous at the edges. This plant is very generally distributed over Great Britain. This species is liable to alter its characters, and three tolerably permanent varieties have been described.

E. fluviatile, water horse-tail, has a sterile stem, nearly smooth, with about thirty striæ and branches; branches rough, doubly angular, simple; the fertile stem simple, with numerous crowded, large, deeply-toothed sheaths. This is the *E. Telmateia* of Ehrhart and Newman's 'History of British Ferns.' Its present name was erroneously given it by Smith, which has been adopted by Hooker and Babington. It is one of the most beautiful of the species, attaining a height of three, four, and even five feet. It is abundant in the neighbourhood of London, especially near Hampstead Heath. It is a native also of the more southern countries of Europe. Although it grows in water, as its name would imply, it still grows in dry situations; and the name *fluviatile* is more applicable to the original plant of Linnæus, the *E. limosum* of English botanists. Horses sometimes eat this plant, and from a passage in Haller, he seems to have supposed that it was eaten by the Romans; he says, 'Hoc fuerit Equisetum quod a plebe Romanâ in cibum recipitur.' (Haller, *Hist.* iii. 1.)

E. limosum has a smooth stem, with 14-16 slight furrows; the teeth of the sheaths short, rigid, and acute; the branches erect, simple, whorled, often abortive. This is undoubtedly the *E. fluviatile* of Linnæus, but we have given the name of Smith, as that which has been followed by Hooker and Babington in their Floras of Great Britain. This plant is seen very commonly in ponds and ditches, and sometimes in running streams, the roots and a portion of the stem being immersed in water. It is a common plant throughout Europe. Linnæus says that in Sweden it is used as food for cattle, in order that cows may give more milk, and also that the reindeer feed on it. He advises that it should be collected in summer as fodder for the winter. Cattle in this country will sometimes eat it. Mr. Knapp also records the fact that the common water-rat is very fond of it. It is probable that in some states of the system of animals it acts medicinally; but neither this nor any other of the species of Equisetum would be fitted for the constant food of animals.

E. sylvaticum, wood horse-tail, has the sterile and fertile stems, with about 12 furrows and numerous whorls of slender compound spreading or deflexed branches; the sheaths lax, with 6-10 membranous rather blunt teeth. It is found in wet shady places and moist woods throughout Great Britain.

E. Drummondii has the sterile stem, with about twenty striæ, very scabrous, with prominent points, particularly above; the branches simple, with four simple angles, the fertile stem simple, with numerous crowded deeply toothed sheaths. This plant has not been long known as a native of Great Britain, but Mr. Newman thinks it is probably a common plant, and says it is identical with the *E. umbrosum* of Willdenow.

E. arvense, corn-field horse-tail, has the sterile stem, with few furrows, slightly scabrous; the branches simple, rough, with four simple angles, the fertile stem simple, with few lax distant sheaths. This is the most common of all the species, and frequently a source of serious injury to the farmer and gardener. It is subject to variation according to the locality in which it grows. It is easily distinguished from *E. umbrosum*, for which it might be mistaken by its drooping and compound branches.

(Newman, *History of British Ferns and Allied Plants*; Babington, *Manual of British Botany*; Loudon, *Encyclopædia of Plants*.)

ERASTIANISM. [Erastus, P. C. S.]

ERASTUS, THOMAS, a physician, and the author of various medical works, but better known for the use made of his name in ecclesiastical discussions, than in connexion with his own profession. He was born at Baden in Switzerland, on the 7th of September, 1524. He obtained the rudiments of his education in his native place, and studied in the neighbouring city of Basel in 1540. There, in 1544, he was attacked by the plague, and narrowly escaped death. He is said to have either on that or some other occasion lost the use of his right hand, but to have acquired the power of writing rapidly with the left. At Basel he seems to have studied divinity, philosophy, and literature. He afterwards went to Bologna, where he studied medicine, and appears to have speedily acquired a high scientific reputation. After having remained nine years in Italy, he went to Germany, and was by the Elector Palatine Frederic III. made Professor of Physic in the University of Heidelberg. The scientific character which he acquired in his own profession appears to have been that of one who did not take dogmas or theories for granted, but acted on induction from his own experience. He was appointed physician to the prince, and held rank as councillor of state in the Palatinate. He soon afterwards entered into polemical controversy. In 1564 a conference was held in the monastery of Maulbronn on the question of the real presence, or rather on the question whether the reference to the body and blood was not entirely figurative, at which Erastus maintained the view that it is figurative. He soon afterwards became involved in his celebrated controversy as to excommunication. A sort of fanaticism in favour of the use of ecclesiastical censures and punishments had been introduced by Olevianus, a refugee from Trier or Treves, and by several fugitives from the cruelties of the Duke of Alva in the Low Countries, and had spread among the Protestants of the Palatinate. Erastus termed it 'febris excommunicatoria,' and thought it an unwise policy for the Protestants, surrounded by their enemies, to be zealous in cutting off members from their own communion. He examined the principles and biblical authority of ecclesiastical censures, and carried on a controversy in which he was violently opposed by Dathenus, and more mildly by his friend Beza. This controversy would have probably died as a local dispute, had it not been revived by Castelvetro, who had married the widow of Erastus, publishing from his papers the theses called 'Explicatio Quaestionis gravissimæ de Excommunicatione,' which bears to have been written in 1568, and was thus published in 1589. The general principle adopted by Erastus is, that ecclesiastical censures and other inflictions are not the proper method of punishing crimes, but that the administration of the penal law, and of the law for compelling performance of civil obligations, should rest with the temporal magistrate. He held that the proper ground on which a person could be prohibited from receiving the ordinances of a church—such as the sacrament or communion of the Lord's Supper—was not vice or immorality, but a difference in theological opinion with the church from which he sought the privilege. The church was to decide who were its members, and thereby entitled to partake in its privileges, but was not entitled to take upon itself the punishment of offences by withholding these privileges, or by inflicting any other punishments, on the ground of moral misconduct.

It is pretty clear that whatever other view may be entertained by particular churches as a matter of opinion, ecclesiastical censures and punishments, unless as in England they are made virtual by mere forms of civil procedure, are a dead letter to all temporal efficacy in every country in Europe where justice is well administered. Few authors so often referred to have been so little read. The original theses are very rare. An English translation was published in 1669 and was re-edited by the Rev. Robert Lee in 1845. By some inscrutable exaggeration, it had become the popular view of the doctrines of Erastus, that his leading principle was to maintain the authority of the civil magistrate over the conscience, and to subject all ecclesiastical bodies to his direction and control, both in their doctrine and their discipline. In the late discussions in the church of Scotland, of which the result was the secession of a large body of the clergy and people because it was found that the church could not make a law to nullify the operation of lay patronage, those who maintained within the church the principle that it had no such power were called Erastians as a term of reproach. As in all cases where such words as Socinian, Arian, Antinomian, &c., are used in polemical debates, the party rejected with disdain the name thus applied to it. But it is singular that in the course of this dispute no one seems to have thought of explaining that the controversy in which Erastus was engaged was about a totally different matter, and that only a few general and very vague remarks in his writings have given occasion for the supposition that he must have held the principle that all ecclesiastical authorities are subordinate to the civil. It is probable that any of the disputants who may have made themselves acquainted with his opinions found them so distinct from their reputed character, that they were disinclined to undermine the arena of conflict by letting the secret come to light. Thus were pamphlets written in refutation of Erastianism without any reference to the writings of Erastus, and perhaps with a knowledge that they did not contain the opinions attacked. Erastus died at Basel on 31st December, 1583, leaving a considerable sum for the promotion of education in Basel and Heidelberg. He had published at the former town in 1565 a work 'De Discrimine Logicæ et Scientiæ Demonstrativæ.' He wrote several works on medical science, the greater part of which are in the British Museum.

(Ersch und Gruber, *Allgemeine Encyclopadie*; Adamus, *Vitae Germanorum Medicorum*, 107—109.)

ERBIUM. [Chemistry, P. C. S.]

EREMECAUSIS, is the act of gradual combination of the combustible elements of a body with the oxygen of the air. It is in fact a process identical with combustion, but not attended in most cases with any sensible development of heat and light. This process is constantly going on in combustible bodies exposed to the action of atmospheric air, and one of the first changes which take place during the decomposition of animal and vegetable substances, is the union of one or more of their combustible elements with oxygen. The change of the elements of wood into the substance called humus, the formation of acetic acid from alcohol exposed to the air, the production of nitrates of the alkalis, and other processes of a like kind, have been shown by Liebig to be dependent on the process of eremecausis. The changes in colour, consistence, and other properties which vegetable juices, saw-dust, leaves of trees, blood, &c., undergo when exposed to the atmosphere are owing to the same cause. These changes however do not take place when water is excluded, nor when the substances are at a temperature of 32°, all bodies requiring a certain amount of temperature to enable them to combine with oxygen. It has also been observed that, although nitrogen itself does not directly combine with oxygen, substances possessing nitrogen are exposed in the highest degree to this process.

Eremecausis differs from fermentation and putrefaction from the fact that it cannot take place without the access of atmospheric air, through which means the oxygen is supplied to the decaying body. Although the terms putrefaction and fermentation are generally applied, the first to decomposing substances emitting odorous gases, and the second to decompositions emitting inodorous gases, it will be found that these processes are essentially the same, putrefaction going on in bodies containing nitrogen, fermentation in substances without this gas. [Fermentation, P. C.] Although it is not uncommon for fermentation and putrefaction to be regarded as processes which may go on in bodies independent of external agents, Liebig has pointed out the fact that in all cases eremecausis must take place previous to any decomposition in organic substances. 'The juices of the fruit,' he observes, 'or other parts of a plant which very readily undergo decomposition, retain their properties unchanged as long as they are protected from immediate contact with the air, that is, as long as the cells or organs in which they are contained resist the influence of the air. It is not until after the juices have been exposed to the air, and have absorbed a certain quantity of oxygen that the substances dissolved in them begin to be decomposed.' Gay Lussac found that the juice of grapes which were expressed under a receiver filled with mercury, so that air was completely excluded, did not ferment; but if the smallest possible quantity of air was admitted, fermentation immediately began. Again he found that if the juice was exposed to a boiling temperature, and then bottled and corked tight, that it would not ferment till again exposed to the influence of atmospheric air.

In the same way animal food of every kind is kept from putrefaction by being heated to, and secured in vessels at, the temperature of boiling water. Food thus prepared has been kept for fifteen years, and when the vessels were opened in which it was contained, it has been found as fresh as when first secured. The oxygen in these processes acts by exciting a change in the composition of the azotised matters dissolved in the juices, the composition of these substances undergo a change in consequence of their contact with oxygen, and new combinations are produced. A remarkable and important fact with regard to this process is, that when this condition of intestine motion is once excited, the presence of oxygen is no longer necessary. The smallest particle of a body containing nitrogen in the act of decomposition, communicates the same state to the particles in contact with it, and the whole mass thus becomes influenced by the first oxygenated particle. If the atmospheric air be excluded after this process has commenced, the fermentation or putrefaction proceeds uninterruptedly to its completion. It is thus that a single particle of animal or vegetable matter in a state of eremecausis will cause, by contact with other substances, fermentation and putrefaction, and upon this fact depends the necessity of adding yeast or some ferment to saccharine solutions before fermentation will properly take place.

In carbonaceous substances their decomposition is usually attended with the formation and giving off of carbonic acid, but in substances containing nitrogen other secondary compounds are formed, more especially nitric acid, and the decomposition of these substances is sometimes called nitrification. Liebig has shown that the nitric acid in these cases is not formed by the direct union of oxygen and nitrogen, but that the first consequence of the slow decomposition of nitrogenized bodies is the formation of ammonia, and that it is the nitrogen of the ammonia, whilst its hydrogen is uniting with oxygen to form water, that unites with the oxygen of the air to form nitric acid. Ammonia is more readily oxidized than any other compound of nitrogen, and this is to be attributed to the presence of hydrogen, the oxidation of which yields water, which is necessary to the formation of nitric acid. Nitric acid may be formed in this way in substances containing no nitrogen, as the atmosphere is capable of supplying ammonia; and this will explain the presence of nitrates on the surface of the earth, on old walls, &c., as well as in decomposed animal matters.

(Liebig, *Chemistry of Agriculture;* Turner, *Elements of Chemistry*, 7th edition.)

ERIGERON, a genus of plants belonging to the natural order Compositæ, the sub-order Corymbiferæ, the tribe Asteroideæ, the sub-tribe Asterineæ, the division Astereæ the sub-division Erigereæ. It has many-flowered radiant heads; the flowers of the ray ligulate, with pistils only and in many rows, those of the disk tubular; mostly with both stamens and pistils, the receptacle naked and foveolate; the involucre imbricated, the pappus pilose in one or many rows, the fruit compressed.

E. Philadelphicum has the stem slightly furrowed, downy, with spreading hairs; the leaves of the root cuneate-obovate, sometimes deeply sinuate, the upper becoming gradually entire, oblong-lanceolate, and amplexicaul; the florets of the ray 1-200 pale purple, slightly bifid. This plant is a native of North America, and is used as a medicine in the United States. It possesses stimulant properties, and is given as an emmenagogue; it also acts on the kidneys, and is considered a valuable diuretic. It has a powerful fœtid smell.

E. acris has the stem corymbose, the branches alternate, bearing single heads; the leaves linear, lanceolate, entire, spreading: the lower leaves narrowed below; the ray erect, scarcely longer than the disk; the inner female florets filiform, numerous. It has a stem 6-18 inches high; the flowers yellow in the disk and pale blue in the ray. The ashes of this plant contain about five per cent. of potassa, and it is sometimes burned for procuring the alkali. It has a strong scent, and like many other species of the family is said to keep away fleas. With species of Conyza [Conyza, P. C. S.] and Pulicaria, it has the name of flea-bane. It is a native of Europe, and is a common plant in Great Britain. *E. canadensis* and *E. alpinus* are also found in England and Scotland: the first is a rare plant, and is found on waste ground; the second is a native of Highland mountains. The species are numerous, and some of them are ornamental plants.

(Babington, *Manual;* Burnett, *Outlines of Botany;* Lindley, *Flora Medica.*)

ERIODENDRON. [Wool-Tree, P. C.]

ERO'DIUM (from ἐρώδιος, a heron), a genus of plants belonging to the natural order Geraniaceæ. It has 5 sepals, 5 petals, 10 monadelphous stamens, 5 fertile and 5 sterile with glands at their base; the fruit beaked, separating into five 1-seeded capsules, each with a long ultimately spirally-twisted awn, bearded internally. The species are herbs or undershrubs, having variously-formed leaves, membranous stipules, and many-flowered peduncles. The species of this genus, like those of Geranium and Pelargonium, are numerous, upwards of fifty having been described.

E. cicutarium, Hemlock-leaved Heron's Bill, has a procumbent hairy stem, the peduncles many-flowered, the claws of the petals ciliated, the perfect stamens ciliated, not toothed below, glabrous, the beak hairy, the leaves pinnate, the leaflets sessile, pinnatifid, cut. The flowers are purplish or white. It is a native throughout the whole of Europe, and is found in the north of Africa. It is abundant on sandy soils and waste ground in Great Britain. There are several well-marked varieties, some of which may be really species, as the *E. c. pimpinellæfolium.*

E. moschatum, Musky Heron's Bill, has a procumbent hairy stem, many-flowered peduncles, the claws of the petals not ciliated, the perfect stamens toothed at the base, glabrous, the beak downy, the leaves pinnate, the leaflets nearly sessile, ovate, unequally cut. It is found in waste places in Great Britain, but is an unfrequent plant. It is a larger plant than the preceding, and emits, when handled, a strong musky odour. This plant is very generally diffused, and has been found all over Europe, at the Cape of Good Hope, and in Peru.

E. maritimum, Marine Heron's Bill, has a prostrate slightly hairy stem, the peduncles 1-2-flowered, the petals very minute, the leaves simple, ovate, cordate, stalked, lobed, and crenate. This is a rare plant, but a native of Great Britain, in sandy and gravelly places near the sea.

Most of the remaining species are natives of Europe; some are found in the north of Africa, two or three in Asia, and the same number in America; but the mass of them are truly European. The perennial species are ornamental, and will thrive well in any kind of garden soil. They may be propagated by dividing the roots or by seed. Many of the annual species are handsome plants, and may be propagated by seed, which ripens in this country, and only requires to be sown in the open border to spring in any kind of soil.

(Babington, *Manual of British Botany;* G. Don, *Gardener's Dictionary.*)

ERO'PHILA. [Draba, P. C. S.]

ERSKINE, EBENEZER, founder of a considerable sect of seceders from the established church in Scotland, called the Secession church, was born on 22nd June, 1680. He studied in the university of Edinburgh, for some time acted as tutor and chaplain in the family of the Earl of Rothes, and became a licentiate in divinity in 1702. In 1703 he was chosen minister of Portmoak in the shire of Kinross. He became a very popular preacher, and though his charge was in a retired district people flocked from distant parts of Scotland to attend on his ministration. After having resisted various offers of ministerial appointments in other places, he was prevailed on to accept of a charge in the town of Stirling in 1731, after he had served for twenty-eight years in Portmoak. Mr. Erskine's first difference with his colleagues of the church of Scotland was in his support of the principles of 'the marrow of modern divinity,' a subject of great contention during the early part of the eighteenth century. He was one of several clergymen who, in connection with this subject, were 'rebuked and admonished' by the General Assembly. The secession of the body headed by Mr. Erskine was occasioned by the operation of the Act of Queen Anne's reign restoring lay patronage in the church of Scotland, and, though not in all respects technically the same, it was virtually on the same ground as the late secession of 'The Free Church.' The presbytery of Kinross, led by Erskine's brother Ralph, had refused to induct a presentee forced on an objecting congregration by the law of patronage. In 1732, the General Assembly enjoined the presbytery to receive the presentee. At the same time they passed an act of Assembly regulating inductions, which, as it tended to enforce the law of patronage, was offensive to Mr. Erskine, and he preached against it. After some discussion, the General Assembly decided that he should be 'rebuked and admonished,' confirming a decision of the inferior ecclesiastical courts. Against this decision Mr. Erskine entered a 'protest,' in which he was joined by several of his brethren. He was afterwards suspended from his functions. The Assembly subsequently endeavoured to smooth the way for his restoration, but he declined to take advantage of it, and he and his friends, including his brother Ralph, formally seceded in 1736. [Seceders, P. C.] When the Secession was divided into the two sects of Burgers and Anti-burgers, Mr. Erskine and his brother were of the party of the former. He died on 22nd June, 1756.

(Brown, *Historical Account of the Secession;* Chambers, *Lives of Eminent Scotsmen.*)

ERSKINE, RALPH, author of Gospel Sonnets, and other religious works, was born on the 18th of March, 1685, and died on the 6th of November, 1752. He became clergyman of the parish of Dunfermline in 1711, and his celebrity chiefly rests on his alliance with his brother Ebenezer in the founding of the sect of the seceders in Scotland. [Erskine, Ebenezer.]

ERSKINE, JOHN, a writer on law, was born in the year 1695. His father was the honourable John Erskine, son of Lord Cardross, and he was thus the cousin-german of Lord Chancellor Erskine. Erskine's life was that of a recluse student, and was marked by few incidents. In 1719 he became a member of the faculty of advocates, but he does not appear to have had much practice. In 1737, he was appointed professor of Scots Law in the university of Edinburgh. In 1754, he published 'Principles of the Law of Scotland' in one volume 8vo., a work remarkable for its lucid arrangement, and for the terseness and clearness of its exposition of the leading principles of the law. It was designed to be a text book for his students, but became a leading law authority. It passed through several editions, the last of which was edited in 1827, by Professor More, the present occupant of Erskine's chair. He retired from his professorship in 1760, and died at his own estate of Cardross in 1765. He had employed his years of retirement in expanding the matter of his 'Principles' into a larger work, which he left behind him nearly finished, and which was published in 1773, in two volumes folio, with the title 'An Institute of the Law of Scotland.' This work has been repeatedly republished with notes, bringing down the law to the dates of the respective editions. It is the great oracle of Scottish law, an authority almost without appeal, and as firmly established as 'Coke upon Littleton' is in England. It is of little value in respect of its constitutional law, which the author seems not to have been capable of observing otherwise than in mere detail. Owing to the late increase of commerce and manufactures in Scotland, the portion relating to these subjects is meagre and antiquated. In all things however relating to the rights of persons arising from their relation to each other, and in the peculiar rules of the feudal system in Scotland, the work continues to be of great value, and to be as useful to the practical lawyer as in its profundity of research and clearness of detail it is an object of admiration to the theoretical student.

ERSKINE, JOHN, an ecclesiastical leader, son of the preceding, was born on the 2nd of June, 1721. He was licensed as a preacher in 1743, and in 1744 obtained the charge of the parish of Kirkintilloch, near Glasgow. In 1763 he received the degree of D.D. from the university of Glasgow. In 1767 he was appointed one of the ministers of the collegiate church of the Greyfriars in Edinburgh. He had for his colleague Dr. Robertson the historian, who was leader of the moderate party in church politics, or that body which had the least affection for the predominant characteristics of the Presbyterian creed and polity, while Erskine was the leader of the Evangelical Popular, or as it was sometimes called Orthodox party—the same which lately seceded from the church of Scotland, and formed the 'Free Church.' Erskine was an active popular preacher and leader, and the titles of the books and pamphlets written by him would fill a considerable space. He died on the 19th of January, 1803. His memory is still revered by his own party.

(*Account of the Life and Writings of John Erskine,* by Sir Henry Moncrief Wellwood.)

ERU'CA, a genus of plants belonging to the natural order Cruciferæ, and to the tribe Brassiceæ. It has an erect calyx, obovate petals, distinct; not toothed stamens; an oval, oblong, 2-celled, 2-valved, silique; smooth concave valves, with an ensiform seedless beak, scarcely shorter than the valves; the seeds globose. The species are annual branched herbs, with erect terminal racemes of flowers, which are white and yellow, and remarkable for their beautiful reticulation of brown veins.

E. sativa, Garden Rocket, has lyrate pinnatifid leaves, with toothed acute lobes, a hairy stem, the pedicels shorter than the deciduous calyx. It is a native of cultivated fields and waysides in the north of Africa, in Spain, Portugal, France, Italy, Switzerland, and Greece. It is very subject to varieties, and many have been described by various botanists. Although mostly hairy, sometimes its stem is smooth. In height it varies from three inches to two feet, and the flowers are very variable in the depth and arrangement of their colours. When full grown it has an acrid and unpleasant taste, and a strong, peculiar, almost fetid smell; but when young and tender it is frequently eaten as a salad, especially on the Continent. It is the *Roquette cultivée* and *La Rocket des Jardins* of the French, *Raukette* of the Germans, and *Ruccola* of the Italians. The whole plant has been used in medicine as a sialagogue. The ripened seeds are a good substitute for the seeds of the mustard, but not so pungent. When cultivated as a salad, the seeds should be sown in a warm border early in February, and again in March and April for successive crops. The plants should be thinned, after they have produced the first rough leaves, to about three or four inches apart, and they should be kept clear of weeds. If a supply is required throughout the year, the seeds may be sown every month. The plants sown in February should be allowed to produce seed, which ripen in August, and may be used for all the sowings. *E. hispida* and *E. vesicaria* are European plants, and when cultivated as ornament need only to be sown in the open border and treated as other hardy annuals.

(Lindley, *Flora Medica;* Don, *Gardener's Dictionary.*)

ERUCASTRUM, a genus of plants belonging to the natural order Cruciferæ, and to the tribe Brassiceæ. It has a square pod, the valves convex, with one straight nerve, the seeds oval or oblong in a single row. This genus has been formed by Schimper and Spenner for some of the species of the old genus Sinapis. *E. incanum*, the *Sinapis incanus* of Linnæus, has been found in sandy places in Jersey and Alderney, and has consequently a place in the British Flora. It has adpressed pods, which are turgid, with a short 1-seeded beak. The stem reaches from 1-3 feet high. This plant is also a native of the South of Europe, especially Spain; and is the *Cakile Hispanica* of L'Heritier; the *Hirschfieldia adpressa* of Moench. Koch, in the 'Synopsis Floræ Germanicæ et Helveticæ,' gives three species of this genus as natives of Switzerland and the upper district of the Rhine.

(Babington. *Manual of British Botany;* Don, *Gardener's Dictionary.*)

ERVUM [Vicieæ, P. C.]

ERY'NGIUM, a genus of plants belonging to the natural order Umbelliferæ, and the tribe Saniculeæ. It has a calyx of five leafy teeth, the petals erect, oblong, with a long inflexed point, the fruit obovate, covered with chaffy scales without ridges or vittæ. The species are usually perennial spiny herbs, with the flowers congregated into oblong or roundish dense heads.

E. maritimum, Sea Holly, has the radical leaves roundish, plaited, spurious stalked, the upper leaves embracing the stem, palmately lobed, the leaves of the involucre 3-lobed, spurious, longer than the heads, the scales of the receptacle 3-lobed. The stem is more than a foot in height, and is branched and leafy. It is a native of Europe on the sands of the sea-shore, and is found on the European and African shores of the Mediterranean Sea. It is abundant on the eastern shores of England, and is found in Scotland and Ireland. The plant is called in England Sea Eryngo, Sea Hulver, and Sea Holme. According to Linnæus the flowering shoots are very good when boiled and eaten like asparagus. The leaves are sweetish, with a warm aromatic flavour. The root also is sweet to the taste, and has an aromatic smell. It has been used in medicine as a tonic, and Boerhaave regarded it as a valuable aperient and diuretic. The root is also supposed to possess aphrodisiac virtues. It is candied and sold in the shops in London as a sweetmeat. There is still an establishment at Colchester, in Essex, where the roots are candied, in which town this preparation was first made, more than two centuries since, by Robert Buxton, an apothecary. It is not now much used by medical men, but at one time it had a reputation in many diseases.

E. campestre has the radical leaves two or three times pinnatifid, spinous, stalked, the stem leaves embracing the stem, bipinnatifid, the leaves of the involucre lanceolate, spinous, longer than the heads, the scales of the receptacle undivided. It is a more bushy and slender plant than the last. It grows on waste ground, and in dry sandy fields, and is a very common plant in the south of Europe. It is found in England and Scotland, but is a rare plant. There is a plant found on the banks of the Tyne called *E. campestre*, but Mr. Babington thinks this may be a different species. The plant which Ray describes as growing on the shore, called Friar's Goose, below Melling, in Yorkshire, Mr. Babington thinks requires further examination, before determining the claim of this plant to be considered a true native of Great Britain.

E. fœtidum has the radical leaves lanceolate, bluntish, narrowed at the base, spinous; the floral leaves palmate, sessile, the leaves of the involucre lanceolate, much longer than the heads, the palea among the flowers entire. It is a native of Jamaica, Cayenne, Demerara, Florida, and Brazil, in fields and woods. The negroes and poorer whites in Jamaica regard this plant as a valuable remedy in hysterical fits; hence it is called in the West Indies fitweed. It is administered in the form of a decoction or infusion of the whole plant.

E. aquaticum, Rattle-snake Weed, has the leaves broadly linear, with parallel nerves; the lower leaves ensiform, the floral leaves lanceolate, toothed; the leaves of the involucre shorter than the heads of flowers; the stems dichotomous. It is a native of North America, from Pennsylvania to Virginia. It is also found in the Society Islands, California and Buenos Ayres. It inhabits marshes, inundated pastures, and the banks of rivers. This plant is employed in North America as an application to the bite of the rattle-snake, hence its common name.

Nearly one hundred species of this genus have been described. They are found in greatest numbers in America, but many are inhabitants of Asia, Africa, and Europe. They are most of them handsome and ornamental plants, and worthy of cultivation. They will grow freely in any common garden soil, but the lighter or more sandy the soil the better they will grow. Some of the species require the greenhouse or frame, and they should be grown in pots. They may be propagated by dividing the roots or by sowing the seed.

(Don, *Gardener's Dictionary*; Babington, *Manual of British Botany*; Lindley, *Flora Medica.*)

ERY'SIMUM (from ἐρύω, to draw), a genus of plants belonging to the natural order Cruciferæ, and to the tribe Sisymbreæ. It has a tetragonal pod, the valves prominently keeled with one longitudinal nerve, the stigma obtuse, entire or slightly emarginate, the seeds in a single row, the funiculus filiform. The species are annual, biennial, or perennial herbs, with variable leaves, and elongated, terminal, many-flowered racemes.

E. Alliaria of Linnæus, Smith, Schkuhr, and others, is generally now admitted as the type of a new genus, *Alliaria* of Adanson. It differs from Erysimum in not having its valves keeled with a single nerve, but having 3 longitudinal nerves, and in the seeds being striated, and the funiculus flattened and winged. *E. Alliaria* is the *A. officinalis* of Andrzeijowski, who is followed by De Candolle in his 'Prodromus,' and Babington in his 'Manual.' Koch however follows Scopoli and places it in *Sisymbrium* as *S. alliaria;* from which genus it differs only in its flattened winged funiculus. It has heart-shaped leaves, the lower ones being reniform and coarse, repando-crenate; the pods are erect and patent, much longer than their stalks, and the seeds are oblong and cylindrical. The stem is erect, one to two feet high, and slightly branched. The flowers are white. It is a native all over Europe, under hedges and in ditches. It has a strong smell, and a taste not unlike garlic, for which it is frequently used as a substitute, whence it has obtained its Latin name Alliaria, from Allium, garlic. It is very generally used by the poor people of the countries in which it grows as a condiment, with bread and butter, salted meats, or in salads. In England it is known by the name of Sauce Alone, and Jack by the Hedge. In German it has several names as das Knoblauchkraut, der Knoblauchhederich, Lauchel, Waldknoblauch, Ramfen, Ramschelwurzel, Gernsel, Salsekraut, Saskraut. In French it has the names l'Alliare, l'Herbe aux Aillets, &c. Although not often found on the tables of the middle or upper classes, Mr. Neill says; that 'when gathered as it approaches the flowering state, boiled separately and then eaten to boiled mutton, it certainly forms a most desirable pot-herb, and to any kind of salted meat an excellent green.' Linnæus says that sheep and cows and poultry eat it, but that horses and goats refuse it. When eaten by cows it gives a disagreeable flavour to the milk. Poultry also which eat it have a bad flavour when cooked. The seeds when powdered produce sneezing, and have been employed as a sternutatory. The leaves were formerly used as a diaphoretic, and a poultice of them was recommended as an antiseptic in gangrenous and cancerous ulcerations.

A second species of Alliaria has been described as *A. brachycarpa*, a native of Iberia.

E. cheiranthoides, Worm-seed, Treacle Mustard, has oblong-lanceolate leaves, slightly toothed, with stellate three-parted hairs, all narrowed into a slight footstalk, the pedicles longer than the calyx, two or three times shorter than the pods, the pods patent, ascending, the seeds small, numerous. It is a native of Europe, also of North America. It is found not uncommonly in Great Britain; it inhabits cultivated ground, waste places, and osier holts. It varies greatly in size according to situation. The flowers are very numerous, small, and yellow. It has obtained its name worm-seed from the fact of its seeds being sometimes used as a remedy for intestinal worms. It was also formerly employed as an ingredient in the famous Venice treacle, and hence the whole genus has been called treacle-mustard. Babington marks this and all the other species of Erysimum as plants that have been possibly introduced into Great Britain, though now looking very like true natives.

E. virgatum has linear lanceolate leaves, entire, with stellate two or three parted hairs, the lower ones narrowed into a footstalk, the upper leaves mostly sessile, the pedicels as long as the calyx, many times shorter than the pod, the pod erect, the seeds large. It is found in Great Britain plentifully near Bath. It is also a native of the Alps and of Holland.

E. orientale has elliptical heart-shaped obtuse leaves clasping the stem, the radical leaves obovate, all smooth, glaucous, undivided, entire. This is the *Coringia orientalis* of Andrzeijowski, and *E. alpinum* of Baumgartner, and *Brassica alpina* of Linnæus. It is a native of the south of Europe, and is found in England and Ireland, in fields and cliffs near the sea. It has white or cream-coloured flowers. There are about fifty species of Erysimum, most of them natives of Europe, and a few in the temperate districts of Asia, Africa, and America. Some of them are ornamental and worthy of cultivation. The perennial herbaceous species are well adapted for the flower-border, and may be grown in any common garden soil. The smaller species may be employed for ornamenting rock-work, and many of them may be grown in pots with other alpine plants. The perennial species may be propagated by cuttings, by dividing the roots, or by seeds. The annual and biennial species may be sown in the open ground.

(Babington, *Manual of British Botany*; Don, *Gardener's Dictionary*; Sowerby, *English Botany.*)

ERYSIPHE. [GASTEROMYCETES, P. C. S.]

ESCROW. [DEED, P. C.]

ESCUTCHEON. [HERALDRY, P. C.]

ESOX, a genus established by Linnæus for the reception of the pike and some allied fishes. It is now subdivided, and the resulting genera, with the flying-fishes (*Exocœtus*), constitute the family Esocidæ. The genus *Esox*, as at present received, has for its type the *Esox Lucius* of Linnæus, the common pike. The generic character is founded on the form and armature of the organs of mastication. The jaws, palatine bones, and vomer are furnished with teeth of various sizes. The head is oblong, obtuse, depressed, and large in proportion to the body. The dorsal fin is placed far back and over the anal. Both these fins are entire, which is also the case in the genus *Belone*, of which the gar-fish is the type (*Esox Belone* of Linnæus); but in that fish the head and jaws are greatly produced, the latter being linear and pointed. *Scomberesox* (the Saury) is a third genus of this family, having a head resembling that of *Belone;* but the anal and dorsal fins are divided posteriorly into finlets resembling those of a mackerel. *Hemiramphus* is a curious genus of sea-pikes, in which the upper jaw is extremely short, while the lower one resembles that of the gar-fish. *Exocœtus*, the flying-fish, was distinguished from *Esox* by Linnæus. It has the head comparatively short, the dorsal and anal fins placed much farther forward, and the pectoral fins so large as to serve the purpose of wings, or rather of parachutes, which sustain the fish in the air for some time after it has sprung out of the water.

The true or fresh-water pikes are well known fishes, esteemed for food, and remarkable for their voracious and destructive habits. They are the longest lived and largest of fresh-water fishes, and many wonderful stories are narrated of them. Gesner gives an account of one, the skeleton of which was preserved at Mannheim, which weighed 350 pounds, and was probably between 200 and 300 years old. Pennant informs us of one ninety years old; and pikes from fifty to seventy pounds weight have been taken in Scotland and Ireland. It grows with great rapidity, attaining a length of from eight to ten inches in its first year. The Mannheim pike was said to have been nineteen feet in length, and in our own country they have been taken nine feet long. The pike eats up everything eatable which comes in its way. Being strong, swift, and courageous, it masters all other fishes in its locality. It will also attack birds and small quadrupeds, if within reach, and has been known to quarrel with the otter for its prey, and to assault man himself. Pikes are found in Europe, Asia, and North America. In the United States several species are common.

The habits of the sea-pikes, the gar-fish, and the saury (*Scomberesox*) are not so well known. They are gregarious, and swim near the surface of the water, leaping out of it with great agility, and playing round bodies which float on the surface of the sea. The peculiar formation of the heads of these fishes renders the nature of the food a subject of curiosity among naturalists; but the question is not yet settled. On the southern coasts of England and Ireland they are common. The bones of the Belone are green: the flesh is firm and white, and has much the flavour of that of the mackerel.

ESSEX, JAMES, the first professional man in the last century who made Gothic architecture his study and practice, was the son of a carpenter in good business at Cambridge, where he was born in 1723. Educated in the school of King's College, the unrivalled Chapel became the object of his admiration, and finally impressed him with the powers and beauties of a style which was then neither valued nor understood, but scornfully rejected as monkish and barbarous. Except his own eyes and his own diligence, he had nothing to assist or direct him in the study of it—nothing to give him even the slightest insight into its principles. Greatly therefore is it to his credit that his own judgment and perseverance enabled him to attain the knowledge of it, and to do in it what he did, instead of being led astray like Batty Langley, who had about that time just published his 'Gothic Architecture improved by Rules and Proportions.' In 1757 he was employed by Bentham to make drawings for his work on Ely Cathedral, and from him he acquired much information relative to the history of Gothic architecture and its leading styles; and of that cathedral itself he altered the choir in 1770, and conducted extensive repairs in other parts for many years afterwards. He was also engaged in repairing Lincoln Minster, where he erected a stone altar-piece of his own designing. Besides various alterations at several of the colleges at Cambridge, he executed some repairs at King's College Chapel, and designed the stone screens about the altar there. Among his other works was a monumental cross at Ampthill, in memory of Catherine of Aragon; and improvements in the antient mansion at Maddingley, Cambridgeshire, the seat of Sir John Hinde Cotton. He also published designs for new buildings at King's, Benet (Corpus Christi), and Emmanuel Colleges, and for a new Public Library at Cambridge. His reputation as an antiquary was considerable, and he was acquainted with most of those who were noted for their attachment to similar studies—Gray the poet, Horace Walpole, Gough, Tyson, Cole of Melton, and others. Besides being a member of the Society of Antiquaries, he contributed some papers to their Archæologia, viz. 'Remarks on the antiquity of different modes of brick and stone buildings in England,' vol. 4; 'Observations on Lincoln Cathedral,' vol. 4; 'On the origin and antiquity of Round Churches,' vol. 6. His name would no doubt have been more generally known had he lived to effect his intention of publishing Plans and Sections of King's College Chapel. He died at Cambridge of a paralytic stroke, September 14th, 1784, only four months after his mother, who reached the age of eighty-four.

ESSINGTON, PORT, is the first and to this day the only existing European settlement on the northern coast of Australia. The idea of establishing a colony in this part of the world appears to have been suggested by the unprecedented rapidity with which the colony of Singapore rose in the year following its establishment, which took place in 1819. [SINGAPORE, P. C., vol. xxii. p. 41.] As the trading population of the western portion of the Indian Archipelago had resorted to Singapore for the disposal of their produce and the purchase of European and Indian commodities, it was thought that a similar establishment at the eastern extremity of that archipelago would attract the merchants of the eastern portion of it. But the first attempt was not successful. The coast of this part of Australia having been surveyed a few years before, the new colony was founded in 1824, in Apsley Strait, which separates the islands of Melville and Bathurst, and was called Fort Dundas. In 1827 a small establishment was erected at Raffles, on the peninsula of Coburg, and called Fort Wellington. But both settlements were abandoned in 1828, because none of the Malay traders resorted to them. The climate was found to be rather unfavourable to Europeans, and the soil of an indifferent quality; besides which, Apsley Strait is difficult of access, and encumbered with shoals. Major Campbell, who was the last commandant of Fort Dundas, had an opportunity of examining the country in the neighbourhood of these settlements, and he recommended the establishment of a colony at Port Essington, which was made in 1838.

Port Essington is a deep inlet, situated on the northern side of Coburg peninsula, which projects west-north-west from the mainland of Australia, between Mount Norris Bay on the north-east and Van Diemen's Gulf on the south, and extends in that direction nearly sixty miles. The greatest breadth of the peninsula is fifteen miles, and its narrowest part, where it is joined to the main by a neck of land of five miles in length, is two and a half.

Port Essington lies between 11° 6′ and 11° 25′ S. lat., and between 132° 5′ and 132° 18′ E. long. The inlet at its entrance, between Point Smith on the east, and Vashon Head on the west, is seven miles wide, and extends south by east between seventeen and eighteen miles. Its average breadth is five miles. The depth of water varies between five and twelve fathoms, and at the southern end it forms three spacious harbours, each of which extends inwards three miles, with a width of about two; the depth of water is five fathoms, with a bottom of stiff mud and sand. These harbours are sheltered from every wind, and afford excellent and secure anchorage for vessels. Indeed the whole port is a secure place of anchorage for vessels of any size, and forms altogether one of the finest harbours in the world. There is no harbour yet known (Port Jackson excepted) to be compared with it in the whole extent of Australia, and it may be entered with safety both by night and day. Being within the range of the regular monsoon, it is accessible to the Malay and Bugis trading proas and to the junks from China.

The shores of this inlet present a pleasing variety of little bays and sandy beaches, alternating with bold cliffs and steep clay banks. The interior of the peninsula is a continuous forest of trees of dark-green foliage, occasionally relieved by small round hills, rising a hundred feet above the general elevation of the land, which rises in gentle undulations from one hundred to two hundred feet above the level of the sea, but in many places only from thirty to sixty feet. The soil is in general indifferent, but in many places it is good, principally on the low flats and hollows, and near tracts which are swampy in wet weather. The best land is found on the east of Port Essington. The vegetation is luxuriant. The forest land is clear of underwood; the grounds and hollows produce good grass, even in the middle of the dry season, and it is supposed that most, if not all, the tropical productions could be brought to considerable perfection on Coburg peninsula. The trees, though not of great dimensions, are of sufficient size for house-building and agricultural purposes. Most of the trees introduced by the settlers thrive very well, especially the orange, lemon, shaddock, cocoa-nut, and tamarind trees. Pine-apples are excellent; bananas, pumpkins, and sweet potatoes, succeed well; also the sugar-cane, turmeric, arrow-root, capsicums, and culinary vegetables. But the vegetation suffers much during the dry season, and requires to be irrigated. There are some indigenous roots which the natives use as food.

The woods of the peninsula contain buffaloes, wild cattle, ponies, and pigs. They appear to be the offspring of the stock left at Port Raffles when the settlement was broken up, with the exception of the buffaloes, which are met with in considerable numbers, and probably were brought there long before. There are also kangaroos, bandicoots, iguanas, pigeons, quails, curlews, wild geese, ducks, and swamp pheasants, and a great variety of perroquets, cockatoos, hawks, herons, cranes, and gulls. The inlet is also well stocked with fish, especially mullet, cavallos, bream, garsh, flounders, whitings, a kind of pike, white mackerel, sting-ray, a fish resembling a herring, fourteen or fifteen inches long, ship-jacks, old wives, and several others. Of shell-fish there are the common oyster and the large mother-of-pearl shell oyster, green turtle, spotted crabs, oysters, cockles, craw-fish, cowries, and various other small shell-fish. The most important of the sea productions is the trepang or *biche de mer*, which is very abundant along the northern coast of Australia, from Endeavour Strait (142° 30′ E. long.) to Dundas Strait (131° 30′), which divides Coburg peninsula from Melville Island, and attracts a large fleet of Malay proas during the months of December, January, February, March and April, their fishing-ground extending from the Gulf of Carpenteria to Dundas Strait. In November the Malays begin their fishing by going to the eastward through Bower Strait, which is west of the Gulf of Carpenteria, and then gradually return with the monsoon to the westward until April or May, when, having cured the trepang and completed their cargoes, they repair to the ports in the Indian Seas from whence they sailed. These Malays carry also on some commerce with the natives, from whom they obtain large quantities of tortoise-shell in exchange for iron, rice, and old clothes.

The north-west monsoon brings the rainy season. It is preceded by squalls and variable winds. The time of its commencement varies between three and four weeks. Sometimes it begins at the end of October, and at other times in November or the beginning of December. The rain during this monsoon falls in torrents, but seldom continues above two or three hours at a time. It generally falls from two to five o'clock in the afternoon or during the night. The general range of the thermometer is from 80° to 95° in the shade. The mean heat at midday is between 87° and 92°, and the extremes 70° and 96°. During this monsoon there is almost daily thunder in the afternoon and evenings. The termination of the north-west monsoon is indicated by squalls, and usually a tempest in the early part of April. The sun then returns to the northward, the wind settles in the north-east, the sky becomes clear, the rains cease, the atmosphere becomes drier, and the weather more temperate. In May the thermometer ranges between 75° and 95°, the midday heat being 89°. June, July, August, and September are the most pleasant season in the year. The mornings and evenings are agreeably cool, and exercise can be freely taken until ten in the morning, and may frequently, with impunity, be taken even in midday. Very few showers fall during these months, but there are heavy dews at night. In exposed places vegetation is completely burnt up. The thermometer during these months is between 69° and 75° at six o'clock in the morning, 84° at three in the afternoon, 77° at nine at night: the extremes are 68° and 90°. Notwithstanding the clearness of the sky during the dry season, the atmosphere contains considerable moisture, which is evident from the great difficulty of keeping steel articles from rust. The monsoons blow uniformly at forty miles from the coast. In the interval the winds often blow in the direction of the monsoons, but frequently they are changed into regular sea and land breezes. In Port Essington these breezes are frequently affected by the tides. After a calm they spring up and blow into the port with the flood, and again fall calm or blow out with the ebb.

Meteorological observations have been made regularly for four years, at six o'clock in the morning and at two o'clock in the afternoon. The following table contains an abstract of them :—

	Morning.	Afternoon.	Mean.
January . . .	80·3°	87·5°	83·9°
February . . .	80·0	88·0	87·0
March . . .	79·3	89·0	84·1
April . . .	79·1	89·8	84·4
May . . .	78·8	89·3	87·1
June . . .	73·2	84·6	78·9
July . . .	71·8	84·5	78·1
August . . .	71·5	85·4	78·4
September . .	75·0	88·0	81·5
October . . .	78·6	91·2	84·9
November . . .	83·6	91·9	87·7
December . . .	80·5	92·8	86·6

The average heat of the whole year is 83°, or about that of the equator. The difference of temperature between the observations in the morning and in the afternoon does not generally amount to more than 7 or 8 degrees in the rainy season, but during the dry weather it is commonly 12 degrees, and frequently even 20.

On the western shores of Port Essington the town of Victoria was founded in 1838. It stands upon a rising ground, elevated about fifty feet, in the highest parts, above high-water mark, and is built on a dry soil, which evidently conduces to the healthiness for which it is remarkable. In 1843 it consisted of about ten wooden houses and twenty-nine huts, formed for the most part of reeds, surrounded by gardens, and contained a population of about sixty persons. The Malays have not yet settled there, which is attributed to the conditions imposed on the settlers by government; but, as these have lately been more accommodated to the views of the Malays, it is to be hoped that the population will soon be increased by settlers from Timor, Celebes, and other islands, which is an object of great importance for the prosperity of the colony, as Europeans are unable to do the labour required for cultivation in this climate.

(Major Campbell, 'Geographical Memoir of Melville Island and Port Essington, Northern Australia,' in *London Geographical Journal*, vol. iv.; Earl, 'Account of a Visit to Kissir,' in *London Geogr. Journ.*, vol. xi.; Owen Stanley, 'Notes of a Cruise in the Eastern Archipelago,' in *London Geogr. Journ.*, vol. xii.; and *General Report of the Colonial Land and Emigration Commissioners*, printed by order of the House of Commons, 1844.)

ESTRA'NGELO, or ESTRANGHELO, is the name of the most antient of the three kinds of characters used in writing the Aramaean or Syriac language. The alphabet so called, of which there is a copy in the Prolegomena to Walton's 'Polyglot,' p. 11, is distinguished by the stiffness and angular forms of the letters from that found in all printed Syriac books, which is denominated fscitto (that is, simple), or sertto (linear). A character nearly resembling the Estranghelo is stated to be still commonly used in writing by the Nestorians and some of the Melchitae. It is believed to have been originally common to all the nations or tribes speaking any Chaldaic dialect. The Syriac grammarians also enumerate a third alphabet, which they designate the eefifo (meaning the duplicated), or the messttariono (the split); but this is merely an alphabet of what we should call open letters, used for ornamental purposes.

See *Grammatica Syriaca, sive Chaldaica, Georgii Michaelis Amirae Edeniensis è Libano*, 4to., Rom. 1596, cap. i., where copies of all the three alphabets are given.

ETESIAN WINDS. [WIND, P. C.]

ETON, a parish in Buckinghamshire, situated in a valley on the north bank of the Thames, one mile north of Windsor and 23 miles west by south of London. Windsor and Eton are in different counties and on opposite sides of the Thames, but they form in appearance only one town. The line of houses is interrupted only by the river, over which there is a bridge of cast-iron, erected in 1823-4 from the design of Mr. Hollis. The town of Eton principally consists of one long street which is well paved and lighted. The parish church is a neat modern edifice from a design by Mr. Hollis, the engineer of the bridge. The living is a rectory, in the peculiar jurisdiction and incumbency of the provost of Eton. There is a charity-school founded by a former French master at Eton College, who endowed it for the instruction of sixty boys and thirty girls. The parish of Eton is small, and contains only 690 acres. Eton College is extra-parochial. In 1841 the population of Eton was 3526, and the number of inhabited houses was 533; there were 11 uninhabited houses and only 3 building.

ETON COLLEGE was founded and endowed by Henry VI., as the 'College of the Blessed Marie of Eton by Wyndesore.' The foundation charter is dated at Windsor, 12th September, 1440, and is in good preservation. It was confirmed by act of Parliament at Westminster, May 4th, 1441. The Statutes of Eton College are printed in the Parliamentary Reports on the Education of the Lower Orders, 1818. The original foundation was a provost, ten priests, four clerks, six choristers, twenty-five poor grammar-scholars, and a master to teach them, and the like number of poor men. It now consists of a provost, seven fellows, two conducts, seven clerks, seventy King's scholars, ten lay clerks, ten choristers, and a number of inferior officers and servants. The scholars must be born in England, of parents lawfully married. By the foundation statute, they should be clothed in some coarse uniform, but this is not done, and their education should be gratis, but a sum of 6*l*. or 7*l*. a year is now charged for their instruction. Practically however the children of persons who are really poor do not pay anything; but generally speaking, there is little difference in the relative situation or comparative opulence of the parents of the oppidans (scholars who are not on the foundation) and the collegers. The foundation scholars are admissible from the age of eight to sixteen, and unless elected at the age of seventeen, and put on the roll for admission to King's College, Cambridge, another foundation of Henry VI., they are superannuated at eighteen. Those scholars who are elected may continue in college till nineteen; and even at eighteen they may leave the college and continue as oppidans. The annual election to King's College takes place in July or August, after an examination of the upper class by the provosts of Eton and King's College, Cambridge, the vice-provost of Eton, two fellows of King's College, called 'Posers,' and the head master of Eton. The successful candidates are not immediately transferred to Cambridge, but remain at school until a vacancy occurs on the foundation of King's College. On their removal to Cambridge the Eton scholars are received on the foundation and maintained out of its endowments, and after three years they succeed to fellowships. The number who go to Cambridge averages four yearly. There are two scholarships at Merton College, Oxford, for foundation scholars who are not elected for King's College, Cambridge: the scholars who are sent to Merton College are called 'Postmasters.' There are some other exhibitions, amongst which are several for superannuated scholars. In 1829 the Duke of Newcastle founded and endowed three scholarships of the value of 50*l.* each; and in 1842 Prince Albert instituted an annual prize of 50*l.* for promoting the study of modern languages. The Eton Montem is an antient ceremony which takes place triennially. Its object is the collection of 'Salt-money,' which, after defraying expenses, is given to the senior scholar called the Captain of the School, on his removal to King's College, Cambridge. The scholars go in procession to Salthill, and 'salt-bearers,' assisted by scouts, both arrayed in gay fancy dresses, levy contributions from the visitors, which in some years exceed 1000*l.*, as the festival is not only attended by old Etonians, but by persons of rank and fashion who have children at the school, or who are attracted by the gaiety and animation of the festival. Besides the scholars on the foundation, Eton College is attended by upwards of six hundred scholars called oppidans, many of whom are the sons of persons of rank and fortune, and board with the masters, from whom they receive instruction as stipendiary pupils. The school is divided into upper and lower, and each is subdivided into three classes. There are a head master and lower master, ten assistant-masters in the upper school and three in the lower school, and a mathematical master, and the whole sixteen are in holy orders. There are also masters for the French, Italian, and German languages, and other branches of education. The 'Journal of Education' contains an account of the course of instruction pursued at Eton, but some alterations have been made since that time.

At the dissolution of the monasteries the revenues of Eton College were estimated at 1100*l.* In 1506 the total income of the College was 652*l.* and the disbursements amounted to 645*l.* The income of the College from its endowments at present amounts to about 7000*l.* a year, derived from reserved rents, corn-rents, sale of woods, and also from manors, by fines and heriots. The average income of the fellows is about 550*l.*, and the average of the provostship is that of a double fellowship and about 400*l.* a year besides. The fellows have besides the power of presenting themselves to one living. The college has about forty livings in its gift. The fines are divided into nine parts, two of which are received by the provost, and the seven fellows have each one part. Each fellow has in addition 50*l.* a year, which is called a stipend. They have also lodgings, and have generally offices in the college with a moderate salary. The sum collected for teaching the seventy collegers and some six hundred oppidans is divided between the upper master in the upper school and the lower master in the lower school.

The College buildings are a conspicuous and ornamental object, especially if viewed from the terrace of Windsor Castle. They consist of two quadrangles, built partly of freestone, but chiefly of brick, in a style somewhat resembling the north front of St. James's Palace. In one quadrangle are the school and the chapel, with lodgings for the foundation scholars, and in the other are the library, which contains a rich and valuable collection, the provost's house, and the apartments of the fellows. The chapel, which is built of stone, is externally a handsome structure, though very plain in the interior. Its length is 175 feet, including an ante-chapel, which is sixty-two feet long. In the centre of one quadrangle is a bronze statue of Henry VI., and in the chapel there is another statue of the same king by Bacon. The extensive playing-grounds on the north-west of the college are ornamented with an avenue of stately trees.

ETSHMIADZIN is an Armenian convent situated in that part of the Russian government of Georgia which was ceded by Persia in 1828. It is about three hours' distance from the town of Erivan on the west, and lies in the plain which separates the high summits of the Ala-Ghesh from the still more elevated masses of Mount Ararat. This plain is fertilized by a great number of canals, which are abundantly supplied with water from the river Kharsakh or Karpi-shai, which rises on the eastern declivities of Mount Ala-Ghesh, and running southward, falls into the Aras or Araxes. The convent is of great extent, and surrounded by a wall more than thirty feet high. The circuit of the wall is stated to exceed two versts, or nearly one mile and a half. This convent has for many centuries been the seat of the Armenian patriarch called Catholicos, and thus has become the centre of the Armenian literature. It contains a considerable library. Literature flourished among the Armenians immediately after their conversion to Christianity, which took place in the fourth century, and the ardour and zeal of the learned Armenians were then so great that almost all Greek authors of value, and some Latin writers, were translated into the Armenian language. The learned Europeans who visited the convent in the present century wished to see the library, but they could not obtain access to it: they were only informed that it contained 16,000 manuscripts. As soon however as Russia had been put in possession of the country, the Russian government repeatedly asked for a catalogue of the library, and at last obtained it. It was printed in St. Petersburg in the Russian language, and contains only 635 manuscripts, of which 462 are in the Armenian language, and the remainder in foreign languages. The catalogue is divided into eleven sections:—1. Manuscripts of the Bible and Commentaries referring to it, 83 in number; 2, Theology, 22 manuscripts; 3, Poetry, 8; 4, Church-books, 33; 5, History and Geography, 86; 6, Classics, 34; 7, Sermons, 53; 8, Fathers of the Church, &c., 105; 9, Books referring to the Church of Armenia, 4; 10, Dogmatical writings, 14; 11, Prayer-books, 22. Though this library does not contain the works of Diodorus Siculus, Polybius, and others, which it was hoped would be found in it, there is good reason for expecting that the historical works will throw a new light on the numerous political changes to which the nations of Western Asia have been subject since Christianity was established in Armenia.

(Ouseley's *Travels in various Countries in the East*; Ker Porter's *Travels in Georgia, Persia, Armenia, &c.*; Brosset, *Catalogue de la Bibliothèque d'Echchmiadzin*, Petersburg, 1840.)

EUGENIACRINITES, a genus of fossil Crinoidea. (Goldfuss.)

EU'GNATHUS, a genus of fossil Placoid fishes, from the lias, thirteen British species. (Agassiz.)

EULO'PHIA (from εὐ, and λόφος, a crest), a genus of plants belonging to the natural order Orchidaceæ. It has an open spreading perianth; the sepals and petals ascending nearly equal, either quite distinct or united with the more or less lengthened base of the column; the lip horned or shortly spurred, sessile, with the veins crested, bearded, or quite smooth, usually 3-lobed, sometimes undivided; the column half-terete, edged; the anther terminal, opercular, the pollen masses 2, waxy, 2-lobed, or hollowed out at the back, with a short linear caudicula, and a transverse gland. The species are terrestrial plants, with pseudo-bulbous rhizomata, long membranous plaited leaves, and radical many-flowered scapes. Most of the rhizomata and roots of the species of the family Orchideæ yield starch in a peculiar form. The roots of the species of Orchis are used in Europe, under the name of Salep, as an article of diet, and the same use is made of the rhizomata of a species of Eulophia in the East Indies Although specimens of the plant were brought from Cashmere by Dr. Royle, they were not in a state of preservation to be identified.

(Lindley, *Flora Medica.*)

EUO'MPHALUS, a genus of fossil Gasteropoda, from the Palæozoic strata. (Sowerby.)

EUO'NYMUS (εὐώνυμος, literally 'having a good name,' and hence various derived senses), a genus of plants belonging to the natural order Celastraceæ. It has a flat 4-5-lobed calyx with a peltate disk at the base; 4-5 petals inserted in the margin of the disk; 4-5 stamens inserted in the disk; a single style; the capsule 3-5-celled, 3-5-angled, the dehiscence loculicidal; the seeds solitary, with a fleshy arillus, not truncate at the hilum. The species are shrubs with tetragonal or terete branches, and ovate usually opposite leaves, yielding a fetid odour when bruised, and considered poisonous.

E. Europæus, Spindle-tree, has the petals oblong, the flowers mostly 4-cleft, and tetrandrous, the branches tetragonal, smooth, and even, the leaves elliptic-lanceolate, minutely serrate, the capsule obtusely angular, not winged. It is a native of Europe in hedges and thickets, and is found abundantly in Great Britain. The flowers are small, of a greenish white colour, and give out a fetid odour. Its wood is tough and white, and is used for making skewers. It has from this got the name of Prick-wood; Gerard calls it Prick-timber. Its French name is *Fusain*, in allusion to its use in making spindles. It is called also in French *Bonnet de Prêtre* and *Bois à Lardoire*, the former in allusion to the capsules, which, when open, bear some resemblance to a priest's cap; the latter from the use made of the wood in making skewers and larding pins. It has, in common with the Cornus sanguinea, the names of Dogwood and Gatteridge Tree; the first name is in allusion to the use of the wood of these trees for making an infusion with which mangy dogs were washed. It is also known in English by the name of Louse-berry, a name which it has got from its berries being used when powdered as an application to the head for the destruction of lice. The wood of this tree is also used by musical instrument makers. When used for skewers, tooth-picks, &c. the branches are cut when the shrub is in blossom, as that is the period when the wood is toughest. Linnæus says that cows, goats, and sheep eat the leaves, but that horses refuse them. The berries are poisonous, and produce, when eaten, vomiting and purging. Whilst growing wild in hedges and coppices this plant does not attain any great size; but when planted and allowed to grow alone, it becomes a tree, and reaches a height of twenty or thirty feet. Although almost entirely neglected in the planting of pleasure-gardens, it forms a singularly beautiful object in the autumn, when its clusters of red berries are ripe. The seeds are covered with an arillus, which is of a beautiful orange colour.

E. verrucosus has the branches warted with proximate lenticular glands, the leaves ovate and slightly serrate, the flowers three on a peduncle, the petals ovate, the capsule bluntly 4-cornered. This is a deciduous shrub or low tree, a native of Austria, Hungary, and Carniola. This tree has a singular appearance, and is worthy of cultivation on that account amongst collections.

E. latifolius has smooth branches, broad ovate leaves, trichotomous many-flowered peduncles, oval obtuse petals, the lobes of the capsule acutely angular and wing-formed. It is a deciduous shrub or low tree, attaining a height of 10-20 feet, and is a native of the south of Europe. Its fruit is large and of a deep red colour: the decaying leaves are also reddish. This is the handsomest species of the genus. It has broad shining leaves, and its large red pendulous fruits, with their orange-coloured seeds, which are suspended in the air when the capsules open, contribute much to the beautiful appearance of this tree.

E. Americanus, American Spindle-tree, has smooth branches, the leaves almost sessile, elliptic-lanceolate serrated, the flowers one to three, on a peduncle, the petal sub-orbiculate, the capsules warty. This is a sub-evergreen recumbent shrub, and is a native of North America from Canada to Florida. The capsules are of a deep crimson, the seeds white, and the arillus scarlet. They add much to the beauty of this plant, and have given rise in America to its common name, the *burning bush*. It is of easy culture in a moist soil. Several varieties have been described by botanists. *E. atropurpureus* is found in English gardens, and is a native of America. *E. Hamiltonianus* is a Nepaul species recently introduced. *E. nanus* is a dwarf species.

About thirty species have been described. All the hardy kinds are easily cultivated in any common soil in the open air. They may be propagated by seeds which ripen in this country. Cuttings planted in the autumn will readily take root.

(Loudon, *Encyclopædia of Trees and Shrubs*; Don, *Gardener's Dictionary*.)

EUPATO'RIUM, a genus of plants belonging to the natural order Compositæ, the tribe Eupatoriaceæ, the subtribe Eupatorieæ, and the division Adenostyleæ. It has 3-100 flowered heads, a flat naked receptacle, the scales of the involucre in 1 or 2 or more rows, equal or unequal, loosely or closely imbricated, the throat of the corolla hardly dilated, the anthers inclosed, the arms of the style exserted, cylindrical, obtuse; the pappus in one row, hairy, rough.

E. cannabinum, Hemp Agrimony, has the leaves in 3 or 5 deep, lanceolate, serrated segments, the middle one longest. It is a native of Europe, and is mostly found on the banks of streams. It is a common plant in the British Isles. The stem is about 3 feet high, and has a slightly aromatic smell. The whole plant is bitter, and was formerly employed in medicine as a tonic and febrifuge. An infusion of this plant is said to be the common medicine of the turf-diggers in Holland against the ulcerations and diseases of the feet and legs to which they are subject. The expressed juice, when taken in large quantities, produces both vomiting and purging.

E. perfoliatum, Thorough-wort, Thorough-wax, Cross-wort, or Bone-set, has subsessile, opposite, linear-lanceolate, acuminate leaves, decreasing gradually in breadth from the stem, where they are widest, to the extremities, serrated, wrinkled, pale underneath, and hairy, especially the veins. This plant is a native of North America in meadows and boggy soils. It has erect, round, hairy stems, branched only at the top with a cylindrical imbricated involucre, inclosing from 12 to 15 flowers, the florets of which are tubular. All parts of this plant are intensely bitter, and a decoction of the leaves has been recommended by American physicians as a valuable tonic and stimulant, and used as a substitute for Peruvian bark in the cure of intermittent fever. In large doses the infusion or decoction of the whole plant is emetic, sudorific, and aperient. It is used with advantage instead of the infusion of chamomile flowers in working off emetics.

E. Ayapana has subsessile opposite, lanceolate, triple-nerved, acuminate, nearly entire, smooth leaves. It is originally a native of South America, on the right bank of the river Amazons, from whence it has been introduced into the East Indies. It has a stem, shrubby at the base, branched and smooth, the heads are pedicellate, and contain about 20 florets. An infusion of this plant is used in Brazil as a diuretic and diaphoretic. It has also been employed as an antidote against the bites of venomous serpents and insects. A quantity of the bruised leaves is laid upon the scarified wound, and the fresh juice is administered from time to time to the patient. The reputation of this plant for the bites of poisonous serpents, like that of many others, is probably undeserved. Other species of Eupatorium possess medicinal properties: *E. aromaticum* and *E. odoratum* have very fragrant roots; *E. perfoliatum* and *E. rotundifolium* have been employed in renal diseases and consumption. The *E. Guaco* of older botanists is now referred to the genus Mikania. [MIKANIA, P. C. S.]

(Burnett, *Outlines of Botany*; Lindley, *Flora Medica*; Lewis, *History of Materia Medica*.)

EUPHRA'NOR, of the Isthmus of Corinth, or the Isthmian, as Pliny terms him, was one of the most celebrated of the antient Greek artists; he was the contemporary of Apelles and Praxiteles, and flourished during the second half of the fourth century before Christ, from about 360 to 320 B.C. He was equally celebrated as painter and as statuary, and, says Pliny, was in all things excellent, and at all times equal to himself. Euphranor, continues Pliny, was the first to represent heroes with dignity, and first used symmetry, where symmetry probably means as much a general keeping of design as correctness of proportions. One peculiarity of his design was a large and muscular limb in proportion to the body. It was this character of his figures probably, as well as colour, that he alluded to, when he said, in reference to two pictures of Theseus, by Parrhasius and by himself, that his own had fed upon beef, while that of Parrhasius had been fed upon roses; the picture of Euphranor probably resembling more nearly the figure of a Greek athlete, while that of Parrhasius was more in accordance with the ideal form of a divinity, as we find them expressed in the Theseus of the Parthenon, and the Apollo Belvedere, respectively, and in many other Greek statues. [PARRHASIUS, P. C.] There are notices of many of Euphranor's works both in painting and in sculpture. He painted in encaustic. There were three noble pictures by him at Ephesus—a group of philosophers in consultation, clothed in the pallium, or shawl; a general sheathing his sword, probably a portrait; and the feigned insanity of Ulysses; Ulysses was represented at the plough, with a horse and an ox under the same yoke, and probably Palamedes with the infant Telemachus were introduced—an admirable subject for a picture. His most celebrated works, however, were a picture of the Twelve Gods, and a Battle of Mantinea, painted in the Ceramicus at Athens.

The latter was painted, according to Plutarch, with a degree of inspiration; it represented Gryllus, the son of Xenophon, at the head of some Athenian horse, defeating the Boeotians under Epaminondas, who is said to have been slain by Gryllus: Plutarch, Pliny, and Pausanias call it a cavalry fight; it took place B.C. 362.

Of the picture of the Twelve Gods, Eustathius relates the following anecdote:—Whilst the picture was in progress Euphranor was wandering about Athens at a loss for a model for his Jupiter, when happening to pass the door of the Gymnasium, he heard repeated the celebrated lines of Homer (Iliad, i. 529),

> 'Kronion spoke, and gave the nod of assent with his dark eyebrows,
> And the ambrosial locks of the king were shaken
> On his immortal head.'

and immediately exclaimed, I have found a model! and went home and painted the head accordingly. However, according to Valerius Maximus, he bestowed so much care upon the head of Neptune, that he exhausted himself, and being unable to exalt the head of Jupiter above it, he is said to have copied the Olympian Jupiter of Phidias. A similar criticism in some respects, with perhaps as little truth, has been often repeated regarding the celebrated picture of the 'Last Supper' at Milan, by Da Vinci: Lionardo is said to have taken so much pains with the head of St. John that he was forced to leave that of our Saviour unfinished, in despair of surpassing the St. John. Euphranor's most celebrated work in sculpture was a statue of Paris, which was praised, says Pliny, for showing at the same time the judge of the goddesses, the lover of Helen, and even the slayer of Achilles. Pliny mentions also several statues by Euphranor, which were at Rome. He left writings on symmetry and on colours.

(Pliny, *Hist. Nat.* xxxiv. 8, 19; xxxv. ii. 40; Quintilian, *Inst. Orator.* xii. 10, 3; Plutarch, *De Glor. Athen.* 2; Pausanias, i. 3; Eustathius, *Ad Iliad.*, i. 529; Valerius Maximus, viii. ii. 6.)

EUPHRA'SIA (from *εὐφρασία*, 'delight'), a genus of plants belonging to the natural order Scrophulariaceæ or Scrophularineæ. It has a campanulate 4-cleft calyx; the upper lip of the corolla galeate emarginate, the lower larger, spreading with the middle lobe emarginate; 4 stamens fertile, the lower cells of the upper anthers with a long spur; the capsules oblong-ovate, compressed, emarginate, with entire valves; the seeds few.

E. officinalis, Euphrasy, Eyebright, has ovate or cordate-ovate nearly sessile serrate leaves, the corolla glabrous, the lobes of the lower lip emarginate, of the upper lip patent sinuate-dentate, the anthers unequally mucronate, hairy. It is from 1 to 4 inches high, and is a native of the heaths and pastures of Europe, the Himalaya mountains, Cashmere, and all the north of Asia. It is common in Great Britain. This species is peculiarly subject to variation. The leaves are ovate, or cordate-ovate, or cordate-triangular, with the teeth acute or obtuse, ascending or spreading. The capsule also varies much in shape. There is scarcely a character permanent except the pubescence of the corolla. This elegant little plant has a slightly bitter and aromatic flavour, and has been employed much in medicine, particularly in diseases of the eye. Its use in these complaints seems to have originated in its bright appearance, and when the doctrine of signs and seals prevailed, this was supposed to indicate its value in brightening the eyes. Although it has lately fallen into disuse, its astringent effect is undoubtedly of value in certain diseases of the eye, and will explain the fact that Professor Kranichfeld has related of its being useful in catarrhal affections of the eye. The expressed juice and distilled water of this plant have been the forms in which it has been employed.

E. Odontites has the leaves narrowed from the base, opposite, linear-lanceolate, remotely serrate, the floral leaves longer than the flowers, the corolla pubescent, the lobes of the lower lip oblong obtuse, the anthers with 2 equal points, hairy. It is a native of Europe, and is abundant in Great Britain in meadows, corn-fields, and waste places. This plant is the *Bartsia Odontites* of Hudson, and the *Odontites rubra* of Persoon.

There are several other species of Euphrasia; although pretty plants, none of them will grow well in cultivation.

(Babington, *Manual of British Botany*; Lindley, *Flora Medica.*)

EU'PODA (from *εὖ*, and *πούς, ποδός*, a foot), Latreille's fifth family of tetramerous Coleoptera. The great size of the posterior thighs, in many insects of this family, gives rise to the appellation. The genus *Sagra*, many species of which, remarkable for brilliant red, purple, and green colours, are brought from the East, and the genus *Crisceris*, are types of subdivisions of the family.

EUPOMPUS. [PAMPHILUS, P. C.]

EU'RYALE (after one of the Gorgons, in allusion to the threatening armed appearance of the plant), a genus of plants belonging to the natural order Nymphæaceæ. It has a calyx of 4 sepals inserted in the torus and adhering to it; 16-28 petals; numerous stamens; 16-20 carpels; the fruit half-inferior arising from the sepals, petals and stamens adhering half-way up. There is but one species of this genus, *E. ferox*, which is an elegant aquatic covered all over with prickles with large peltate orbicular leaves, and bluish purple or violet flowers, about the size of those of the yellow water-lily. It is a native of the East Indies in the lakes Gumtoe and Gogra, also in the province of Kianang in China. This plant presents a very singular appearance. Its petioles and calyxes are hispid with stiff prickles. The leaves are about a foot in diameter. The root or rootstock contains starch, which may be separated as food, or the root may be eaten, as is done by the inhabitants of the districts where it grows.

In cultivation, this plant must be kept in water in a hot-bed or stove. It will produce seeds if the pollen of the anthers, when it is in full bloom, be shaken on the stigmas. It can only be propagated by means of its seeds.

(Don, *Dictionary of Gardening.*)

EURYNO'TUS, a genus of fossil Ganoid fishes, from the limestone of Burdie House and the shales of Newhaven. (Agassiz.)

EURYO'CRINUS, a genus of fossil Crinoidea, from the mountain limestone. (Phillips.)

EURY'PTERUS (Harlan), a singular genus of fossil Crustacea, from North America and Scotland. E. Scouleri occurs in carboniferous limestone at Kirkton, near Glasgow.

EUSEBIUS (Εὐσέβιος), bishop of Emesa in Phoenicia, was born in the neighbourhood of Edessa, and belonged to a very illustrious family. He was from his early youth instructed in the principles of the Christian religion, and had the most distinguished teachers of the time. He afterwards devoted himself to the study of theology under the direction of the celebrated Eusebius of Caesarea and Patrophilus of Scythopolis. However, as he wished to avoid being appointed to any ecclesiastical office too early, he went to Alexandria to spend some time in the study of philosophy. On his return from Alexandria he stayed for some time at Antioch, and formed an intimate friendship with Flaccillus, the bishop of that place. In A.D. 341 Athanasius was deprived by the the Synod of Antioch of his bishopric of Alexandria, and Eusebius, to whom it was offered, refused it, though soon after he accepted the bishopric of Emesa. During the solemnity of his ordination the people of Emesa rose against him, charging him with pursuing mathematics and magic. Eusebius took to flight, and for a time he stayed with his friend Georgius, bishop of Laodicea, but afterwards he returned to Emesa, where he was tolerated, owing to the influence of his friend Georgius. He died at Antioch in A.D. 360. Eusebius was a great favourite of the emperor Constantius, who is said to have been accompanied by him on several military expeditions. Some of his contemporaries charged him with favouring the Sabellian heresies; but Sozomen thinks that this accusation was suggested to his enemies only by their envy of his great virtues. Hieronymus even calls him the ringleader of the Arian party, a strong expression, which, from the pen of Hieronymus, must be taken with great caution, for as far as we know, all that can be said is that Eusebius had a leaning towards the views of the semi-Arians. Eusebius was a man of a very cultivated mind and great eloquence: he wrote a great number of works which were well received by his contemporaries; but all of them are lost, with the exception of a few said still to exist in MS. in some libraries. (Socrates, *Hist. Eccles.* ii. 9; Sozomen, iii. 6; Hieronym., *De Scriptor.* 91; Nicephorus, ix. 5.) His Life written by his friend Georgius of Antioch is lost. There exists, under the name of Eusebius, a collection of fifty homilies, which were published in a Latin translation by J. Gagneius, Paris, 1547 (reprinted at Paris, 1561, 8vo., and at Antwerp, 1555); but all critics agree that these homilies are the productions of a much later age than that of Eusebius of Emesa.

(Cave, *Historia Literaria*, vol. i. p. 156, &c.; Fabricius, *Biblioth. Graec.* vii. p. 412, &c.)

EVA'GORAS (Εὐαγόρας), king of Salamis in the island of Cyprus, from B.C. 410 to 375. His family, the Teucridæ, had been deprived of the government of Salamis by a Phœnician, Abdymon, who, with the view of securing himself against the Greeks, placed his usurped kingdom under the protection of Persia, and promised to reduce the whole island under the Persian dominion. During the reign of the usurper, Evagoras spent his boyhood at Salamis without being molested; but when the usurper had been murdered by one of the Cyprian nobles, Evagoras fled to Soli in Cilicia, for the murderer, in order to secure the throne to himself, was anxious to get rid of Evagoras also, who was then a very promising youth, and distinguished for his intellect as well as bodily strength. However, Evagoras resolved to recover the kingdom of his ancestors, and, accompanied by a band of fifty faithful friends, he made a descent upon Cyprus, defeated his enemies, and fully accomplished his object, B.C. 410. Isocrates, to whom we are chiefly indebted for our knowledge of the history of Evagoras, describes him as a man of great talent as an administrator; he restored the fortifications and the harbour of Salamis, built ships, and endeavoured to establish commerce; but his great ambition seems to have been to establish Greek manners and literature in his kingdom. Hence many a Greek exile, especially Athenian, found a welcome reception there; and Conon, after the battle of Ægospotami, in B.C. 405, was most hospitably received by Evagoras. But he could not hope permanently to improve the condition of his kingdom without previously securing himself against any attacks of the Persians. Through the mediation of Ctesias, the physician of Cnidus, a treaty was concluded between King Artaxerxes II. and Evagoras, in consequence of which Evagoras supported the Persians with money and ships in their war against Lacedæmon, and was afterwards honoured by the Athenians with a statue and the Attic franchise. The friendly relation with Persia, however, did not last long, for Evagoras had enlarged his kingdom, partly by persuading the towns of Cyprus, and partly by force. This was against the interests of Persia; several towns solicited the protection of Artaxerxes, who was prevailed upon to declare war against his vassal. Hecatomnus, a dynast of Caria, received the command of the Persian fleet, and Autophradates that of the army; and according to some accounts Artaxerxes himself went to Cyprus, B.C. 391. Evagoras was supported by the Athenians with ships, and other friends advanced him money. But his small fleet was captured by the Spartan Teleutias, almost as soon as it had left the harbour of Salamis. Notwithstanding this misfortune the Persians made no progress, probably because Hecatomnus had already entered into a secret understanding with Evagoras. In the meantime Evagoras concluded an alliance with King Acoris of Egypt, and in B.C. 388 he received from the Athenians a fleet under the command of Chabrias. Thus strengthened, Evagoras in a short time made himself master of nearly all Cyprus, ravaged Phœnicia, and induced Cilicia to revolt against Persia. Artaxerxes, who had reason to dread the further progress of Evagoras, concluded a peace with the Spartan Antalcidas, B.C. 370, in which Cyprus was recognised as a province of the Persian empire. The Athenians accordingly recalled Chabrias and the fleet they had sent to the assistance of Evagoras, who nevertheless refused to submit to Persia, relying as he did on the aid of Acoris. Artaxerxes made great preparations for war. Evagoras was not wanting either in courage or in the means of defending himself, and although the Persians landed an army in Cyprus, Evagoras contrived to cut off their supplies, which caused an insurrection in the Persian camp; and Evagoras, who had increased his fleet to 200 sail, ventured upon a sea-fight off Citium, but he was defeated, and lost many of his ships. Salamis was now blockaded by the Persians by land and by sea, and Evagoras felt that without foreign assistance he must be lost. He therefore left the command at Salamis in the hands of his son Pnytagoras, and went to Egypt to induce Acoris to assist him against the common enemy; but he was disappointed in his hopes. He received indeed a sum of money, but as it was insufficient he entered into negotiations for peace, hoping that he might yet obtain advantageous terms. But Tiribazus, the commander of the Persian fleet, demanded that Evagoras should give up all the towns in Cyprus, pay an annual tribute for his little kingdom of Salamis, and consider the king of Persia as his master. The negotiations were broken off, but Evagoras benefited by the jealousy between the Persian commanders; for Orontes, one of them, contrived to throw suspicion on the conduct of Tiribazus, in consequence of which Tiribazus was recalled and arrested. Some, disturbances which were thereby caused in the Persian army, rendered it easy for Evagoras to defend himself, and Orontes was induced to conclude a peace with Evagoras, in which the latter was recognised as king of Salamis, on condition of his paying an annual tribute and obeying the commands of the king of Persia. But Artaxerxes did not sanction the peace, and Tiribazus, who was restored to his former post, was ordered to continue the war. However Evagoras maintained his position; and the war with Persia, which lasted for ten years, from B.C. 385 to 376, was brought to a close very honourable to Evagoras. He did not long survive the conclusion of the peace, for in B.C. 374, being then at an advanced age, he was murdered by a eunuch whose wife had been seduced by a son of Evagoras. He had been married to Leto, by whom he was the father of a large family. He was succeeded by his son Nicocles. (Isocrates, *Evagoras*; Diod., xiv. 39, 98, 110; xv. 2-9, 47; Photius, *Bibl. Cod.*, 176; Pausanias, i. 3. 2; Xenophon, *Hellen.* iv. 8. 24; Aristotle, *Polit.* v. 8; Lucian, *Pro Imag.* 27.)

From this Evagoras we must distinguish another, who was likewise king of Salamis, and, so far as chronology is concerned, may have been either a son or grandson of the first Evagoras. He was deprived of his kingdom by one Protagoras, but recovered it in B.C. 350, with the assistance of Persia. Soon after however, some calumnies against him having been brought before the Persian king, he was expelled a second time by Protagoras. Evagoras indeed succeeded in justifying himself before the king, but instead of his principality he received a satrapy as a compensation. In consequence of his bad administration he was obliged to escape; he fled to Cyprus, but was overtaken and put to death. (Diodorus, xvi. 42, 46.)

EVAPORATION is the transformation of a liquid substance into a gaseous state by the action of heat: according to circumstances the effect may take place slowly and without any apparent movement of the surface of the liquid from which the vapour rises, or it may take place rapidly and be accompanied by an ebullition.

If any liquid be placed in an open vessel, it will be found gradually to diminish in quantity by a sensible or insensible evaporation, and it will at length disappear: the quantity of vapour proceeding from the same liquid in a given time, is evidently proportional to the area of the exposed surface; but, with equal temperatures, the escape of vapour from different liquids will be found to take place with different degrees of rapidity. An evaporation of the waters at the surface of the earth is going on at all times, and over the surface of an ocean the aqueous vapour held in the atmosphere amounts to an enormous quantity: much of this vapour is precipitated to the earth in dew, rain, &c., but it is probable that the atmosphere, at any place, is never entirely free from it.

The whole quantity of vapour which rises from a liquid having a given surface appears to depend upon the temperature of the liquid; but, in a given time and in the open air, it is influenced by the state of the atmosphere with respect to dryness or moisture: in dry weather, even in winter time, the evaporation is more considerable than in damp weather, but it is greatest when the atmosphere is both dry and warm. At equal temperatures, in a close vessel, the evaporation is the same whether the vessel containing the liquid contain also air or have the air exhausted from it; but in the latter case the quantity of vapour which a given degree of heat is capable of raising occupies the upper part of the vessel immediately, whereas in the former a certain time elapses before that quantity is disengaged.

In order to obtain a knowledge of the quantity of water evaporated in the open air, in a given time, the atmosphere being calm, Dr. Dalton suspended some in a cylindrical vessel of tin from one end of the beam of a balance and raised it successively to different degrees of temperature by heat: he weighed the water before and after each experiment, during the continuance of which the temperature was constant; and the difference divided by the number of minutes gave, for that temperature, the weight of the water evaporated in one minute from the exposed surface. At the boiling-point (212° Fahr.) the evaporation of water from one square inch of surface was found to be equal to 4·244 grains per minute, and at a temperature expressed by 138° one grain per minute: between these limits the quantities of the evaporation, per square inch, in grains, are nearly proportional to the heights, in inches, of the columns of mercury, whose weights are equivalent to the elastic forces of the vapour at the different temperatures.

In these experiments no allowance was made for the effects depending on vapour previously existing in the atmosphere, these effects being very small compared with the elastic force of the vapour rising from the water at such temperatures. But Dr. Dalton, taking f to represent the elastic force of vapour in the atmosphere when at the point of saturation, and f' to be the elastic force of the vapour in the actual state of the atmosphere, the temperature of the air in both cases being that which is indicated by the thermometer at the time of the experiment; found that the quantity of evaporation from a square inch of surface, at such temperature, was proportional to $f-f'$, and might be expressed by $\frac{4\cdot244}{80}(f-f')$. (*Manchester Memoirs*, vol. 5.) The evaporation from ice has been determined by experiment both by Dalton and Gay-Lussac, and found to be equal in quantity to that which, by computation, would take place from water at the same temperature.

To Dr. Dalton we owe also the discovery, admitting however that the aqueous vapour in the atmosphere has no influence on evaporation, that the quantity of vapour raised from a given surface of any liquid, at a given temperature, is directly proportional to the elastic force of the vapour at that temperature; therefore, if the elastic forces of the vapours from different liquids were correctly ascertained, a near approximation, at least, might be made to the amount of evaporation from those liquids. At a temperature equal to 212° (Fahr.) the elastic force of the vapour from water is equivalent to the weight of a column of mercury 30 inches high; the elastic force of the vapour of one kind of alcohol, to the weight of a column 68 inches high; and that of the vapour of one kind of æther, to the weight of a column 219 inches high.

It is stated by Mr. Faraday that, at temperatures above 60 or 80 degrees (Fahr.), there is a small evaporation from mercury; at lower temperatures he could detect none; and he concludes that, below the temperatures just mentioned, the gravity of the particles of mercurial vapour exceeds their elastic force. In this material, as well as in all liquids which boil at high temperatures, the elastic force of the vapour is very small. Sulphuric acid, for example, boils at 300° (Fahr.), and the elastic force of its vapour at a temperature equal to 200° is only equal to that of water at 110°. Solid substances have vapours of such low elasticities, that the highest natural temperature cannot convert them into vapour; and hence Mr. Faraday concludes that the atmosphere does not contain any vapours of earthy or metallic substances.

A few cases occur in which a body passing from a liquid to a solid form acquires thereby an increase of temperature, and the most remarkable case is afforded in the freezing of water. While still existing in a liquid state, water has had its temperature reduced so low, that a Fahrenheit's thermometer in it indicated no more than 5°; but on being made to crystallize, by agitation or otherwise, so much caloric was immediately evolved, that the thermometer rose to 32°. But when, by evaporation, a liquid is transformed into a vapour, heat is abstracted and a thermometer in the liquid indicates a depression of temperature, or the liquid becomes cooled. In India, ice is produced by exposing water during the night in flat unglazed earthen vessels resting upon any imperfectly conducting substances, as sugar-canes, dry stems of maize, and the like. The dryness of the air allows a considerable evaporation to take place, and a thin film of ice is produced. Similar processes are employed in other countries for the purpose of reducing the temperature of liquids. [Cooler, P. C. S.]

But the pressure of the atmosphere on the surface of a liquid prevents, in a great degree, the evaporation from taking place; the conversion of a liquid into a vapour is therefore facilitated by placing the vessel containing the liquid under the receiver of an air-pump and extracting the air: but the vapour itself acts by its elastic force on the surface of the liquid, and impedes, at least for a time, the escape of more than a certain quantity; consequently the cooling process may be greatly accelerated by employing some means of absorbing the vapour as fast as it is formed, thus allowing the evaporation to go on without impediment. The means of accomplishing this end were discovered by Sir John Leslie, who placed a shallow open vessel containing sulphuric acid or muriate of lime along with the vessel containing the water from which an evaporation was to take place under the receiver of the air-pump; when the vapour was absorbed as it rose, and the water was speedily converted into ice. [Freezing Apparatus, P. C. S.; see also Cryophorus, P. C. S.]

If a glass bottle containing water be covered with a cloth which is kept constantly wet by the application of water the evaporation from the wet cloth will soon diminish the temperature of the water which is in the bottle. A similar effect is produced, but in a higher degree, on moistening the bottle with some spirit, as alcohol; and if a cloth dipped in alcohol be applied to the ball of a thermometer, the mercury in the tube will descend while the evaporation continues: the cooling is found to be so much greater as the spirit is more volatile; and it appears to be the greatest when æther is employed.

The degree of cold thus produced is increased by any means which will accelerate the evaporation: thus, by wrapping a piece of linen dipped in æther round the ball of a mercurial thermometer and exposing the apparatus to a current of air, the mercury in the tube has been made to fall as much as 46 degrees. Dr Cullen (*Essays, Physical and Literary*) of Edinburgh put a small quantity of water into a thin glass tube which was suspended in a vessel containing æther: and then, on placing the apparatus under the receiver of an air-pump and rapidly exhausting the air, the evaporation of the æther caused such a diminution of heat in the water that it was converted into ice. By a similar process, using sulphuret of carbon instead of æther, Dr. Marcet (*Phil. Trans.* 1813) succeeded in freezing mercury.

EVERDINGEN, ALDERT VAN, a very able Dutch landscape painter and etcher, born at Alkmaar in 1621. He studied under Roland Savery and Peter Molyn, known as the Cavaliere Tempesta, and he surpassed them both. The wild and the rugged is the prevalent style of his landscapes, and chiefly from Norwegian scenery; he spent upwards of a year in Norway, and took the greatest delight in sketching the wild scenery of its rugged coast. Everdingen was excellent also in sea-storms, and in all his works showed himself a master of aërial perspective. Some of his fine forests are extremely true and picturesque, and he excelled in figures and animals. He died at Alkmaar in 1675. Everdingen's etchings are numerous, but scarce; among them are a series of one hundred Norwegian landscapes, and a series of fifty-six original illustrations to the celebrated Dutch fable of 'Reynard the Fox:' his plates are generally marked A. V. E.

Aldert's elder brother, Cæsar van Everdingen, was likewise a clever painter, and an architect; he painted history and portrait. He was born at Alkmaar in 1606, and died there in 1679.

(Houbraken, *Groote Schouburg*, &c.; Bartsch, *Peintre-Graveur*.)

EVERNIA. [Liverworts, P. C. S.]

EVIDENCE. [Evidence, P. C.] In 1843 an act was passed (6 and 7 Vict. c. 85), entitled 'An Act for improving the Law of Evidence,' which enacts, 'That no person offered as a witness shall hereafter be excluded by reason of incapacity from crime or interest from giving evidence, either in person or by deposition, according to the practice of the court, on the trial of any issue joined, or of any matter or question or on any inquiry arising in any suit, action, or proceeding, civil or criminal, in any court, or before any judge, jury, sheriff, coroner, magistrate, officer, or person having, by law or by consent of parties, authority to hear, receive, and examine evidence; but that every person so offered may and shall be admitted to give evidence on oath, or solemn affirmation in those cases wherein affirmation is by law receivable, notwithstanding that such person may or shall have an interest in the matter in question, or in the event of the trial of any issue, matter, question, or injury, or of the suit, action, or proceeding in which he is offered as a witness, and notwithstanding that such person offered as a witness may have been previously convicted of any crime or offence: provided that this act shall not render competent any party to any suit, action, or proceeding individually named in the record, or any lessor of the plaintiff, or tenant of premises sought to be recovered in ejectment, or the landlord or other person in whose right any defendant in replevin may make cognizance, or any person in whose immediate and individual behalf any action may be brought or defended, either wholly or in part, or the husband or wife of such persons respectively; provided also, that this act shall not repeal any provision in a certain act passed in the session of parliament holden in the seventh year of the reign of his late majesty and in the first year of the reign of her present majesty, intituled "An Act for the Amendment of the Laws with respect to Wills:" provided that in courts of equity any defendant to any cause pending in any such court may be examined as a witness on the behalf of the plaintiff or of any co-defendant in any such cause, saving just exceptions; and that any interest which such defendant so to be examined may have in the matters or any of the matters in question in the cause shall not be deemed a just exception to the testimony of such defendant, but shall only be considered as affecting or tending to affect the credit of such defendant as a witness.' This act does not extend to Scotland.

It is provided by numerous statutes that various certificates, official and public documents, and certified copies of such documents, are to be received in courts of justice, but in some cases a difficulty was experienced in proving that such documents were genuine. In 1845 an act was therefore passed (8 & 9 Vict. c. 113) which provides that in future official and other documents 'shall respectively be admitted in evidence, provided they respectively purport to be sealed or impressed with a stamp, or sealed and signed, or signed alone, as required, or impressed with a stamp and signed, as directed by the respective acts made or to be hereafter made, without any proof of the seal or stamp, where a seal or stamp is necessary, or of the signature, or of the official character of the person appearing to have signed the same, and without any further proof thereof in every case in which the original record could have been received in evidence.' This act will apply to the documents or proceedings of any corporation, or joint-stock or other company, or any certified copy of any document, by-law, entry in any register or other book. Courts of justice and persons judicially acting are required by the act to take judicial notice of the signature of the equity or common law judges attached to any decree, order, certificate, or other judicial or official document. Copies of private and local and personal acts which purport to be printed by the Queen's printers are in like manner admissible, also copies of the journals of either House of Parliament, and royal proclamations which purport to be printed by the printers to the crown, or by the printers of either House of Parliament. Persons who forge the seal, stamp, or signature of documents, or print any private act with a fraudulent intent, are guilty of felony and liable to seven years' transportation, or imprisonment for a term not less than one and not exceeding three years. The act does not extend to Scotland.

EVO'DIA (from εὐωδία, a sweet smell), a genus of plants belonging to the natural order Rutaceæ. It has the calyx 4-5-parted; 4-5 equal petals; 4-5 stamens, smooth; the filaments subulate; the anthers heart-shaped, moveable; the disk cup-shaped, sinuated; the ovary single, deeply 5-lobed, with 2 collateral ovules in each cell; the style single, very short; the stigma terminal, obtuse; the cocci 2-valved, 1-seeded, with a separable 2-valved endocarp. The species are shrubs and trees, with a grateful smell.

E. febrifuga is a tree and has trifoliate leaves, the leaflets lanceolate elliptical, somewhat acuminate; the panicle terminal, downy; the ovary simple, warted. It is a native of the forests of the province of Minas Geraes in Brazil. The bark and young wood are bitter and astringent, and are employed by the medical practitioners of Brazil as a tonic and febrifuge.

E. hortensis has simple or trifoliate leaves, which are pubescent as well as the branches. It is a native of the Friendly Islands and the New Hebrides. *E. drupacea* has smooth leaflets and a four-seeded drupaceous fruit. It is a native of New Caledonia. The two last are shrubs. All the species are worth cultivation on account of their agreeable scent. They may be grown in a mixture of loam, peat, and sand, and propagated by means of cuttings, which should be allowed to strike root under a handglass in heat.

(Lindley, *Flora Medica*; Don, *Gardener's Dictionary*.)

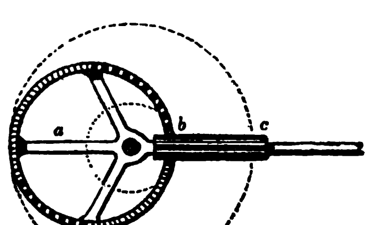
EXCÆCA'RIA, a genus of plants belonging to the natural order Euphorbiaceæ. It has monœcious or diœcious amentaceous flowers; the sterile flowers nothing but staminiferous bracts; the stamens 7-9, united into about three parcels, all connected at the base; the fertile flowers with the calyx 3-fid or absent; the style 3-parted; the capsule 3-coccous.

E. Agallocha is a small crooked stunted tree, with alternate leaves about the extremities of the branches, stalked ovate or cordate, but usually acute at the base, smooth on both sides, remotely and slightly serrate, pointed with two glands at the base, and about two inches long; the petioles about an inch long, smooth, channelled; the stipules small, fine-pointed. The trunk of this plant abounds in a virulently acrid milk, which acts as a powerful poison. Roxburgh says that wood-cutters who accidentally injure this tree have inflammations and ulcerations on those parts of the body where the milk touches. Rumphius calls this tree 'Arbor excæcans,' and says that the Dutch sailors who were sent ashore at Amboyna to cut down timber became furiously mad from the pain produced by the juice of this tree getting into their eyes, and that some of them lost their sight altogether. This tree is common on various parts of the continent of India, and in the Indian islands, especially near the coast. Its specific name appears to have been given it on the supposition that it was one of the plants that yielded the Agallochum, or Aloes-wood, but this is not the case, and this wood is yielded by a different family of plants. [Aquilariaceæ, P. C. S.]

(Lindley, *Flora Medica*.)

EXCENTRIC, or ECCENTRIC, in machinery, a kind of wheel, or revolving cam, in which the axis or centre of motion does not coincide with the geometrical centre, or in which the periphery is not circular. A general notice of such contrivances, and a representation of the kind of excentric employed for working the valves of a steam-engine, are given under Wheels, P. C., p. 315.

Excentrics of various kinds form an important class of mechanical expedients for converting one kind of motion into another. They afford means for converting continuous circular motion, in various ways, into alternating or intermitting rectilinear motion, or into curvilinear, though not rotatory motion. They also furnish means for producing, from the uniform speed of one revolving shaft, rotatory motion of continually varying speed in shafts placed in connexion with it. As an illustration of such an application, Professor Willis, in his 'Principles of Mechanism,' refers to an excentric crown-wheel contrived by Huyghens to produce some of the complex movements of a planetarium. The subjoined diagram will illustrate the action of this apparatus, *a* representing the crown-wheel, which is mounted excentrically upon a shaft which revolves with a uniform speed, and *b c* a pinion driven by it, and made so long that it may be acted upon either by that portion of the periphery of the crown-wheel which is nearest to its axis, and which describes in its revolution a path indicated by the small dotted circle, coming in contact with the pinion at *b*, or by the opposite portion of the periphery, which describes the path indicated by the large dotted circle, and engages the pinion at *c*, where it is intersected by that circle. As the distance from the axis of the crown-wheel to the point *b* is little more than one-third of the distance from the axis to *c*, and as the velocity of the axis or shaft is uniform, it follows that the pinion will be driven nearly three times as fast when in contact with that part of the periphery of the crown-wheel which lies farthest from the axis as when in contact with the part which intersects it at *b*, while every intermediate portion of the periphery of the crown-wheel will impart a different, but intermediate velocity. Such a combination of wheels might be driven by the pinion, in which case, supposing the pinion to have a uniform velocity, that of the crown-wheel, or rather of its axis, will vary. Further variations might be introduced by making the periphery of the crown-wheel of other than a circular form.



Excentrics may be driven by bands or straps; but unless the bands be very highly elastic, it is necessary to apply a stretching pulley or roller, which may be pressed against the strap by the action of a weight, to maintain a uniform degree of tension.

EXCENTRIC WHEELS. [Wheels, P. C., p. 315.]

EXCHANGE. The rules by which operations of exchange are conducted must be either the simple rule of three or the chain rule. [Chain Rule, P. C. S.]

In the simple and direct operation nothing but the rule of three can be required. Thus, the exchange between London and Paris being 25 francs 55 centimes to the pound sterling, 6732 francs is converted into English money by finding the fourth term of the following:—

25·55 : 1 :: 6732 : the answer.

and 139*l*. 14*s*. 6*d*. can be converted into French money by

1 : 25·55 :: 139*l*. 14*s*. 6*d*. : the answer.

But in the case of the indirect operation of passing money from one country into another through a third, a double operation of the rule of three is requisite, which may be facilitated by the use of the chain rule. Suppose, for instance, that the exchange between London and Paris is 25·55 francs to the pound sterling, and that the exchange between Paris and Hamburg is 100 marks to 189 francs. Then, to find out the *arbitrated* value (as it is called) of 139*l.* 14*s.* 6*d.*, remitted to Hamburg through Paris, we have

100 marks are worth 189 francs
25·55 francs ,, 1 pound
139*l.* 14*s.* 6*d.* ,, How many marks?

It is however more common, first to establish an arbitrated *rate* of exchange, by putting 1*l.* in the place of 139*l.* 14*s.* 6*d.*, and then deducing the value of the latter sum. This is more convenient, because it establishes a rate once for all until the exchanges vary.

But the student must not content himself with the simple exposition above given. There are many little matters of business which cannot be explained here, but which may be found in such works as Tate's 'Commercial Arithmetic,' and the 'Counting-House Guide' of the same author.

EXCHANGE, BILL OF. [Bill of Exchange, P. C.]

EXCHANGE, ROYAL, London. The late Royal Exchange which was burnt down on the night of January 10, 1838, has been fully described under Royal Exchange, P. C. The foundation-stone of the present structure was laid by Prince Albert, January 17, 1842, and the building was completed in less than three years, the new Royal Exchange having been opened October 28, 1844, by Queen Victoria, accompanied by Prince Albert, and attended by the principal officers of the court and city.

The architect was Mr. William Tite. The whole of the exterior of the building is of Portland stone, except the steps and the plinths of the columns and pilasters, which are of granite. It is of a simple oblong form, and stands nearly east and west.

At the west end is a portico octostyle diprostyle, or of eight columns in front and two columns in projection, or in depth, and there are also two columns within, behind each third column from the sides of the portico. The front is deeply recessed behind the two middle columns, and in the centre is the principal entrance. The ascent to the portico is by nine low granite steps from the triangular area in front where Chantrey's bronze equestrian statue of Wellington is placed.

The east front has four columns in the centre, the two middle columns free, the two outer each engaged with a pilaster. Above these columns is the clock-tower, the first stage of which is square with ornamented pilasters, the second stage circular with Corinthian columns, crowned by a dome, and surmounted by a vane formed of the grasshopper of the late Royal Exchange, which is of copper, and eleven feet long: it was little injured by the fire, and has been repaired and gilt. The height to the top of the vane is 177 feet; to the top of the dome is considerably less. The eastern entrance is beneath the clock-tower. The east end is connected with the sides by semicircular corners.

The south side is an unbroken line of pilasters and boldly projecting cornice, crowned by a balustrade and attic. There are lofty semicircular arches between the pilasters, and each arch forms a shop front on the ground floor and window for a floor above, except near the centre, which is recessed, and has an entrance from the south.

The north side differs considerably from the south. The centre part projects a little, and has pilasters similar to those on the south side, but there are no pilasters on what may be called the wings of this south front. In the centre of the projecting part is an entrance from the north, opposite to the south entrance. The cornice and balustrades are similar to those on the south, but the line is of course broken by the central projection.

The windows which light the principal rooms of the Royal Exchange from the exterior, form a single range, of similar style on both sides of the building, but with considerable variation in the details.

The length from the portico west to the columns east is 308 feet; the width of the west end is 119 feet, of the east end 175 feet. The portico is 96 feet wide and 74 feet high to the apex of the pediment; the columns, which are 4 feet 2 inches in diameter at the base, are 41 feet high, including base and capital.

In the interior is a central quadrangular area appropriated to the meetings of the merchants, 170 feet by 112 feet. of which 111 feet by 53 feet is uncovered; the four covered sides form the ambulatory, the ceiling of which is divided by beams and pannelling, and both ceiling and sides have been painted in encaustic by Sang, a German artist and his assistants. The quadrangular front of the ambulatory is formed of semicircular arches which spring from square pillars. On the front of each pillar projects a half column with a plain capital, over which are half columns with Ionic capitals, with arches and ornamented windows between, and surmounted by a cornice and pierced parapet. Besides the central area, there is a small court at the east end.

The principal floor is occupied by four suites of apartments, of which the east end of the building and the chief part of the north side is appropriated to the underwriters' establishment of Lloyd's, and contains several handsome apartments. The subscribers' room, which extends along the east end, is 100 feet long by 48 feet wide; the commercial club-room, for strangers visiting London for mercantile purposes, is on the north side, 80 feet long: they are two magnificent apartments. The greater part of the west end is appropriated to the Royal Exchange Assurance Offices, and most of the south side is occupied by the London Assurance Company.

The best view of the Royal Exchange is from the south-west, where the mass of building is seen obliquely in its whole length along the unbroken line of pilasters and cornice, together with the large portico and sculptured pediment; and thus seen in the simplicity of its outline is a structure of much grandeur. Viewed more in detail from other places, it is less worthy of admiration. The arches which form the shop-fronts on both sides and at the semicircular corners appear flat and unsightly; the windows above are profusely ornamented, but the mouldings are such as to produce an effect not rich but gaudy, not magnificent but heavy. The columns and pilasters of the exterior are Corinthian; and the shafts, which are all plain, do not harmonize well with the profuse decoration of the dressings of the windows. The sculpture of the pediment is by the younger Westmacott: the grouping is rich in general effect, but the figures are somewhat too much crowded for distinctness, and there is perhaps too much of the classical forms of drapery in the national costumes worn by the persons arranged on each side of the central figure of Commerce. The sculpture is executed in close-grained limestone. Most of the figures are detached, the rest in high relief, and the modelling and chiselling are excellent. The clock-tower is not inelegant, but viewed from the exterior it appears small and insignificant, and in most situations is not seen; viewed however from the west side of the interior quadrangle, it looks very well. The clock was made by Dent, under the direction of Professor Airy, and the first stroke of each hour is said to be true to a second of time. The general appearance of the architecture of the interior is not unpleasing, though the ornamental mouldings viewed in relation to each other and to the style of architecture, display a good deal of bad taste. The encaustic painting of the ambulatory has a very novel, rich, and agreeable effect. The central area was at first paved with encaustic bricks, but is now flagged, except two small portions on the north and south sides. The flagstones of the ambulatory are of different colours and are arranged in symmetrical forms, but the contrast of colour is not sufficiently strong to produce any striking effect.

In the north-east angle of the ambulatory is a statue of Queen Elizabeth by Watson, and in the south-east angle a statue of Charles II. which stood in the centre of the area of the late Royal Exchange, and escaped with little injury from the fire. In two niches which occupy the place of windows in the projecting front of the north side are two statues, one of Sir Hugh Middleton by Joseph, the other of Sir Richard Whittington by Carew, both habited in the costume of their times, and of excellent design and execution. A statue of Sir Thomas Gresham by Behnes is to be placed in a niche at the east end, similar to those of the north front; and a marble statue of Queen Victoria by Lough, which was exhibited in the Royal Academy this year (1845), is to be placed in the centre of the quadrangular court. The drapery of this statue appears heavy and ungraceful. The artist seems to have aimed at a grandeur of effect which was not produced in the exhibition-room, but the appearance may be improved when the statue is placed upon its pedestal in the central area.

(Wilson's *Description of the New Royal Exchange; Companion to the Almanac*, 1842 and 1844.)

EXCHEQUER CHAMBER. [Courts, P. C.; Exchequer Court, P. C.]

EXCHEQUER COURT. [Exchequer Court, P. C.] Several alterations have been made in this court, the most important of which is the abolition of the equity side of the court, which was effected by 5 Vict. c. 5. The duties which formerly devolved upon the Masters of the court of Exchequer are now performed by the Queen's Remembrancer, whose office was regulated by 5 & 6 Vict. c. 86. [Accountant-General, P. C. S.] This act also abolished certain offices on the revenue side of the court. By a previous act (3 & 4 Wm. IV. c. 99) the following offices of the court were abolished: the lord treasurer's remembrancer, the filacer, secondaries, deputy-remembrancer, and sworn and other clerks and bag-bearer belonging thereto; clerk of the pipe, controller and deputy-controller of the pipe, secondaries, attorneys, or sworn and other clerks and bag-bearer in the office of the pipe; clerk of the estreats; surveyor of the green wax; the foreign apposer and deputy foreign apposer, and clerk of the nichills.

EXCRETION. [Secretion, P. C.]

EXECUTORY DEVISE. [Will and Testament, P.C.]

EXEMPLIFICATION. [Record, P. C.]

EXI'DIA. [Tremellini, P. C.]

EXO'STEMMA (from ἔξω, without, and στέμμα, a crown), a genus of plants belonging to the natural order Cinchonaceæ. It has an obovate 5-toothed calyx; a corolla with a terete tube, and a 5-parted limb with linear segments; the anthers linear, exserted; the capsule crowned by the calyx, dehiscing from the apex through the dissepiments into two half-fruits; the seeds girded by a membranous entire border. The species are trees or shrubs, with lanceolate oval short-stalked leaves, and stipules solitary on each side of the petioles.

E. caribæum, Quinquina Piton, Sea-side Beech, has ovate-lanceolate, acuminated, glabrous leaves; axillary 1-flowered pedicels, rather shorter than the petioles; the calyx bluntly 5-toothed; the style and stamens about equal in length to the corolla. It is a tree about twenty feet high, and a native of the Caribbee Islands, Guadaloupe, St. Domingo, Jamaica, Santa Cruz, and Mexico. This plant is the *Cinchona caribæa* of Jacquin and the *C. Jamaicensis* of Wright. The capsules before they are ripened are very bitter, and produce a burning itching when applied to the nostrils and lips. The bark is also bitter, and possesses a tonic, febrifuge, and emetic action on the system, but it does not appear to have either quinine or cinchonine in its composition. The bark is generally smooth and grey on the outside. Its flavour, according to Dr. Wright, is at first sweet, with a mixture of the taste of horse-radish and aromatic oils, but afterwards it becomes excessively bitter and disagreeable. When examined by the microscope it presents innumerable shining crystalline points, which, according to Guibourt, are some principle peculiar to the bark.

E. floribunda, Quinquina of St. Lucia, has elliptic acuminated glabrous leaves; peduncles terminal, corymbose; flowers smooth; the teeth of the calyx short, acute; the capsules turbinate. It is a native of the West India islands, among woods by the side of torrents. It is the *Cinchona floribunda* of Swartz; *C. Sanctæ Luciæ* of David, *C. montana* of Badier, and *C. Luciana* of Vittmann. The bark is similar to the last, and used as a substitute for the Peruvian bark, but Pelletier and Caventou discovered no quinine or cinchonine in any part of the plant.

E. Souzanum, Quinquina de Piauhi, has leaves, obovate or ovate, acute, smooth; the corymbs few, flowered, terminal; the capsules scarcely an inch long, obovate, compressed, the valves usually 4-nerved; the seeds transversely oblong, with a broad wing all round. This plant is a native of Brazil, and is used as a substitute for the Peruvian bark. Buchner found in it an alkaloid, which he called Esenbeckine, on the supposition that this plant was an Esenbeckia. The alkaloid was probably cinchonine.

E. Peruvianum is the *Cinchona Peruviana* of Poiret. It has ovate-oblong acute leaves, rounded at the base, the upper sessile and cordate. It is a tree ten or twelve feet high, and grows in the colder parts of Peru, on the declivities of the Andes, between the river Chota and the village of Querocotillo, 3000 feet above the level of the sea. The bark is very bitter, and has a sweetish taste with a nauseous smell. There are several other species of Exostemma, which have also been sold as cinchona barks, but the above are those which are well known.

(Don, *Gardener's Dictionary*; Lindley, *Flora Medica*; Bischoff, *Medicinisch-Pharmaceutische Botanik*.)

EXOSTOSIS (ἐξόστωσις), a swelling or tumor of a bone. This term has been applied very generally to all tumors of the bones, whether they partake of the characters of osseous structure or not. This led to the distinguishing these swellings into true and false, the former including true osseous structures, the latter the various forms of cartilaginous tumor, spina ventosa, and those diseases of the periosteum and bone called by Sir Astley Cooper periosteal and medullary exostosis. True exostosis is in fact nothing more than an hypertrophy of the tissues which constitute the bone. Hypertrophy of a bone may arise from natural causes, and is produced by anything which constantly increases the action of a part. It is thus that the same actions which increase the size of the muscles of a blacksmith's arm and a dancer's leg will also be attended with an increased development of the bony attachments of the same muscles. During rapid growth it sometimes happens that one part of a bone grows faster than another, from some increased facility of nutrition in the part, and the consequence is an exostosis. This often occurs in the clavicle of children, but requires no treatment, as subsequent growth removes the deformity.

The more frequent cause of an exostosis, which does require treatment, is the production of increased action of the part by the application of some stimulus. It is difficult frequently, in bones, to trace the increased action to the true cause. It sometimes however follows a blow, and some persons are so predisposed to take on this form of action, that slight injuries are followed by exostoses. The structure and density of exostoses vary much. Sometimes they exhibit a light cellular structure, like the cancellated structure of bones, and are frequently much lighter and more cancellar than is ever observed in this structure in its normal development. At other times the structure of the exostosis is much harder than common bone, and possesses all the characters of ivory. The cancellated structures sometimes attain a considerable size, but the ivory exostoses seldom exceed the size of a bean. The first are most common on the long bones, as the femur, tibia, humerus; the last on the cranium, and bones of the face. Sometimes the increased action of the tissue extends to the whole bone, and every part is enlarged. Remarkable examples of such a thickening of the whole of the cranium occur in the museums of the Royal College of Surgeons and University College.

Exostoses are easily distinguished from other swellings, by their being fixed and immoveable, and at first unattended with any pain or inconvenience. They are also distinguished by the slowness of their growth. Where exostoses are situated on parts of the skeleton in which they do not interfere with other organs, they may be left to themselves. Situated behind the knee-joint, they have been known to interfere with the action of the flexor muscles. The growth of an exostosis from the os-pubis has, by its pressure, rendered the urethra impervious. An exostosis of the femur has been known to obliterate the femoral artery; in the orbit, to produce displacement of the eye. Cases are recorded in which an exostosis of the cervical vertebræ has obliterated the subclavian artery, and, extending backwards from the lower jaw, has produced a fatal impediment to respiration, by its pressing on the larynx. No kind of external treatment is beneficial in any of the forms of exostosis; and when, on account of their position, it is thought right to treat them, they must be removed. The operation consists in sawing or cutting away the bony tumor, which may be done by a trephine, Hey's saw, or Liston's cutting pliers. Of course this operation should only be performed when it can be done without danger to neighbouring organs. Even when the whole of the projection cannot be removed, it will often be found of advantage to take away a part.

(Cooper, S., *First Lines of Surgery*; Cooper, S., *Dictionary of Surgery*; Mayo, *Outlines of Human Pathology*; Liston, *Elements of Surgery*.)

EXPLOSION is the sudden displacement of a considerable volume of air, or of any gaseous particles, accompanied by a loud report.

In the well-known experiment with a glass cylinder having one end covered with a thin bladder tightly bound about it, the column of air incumbent on the bladder suddenly descends into the vessel on the rupture of the bladder when the air beneath is withdrawn by means of an air-pump; and the collision of its particles with one another or with the sides of the vessel produces the vibrations which cause the perception of sound. The particles of steam, in a state of high elasticity, when suddenly liberated by the bursting of the vessel in which they are contained, produce also a loud report by their collision with the atmospherical particles about them, or by the rush of air into the rarefied space which they have quitted. The elastic gases liberated on the application of fire to gunpowder in a tube, and the heat produced at the same time, create a rapid displacement of the particles of the surrounding atmosphere; and these as rapidly falling back into the vacuum within and about the fire-arm, cause a loud report by their collisions. A fulminating powder is the cause of a like explosion being produced, by means of the gases which are set free in consequence merely of the friction of the particles.

The explosions which, in the atmosphere, accompany a flash of lightning, are ascribed to the rush of air into the vacua produced when the aqueous vapours in large portions of space become rapidly condensed. The air which thus occupies a space previously void, by dilating ceases to have the power of holding all the vapour in solution, and much of the latter being condensed, a new vacuum is produced: the neighbouring air again rushes in, and again a report follows. These actions often taking place several times successively, and the rolling sound arising from a succession of reports may then be heard. [Thunder, P. C.]

For the explosion produced by chemical combinations see Detonation, P. C.

EXTORTION. 'Extortion,' says Coke (Co. Litt., 368, b.), 'is a great misprision, by wresting or unlawfully taking by any officer, by colour of his office, any money or valuable thing of or from any man, either that is not due, or more than is due, or before it is due.' It is an offence at common law, punishable by fine and imprisonment at the discretion of the court. Also, money which has been obtained by extortion may be recovered in an action at law. There are various statutes providing penalties for extortion by sheriffs, under-sheriffs, bailiffs, gaolers, clerks of assize, &c.

EXTREME AND MEAN RATIO. To cut a line according to extreme and mean ratio, *εὐθεῖαν ἄκρον καὶ μέσον λόγον τεμεῖν*, is a phrase of Euclid which it is not very easy to explain from the words of it. The meaning is, to cut a straight line in such a manner that the whole shall bear to the greater part the same ratio as the greater part to the less; or to make the greater segment a mean proportional between the whole and the less. Accordingly the square of the greater segment must be equal to the rectangle under the whole and the less segment: and Euclid shows how to make this section in the 11th proposition of the second book.

If the whole line be called unity, and if x be the fraction which is in the greater segment, we must have

$$1-x=x^2, \text{ or } x=\pm\tfrac{1}{2}\sqrt{5}-\tfrac{1}{2}.$$

In the sense of Euclid, only the value $\frac{1}{2}\sqrt{5}-\frac{1}{2}$ will solve the problem; and the other root, with the sign changed, solves the following problem:—To produce a line in such manner that the part produced may be a mean proportional between the given line itself and the line made up of the given line and the part produced. Any one who examines Euclid's construction will very easily see the formation of $\frac{1}{2}$, of $\frac{1}{2}\sqrt{5}$, and the subtraction of the first from the second.

The fraction x cannot be expressed arithmetically, and the segments are incommensurable. But if a and b be any two numbers, of which a is the less, and if we form a third by adding the two, a fourth by adding the second and third, and so on, as in the series $a, b, a+b, a+2b, 2a+3b, 3a+5b, 5a+8b$, &c., it is demonstrable that the farther we go the more nearly does the ratio of any one to the next represent that of the less to the greater segment of a line divided in extreme and mean ratio. If we begin with 1 and 1, we have the series 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, &c. &c. Thus if 89 inches be divided into 34 and 55 inches, the division required is nearly made, for the rectangle has 89×34, or 3026 square inches, and the square has 55×55, or 3025 square inches. This process gives us the results of turning

$$1-x=x^2, \text{ or } x=\frac{1}{1+x}$$

into $x=\frac{1}{1+}\,\frac{1}{1+}\,\frac{1}{1+}$, &c. [Fractions, Continued, P. C.], and then making successive approximations. It is perhaps just worth noting that the nth number in the series 1, 1, 2, 3, 5, 8, &c. is the number of ways in which n can be made up out of odd numbers, differences of order counting as different ways: thus 6 can be made up in 8 ways out of odd numbers. Accordingly, the greater n is taken, the more nearly are the numbers of ways in which n and $n+1$ can be composed of odd numbers in the proportion of the segments of a line divided in extreme and mean ratio.

The use of this division in elementary geometry is as a step to dividing four right angles into five equal parts, as in the 10th proposition of the fourth book. In fact, the half of $\frac{1}{2}\sqrt{5}-\frac{1}{2}$ is the sine of 18°, the fifth part of a right angle.

EYCK, HUBERT VAN. This celebrated old Flemish painter, the elder brother and master of John Van Eyck, was born, according to Van Mander, in 1366, and probably at Eyck (now Alden Eyck), a small village near Maaseyck on the Maas. The two brothers established themselves first in Bruges and afterwards in Ghent. The name of Hubert Van Eyck is nearly lost in that of his younger brother and pupil John, apparently from no other reason than that John alone is mentioned by Vasari in his story of the invention of the new method of oil-painting, while he takes no notice whatever of Hubert; John's name therefore appears as the principal or indeed sole name in all subsequent investigations relating to the origin of this method of oil-painting, and the joint productions of the two brothers are generally adduced as the works of John alone.

Whether the discovery in question was the result of their joint experiments or solely the work of John, it is perhaps now impossible to ascertain; yet as the earliest works in oil were their joint productions, it is scarcely just, on no better authority than an anecdote of Vasari's, to deprive Hubert of the merit of a share either in the discovery or its development.

Van Mander says that they must have painted in their new method as early as 1410, and as Hubert did not die until the 18th of September, 1426, according to the inscription on his tomb in the church of St. Bavon at Ghent, they worked a sufficient number of years together to completely develop it in practice. John Van Eyck cannot have been very old in 1426, as, according to an authentic lottery notice of his widow, though alive in 1445, he died before the 24th of February, 1446, and he was still young when he died, according to Marcus Van Vaernewyck, who published a 'History of Belgium' in 1565. This is somewhat corroborated by a portrait of John in the Museum of Berlin, dated 1430, in which he appears about thirty-five years of age. John was therefore about thirty years younger than his brother Hubert, supposing the latter to have been born in 1366, and accordingly he can have been at first little more than the assistant of Hubert in their masterpiece, the great altar-piece of St. Bavon's, Ghent, which was finished by John in 1432. His name is clearly subordinate to Hubert's in the inscription on the work, which is as follows, the last verse being a chronogram:—

> 'Pictor Hubertus e Eyck, major quo nemo repertus
> Incepit; pondusque Johannes arte secundus
> Frater perfecit, Judoci Vyd prece fretus
> VersV seXta MaI Vos CoLLoCat aCta tVerI.'

The capitals in the last line when added together according to their value as Roman numerals, make 1432.

The merit of Hubert is still more prominently set forward in the following epigram by Vrintius in Saunderus's 'Flandria Illustrata:'—

> 'Quos Deus ob vitium paradiso exegit, Apelles
> Eyckius, hos Vitii* reddidit aere patres.
> Arte, modoque pari pariter concurrere visi,
> Aemulus hinc pictor, fictor et inde Deus.'

The altar-piece is about fourteen feet wide by twelve high, and is in two horizontal divisions, each centre covered by revolving wings or doors, two on each side. There are twelve pictures in all; God the Father, with the Virgin, and Saint John the Baptist, as large as life, one on each side in distinct compartments, constitute the upper centre; the extreme wings of this division are full-length naked figures of Adam and Eve, Adam on the right and Eve on the left of the centre: the interior wings represent, on the right hand, angels singing, on the left, angels playing musical instruments. The lower centre represents in one picture the actual Adoration of the Lamb in small figures; the two wings to the right represent the just judges, Justi Judices, and the soldiers of Christ, Christi milites; the two on the left, the holy hermits, Heyremiti Sti. and the holy pilgrims, Perigrini Sti: there are in all about sixty figures and three hundred heads. An elaborate copy of it was made by Coxie for Philip II. of Spain. [Coxie, Michael, P. C. S.] The colouring of the whole work is beautiful, and many parts are admirably executed, and the painting is still in excellent preservation, owing to the excellent oil vehicle discovered by the Van Eycks.

This medium of the Van Eycks was not merely *oil*: it was several oils mixed with resins, or some such substances, and prepared by fire. Many useless and intemperate discussions have arisen from Vasari's attributing the invention of *oil-painting* to John Van Eyck, but they are due chiefly to a careless or partial consideration of what Vasari really says. In one passage in the Life of Antonello he fully describes, though in general terms, what the Van Eyck medium was, but in others he merely terms it *oil-painting*, a term, after what he had said before, sufficiently characteristic and distinctive. The Cav° Tambroni, however in his preface to the treatise of Cennino Cennini (Rome, 1821), has, with as little ability as honesty, argued solely upon the general expressions of Vasari, and ridiculed the story as an absurd fiction, because mere oil-painting was known in Italy before it was introduced by Antonello of Messina. [Antonello da Messina, P. C. S.] It is true that Cennino Cennini wrote his book in 1437, and it contains five chapters on *oil-painting*, but he prefaces his remarks by the following observation:—'I will now teach you to paint in oil, a method much practised by the Germans.' The oil-painting which Cennino teaches is no more that of the Van Eycks than tempera painting is; it is the very method which the Van Eycks superseded. An old German monk of the name of Tutilo or Theophilus wrote on the same subject centuries before Cennini. [Tutilo, P. C.] The words of Vasari are—'At last, having tried many things, separately and compounded, he discovered that linseed and nut oils were the most siccative: these therefore *he boiled with other mixtures*, and produced that varnish (vehicle) which he, and indeed every painter in the world, had long desired.' This is what the Cav. Tambroni and others have treated as an assertion that John Van Eyck invented and introduced the practice of mixing colours with oil. Several interesting notices of the brothers Van Eyck appeared in the *Messager des Sciences et des Arts*, Gand, 1824; and in the *Kunsblatt* in 1824 and 1826; see also Passavant, *Kunstreise*, &c. (in which there is an outline of the altar-piece of Ghent); and Rathgeber, *Annalen der Niederländischen Malerei*.

---

* Judocus Vyd.

EYES, PROPAGATION BY. The power of propagating plants by any other means than seeds depends entirely on the presence of leaf-buds or '*eyes*,' as they are technically called by gardeners. A plant may in fact be regarded as a congeries of individuals, and each leaf-bud is an individual capable of maintaining an independent existence. Though this is generally true, the buds of all plants will not grow when removed from their parent stock. Many, however, admit of their buds being removed from one branch and placed upon another, which constitutes the process of budding. [Budding, P. C.] Others admit of a branch being removed and placed in the ground, when the leaf-buds upon it will develop, and the wood of the branch form roots. Such branches are called cuttings. [Cutting, P. C.] A few plants admit of single buds being taken and planted in the earth, when they will grow and produce plants in the same manner as seeds. It must however be borne in mind in this case that the individual and not the species, as is the case with seeds, is propagated. The plants which are most frequently propagated by eyes are the potato and the vine. It appears that for plants to grow in this manner, the bud requires that a due supply of nutriment should be stored up in the branch or part of the stem to which it is attached. This is undoubtedly the case in the potato, where a large quantity of amylaceous matter is stored up in the tubers, so that a bud cannot be taken without carrying away fragments of its alimentary secretions. Mr. Knight observed with regard to the buds of the vine, that those grew with most rapidity and strength which were in contact with the largest quantity of alburnum, which he regards as the nutritious matter of the young buds. The provision, however, of alimentary matter may be in some cases, as has been pointed out by Dr. Lindley, disadvantageous by promoting too great a development of stems and leaves. According to theory, the more nutritive matter there is for the eyes, the greater crop there will be; and thus it would seem that it would be more advantageous to plant whole potatoes than portions of the potato or sets. Dr. Lindley proved by a series of numerous experiments, that the weight of potatoes per acre is greater under equal circumstances from sets than from the whole tubers by upwards of from seven cwt. to three tons per acre, and considerably more on comparison of the clear produce after deducting the weight of sets employed in both cases. He supposes 'the rankness of the vegetation from the whole tubers to be the cause of the diminished crop; for the stems were unable to support themselves, and were blown about, laid, and broken by the wind.' A curious fact with regard to the growth of the eyes on different parts of the potato has been recently pointed out in the 'Gardener's Magazine.' It is well known to the cultivators of potatoes in Lancashire that different eyes germinate and yield their produce at very different times, some being ripe or fit for use as early as the middle of May, and others not till June or July. It is found that it is the sets which are nearest the extremity of the potato which ripen soonest; and these are planted in Lancashire in warm places, in March or the beginning of April, and are ready for the market by the middle of May. The produce of the next sets are ready a fortnight after, and that from the root end still later.

In propagating the vine by this means an eye is taken with a small portion of the stem adhering to it, and is placed in earth with a bottom heat of 75° or 80°. It should be kept in a damp atmosphere, when it speedily shoots upwards into a branch, and at the same time establishes itself in the soil by the development of roots. In order to insure the success of this operation, it is necessary that the bud should be dormant at the time it is removed, and that a small piece of well-ripened wood should be separated with it.

There is another mode of propagating plants resembling this, and that is by planting the abortive branches, called 'Knaurs,' and embryo buds. [Tissues, Vegetable, P. C.] This plan is pursued in Italy for the propagation of olive trees. These knobs or abortive branches are produced by other trees besides the olive, and might be made use of for the same purpose. The beech, the poplar, the cedar, and many other trees produce these knobs in abundance in this country.

It has been found that under certain circumstances many leaves are capable of producing buds, and these buds of producing an entire plant. Although it was announced at the beginning of the last century, by Agricola in Germany, and Bradley in England, that plants might be propagated to any extent by means of leaves, there can be no doubt that their object was to impose upon the public, and none of the advantages which they represented to be derived from the system have followed upon its repetition. The fact of buds having been produced upon the veins of leaves is interesting in a morphological point of view, but no practical application has at present been made of it that we are aware of.

(Lindley, *Theory of Horticulture*; *Horticultural Transactions*, vols. i. ii.; *Gardener's Magazine*, vol. i. and vii.)

INDEX TO THE LETTER E.

VOLUME I.

Ear-Trumpet, page 504
Earle, John, 504
Earlom, Richard, 504
Easter, 504
Easter-Dues [Offerings, P. C. S.]
Eastern Empire [Roman Empire, P. C. S.]
Eccentric, in Machinery [Excentric, P. C. S.]
Ecclesiastical Commissioners for England, 507
Ecclesiastical Courts, 508
Ecculiómphalus, 512
Echinóchloa, 512
Echinolámpas, 512
Echinóphora, 512
Echinóstachys, 512
E'chium, 512
Edáphodon, 512
Edictal Law, 512
Edwards, Richard, 513
Eft, 513
Egg-Trade, 513
Egra, 513
Eidograph, 513
Elæodendron, 513
Eláphrium, [Calophyllum, P. C. S.]
Elásmodus, 514
Elastic Bands [Wheels, P. C. p. 312; Caoutchouc, P. C. S. p. 283]
Elaterin [Chemistry, P. C. S.]
Elatináceæ, 514
Elder [Sambucus, P. C.]
Eldon, John Scott, Earl of, 514
Election Committees, 516
Election of Members of Parliament [Parliament, P. C. S.]
Electric Telegraph [Telegraph, Electric, P. C. S.]
Electricity, Atmospheric, 517
Electricity, Condenser of [Condenser of Electricity, P.C.S.]
Electricity, Distribution of [Distribution of Electricity, P. C. S.]
Electro-Metallurgy, 518
Electro-Plating and Gilding [Electro-Metallurgy, P.C.S.]
Electrotint [Electro-Metallurgy, P. C. S.]
Electrotype [Electro-Metallurgy, P. C. S.]
Eleócharis, 521
Elephántopus, 521
Elimination, 521
Elizabethan Architecture, 522
Ellipsolithes, 524
Elliptic Functions, 524
Elliptic Polarization, 524
Elliston, Robert William, 525
E'lymus, 526
Emblements, 526
E'mblica, 526
Embossing, 526
Embroidery, 527
E'mbryon, 527
Emphyteusis, 529
Empyéma, 529
Enamelling, 530
Enarea, 530
Encaustic Tiles and Pavements [Tiles and Pavements, P. C. S.]
E'nchodus, 531
Endocarp [Pistil, P. C. S.]
Endogenites, 531
Endowment [Dower, P. C.; Vicarage, P. C.]
Enfranchisement [Copyhold, P. C. S.]
Engravings [Copyright, P. C. and P. C. S.]
Enlargement of Objects, 531
Entobia, 531
Entomocónchus, 531
Eocene, 531
Ephedra, 531
Ephémera, 531
Ephraem, or Ephraim, 532
Epilóbium [Willow-Herb, P. C.]
Epimédium, 532
Epipactis, 532
Epiphánius, 533
Epiphégus, 533
Epistaxis, 533
Eprouvette, 534
Equality, Approach to, 534
Equation, Binomial, 535
Equation, Personal, 535
Equations, Differential, and Equations of Differences, 536
Equisétum, 540
Erastianism [Erastus, P. C. S.]
Erastus, Thomas, 541
Erbium [Chemistry, P. C. S.]
Eremecausis, 541
Erigeron, 542
Eriodendron [Wool-Tree, P C.]
Eródium, 542
Eróphila [Draba, P. C. S.]
Erskine, Ebenezer, 542
Erskine, Ralph, 543
Erskine, John, 543
Erskine, John, 543
Erúca, 543
Erucástrum, 543
Ervum [Viciee, P. C.]
Ery'ngium, 543
Ery'simum, 544
Erysiphe [Gasteromycetes, P. C. S.]
Escrow [Deed, P. C.]
Escutcheon [Heraldry, P. C.]
Esox, 544
Essex, James, 545
Essington, Port, 545
Estrángelo, 546
Etesian Winds [Wind, P. C.]
Eton, 546
Eton College, 546
Etchmiadzin, 546
Eugeniacrinites, 547
Eúgnathus, 547
Eulóphia, 547
Euómphalus, 547
Euónymus, 547
Eupatórium, 548
Euphránor, 548
Euphrásia, 549
Fápoda, 549
Eupompus [Pamphilus, P C.]
Eúryale, 549
Eurynótus, 549
Euryócrinus, 549
Eury'pterus, 549
Eusebius, 549
Evágoras, 549
Evaporation, 550
Everdingen, Albert van, 551
Evernia [Liverworts, P. C. S.]
Evidence, 551
Evódia, 552
Excæcária, 552
Excentric, 552
Excentric Wheels [Wheels, P.C. p. 315]
Exchange, 552
Exchange, Bill of [Bill of Exchange, P. C.]
Exchange, Royal, London, 553
Exchequer Chambers [Courts, P. C.; Exchequer Court, P. C.]
Exchequer Court, 553
Excretion [Secretion, P. C.]
Executory Devise [Will and Testament, P. C.]
Exemplification [Record, P. C.]
Exidia [Tremellini, P. C.]
Exostemma, 554
Exóstosis, 554
Explosion, 554
Extorsion, 555
Extreme and Mean Ratio, 555
Eyck, Hubert van, 555
Eyes, Propagation by, 556

F.

FABBRO'NI, A'NGELO, born at Florence in 1732, studied at Rome, where he distinguished himself for his ability in Latin composition, through which he became acquainted with the learned Bottari, who introduced him to the Papal Court. In 1766 Fabbroni published the first volume of his Latin biographies of the learned men of modern Italy: 'Vitæ Italorum doctrina illustrium,' a work which he afterwards extended to twenty volumes, 8vo., and for which he has been styled by some the Plutarch of modern Italy. His patron Bottari not being on friendly terms with the Jesuits, who had great influence at Rome under Pope Clement XIII., and who accused Bottari of a bias in favour of the Jansenists, Fabbroni found that he had little chance of making his way at the Papal Court, and he returned to Florence in 1767, where the Grand-Duke Leopold appointed him President of the Collegiate Church of S. Lorenzo, and afterwards made him Prefect of the University of Pisa, and Prior of the military order of S. Stefano. After this Fabbroni travelled through Germany, France, and England, and made the acquaintance of many learned men in those countries. On his return to Tuscany in 1773, he devoted himself entirely to literary pursuits. He continued his series of Latin biographies already mentioned; he wrote also some Italian biographies; he edited the 'Giornale Pisano,' a literary magazine, which enjoyed considerable reputation in the latter part of the eighteenth century, and he published an interesting history of the University of Pisa: 'Historia Academiæ Pisanæ,' 3 vols. 4to., Pisa 1791. Fabbroni died at Pisa in 1803. A cenotaph was raised to his memory in the Campo Santo of that city. Fabbroni was considered one of the best Latin scholars and writers of Italy in the eighteenth century. His Italian works are: 'Elogj d. alcuni illustri Italiani,' 2 vols. 8vo., Pisa, 1789; 'Elogj di Dante, di Poliziano, di Ariosto, e di Tasso,' 8vo., Parma, 1800; 'Dissertazione sulle Statue appartenenti alla Favola di Niobe,' Florence, 1799. He also contributed to the collection of 'Memorie de' più illustri Pisani,' 4 vols. 4to., Pisa, 1790.

(Lombardi, *Storia della Letteratura Italiana nel Secolo XVIII.*; Gamba, *Serie di Testi di Lingua*; *Life of Fabbroni*, written by himself, and inserted in the last volume of his 'Vitæ Italorum.'

FABA. [Vicieæ, P. C.; Bean, P. C.]

FABOI'DEA, Mr. Bowerbank's generic title for many seed-vessels in the London clay of Sheppey (*Fossil Fruits of the London Clay*).

FABRIA'NO, FRANCESCO DI GENTILE DA, commonly called Gentile da Fabriano, was born at Fabriano, in the Marc of Ancona, in the second half of the fourteenth century, about 1370. He was instructed by his father Niccolò in the physical and mathematical sciences, and was placed with Allegretto di Nuzio, called Gritto da Fabriano, to learn painting.

Gentile executed many works in fresco and a temperà at Gubbio and other cities of the Marc of Ancona; and also at Orvieto, Florence, and Siena. He painted in 1423 a Madonna for the Cathedral of Orvieto, and he is styled in the register of the cathedral—egregius magister magistrorum. He painted in the same year at Florence an admirable picture of the Adoration of the Kings, for the sacristy of Santa Trinità, which is now in the gallery of the academy at Florence, and is one of its choicest pieces. But his masterpiece, according to Vasari, was an altar-piece of the Virgin, &c., in the church of San Niccolò at the gate of San Miniato, painted in 1425, now lost, with the exception of two fragments still in the church. Gentile worked also with great distinction at Venice and at Rome: he was presented by the Senate of Venice with the patrician toga, and granted a pension for life, for a painting in the council chamber of the naval victory of the Venetians over the fleet of Frederic Barbarossa in 1177: it fell to pieces in the sixteenth century through damp. At Rome he painted some of the decorations of the church of San Giovanni in Laterano, ordered by Pope Martin V.; and a fresco of the Madonna and child with St. Benedict and St. Joseph, over the tomb of Cardinal Adimari, in the church of Santa Maria Nuova; all of which have now perished. It was the latter work which excited the admiration of Michael Angelo, and led him to say that his style was like his name—Gentile. His colouring and execution were excellent for his period, and he was one of the most meritorious artists of his time. His works, though they were not to be compared with those of Masaccio, or even of Fra Giovanni da Fiesole, which they resemble, were an immense improvement upon the rigid meagre forms of Giotto and his school. Gentile taught Jacopo Bellini at Venice, and that painter's son Gentile was Fabriano's namesake. Gentile was also as superior in the theory of his art as its practice: he left writings on the origin and progress of art, on the mixing of colours, and on the art of drawing lines; but whether they still exist, does not appear. He died about 1450. There is some account of Gentile in the *Memorie Storiche delle Arti e degli Artisti della Marca di Ancona*, by the Marquis A. Ricci, Macerata, 1834; see also Vasari, *Vite de' Pittori*, &c.; and the notes to the German translation by Schorn.

FABROT, or FABROTUS, CHARLES-ANNIBAL, a jurist, was born at Aix in Provence, in 1580 or 1581. In the memoirs of the French jurists the names and conduct of their patrons generally occupy an important position: among those who were instrumental in bringing Fabrot into notice occur the names of two distinguished men, Fabri de Peiresc, and Bignon, the avocat-general. With an interval of a short residence in Paris in 1617, Fabrot appears to have taught law in the University of Aix from the year 1609 to 1637, when he went to Paris to print his edition of the Institute of Theophilus, or the Greek version of Justinian's Institute ('Institutionum Justiniani Imperatoris Paraphrasis Græca, etc., recensuit, et Scholiis Græcis auxit, Car. Annibal Fabrotus'). Having got access to the MSS. in the possession of Cujacius, and to others in the public libraries, he long laboured in the preparation of an edition of the 'Basilica,' which containing a version of the several parts of the Corpus Juris, and also the additions made under the Eastern emperors, were, unless through the fragments edited in Latin by Hervetus, known to the jurists only in MS. Fabrot's edition was published at Paris in 1647, in 7 volumes folio ('Basilicorum Libri Sexaginta, cum Versione Latina C. A. Fabrotti et aliorum'). This edition contains thirty-three complete and ten incomplete books of the sixty. [Basilica, P. C.] In 1658 Fabrot edited at Paris the works of Cujacius, in 10 volumes folio; a well-known edition, but not well provided with means of reference. The labour connected with this work is said to have occasioned the death of its editor; he died at Paris on the 16th of January, 1759. He wrote several minor works on jurisprudence, and some on the science now called medical jurisprudence, e.g. 'Disquisitiones duæ: prior de Justo Partu—altera de Numero Puerperii.' Some of these minor works are in the 'Thesaurus Juris Romani' of Everard Otto. The 'Biographie Universelle' attributes to him 'Les Antiquités de la Ville de Marseille,' translated from the Latin of Raymond de Solier, and published in 1615. Taisand refers for his memoir of Fabrot to Niceron, and the 'Nouveau Dictionnaire Historique' and other ordinary French works of reference appear to go to the same source.

(Niceron, *Mém. des Hommes Illustres*, xxix. 353-363.)

FACTORIALS. The subject treated under this word is one which daily becomes of more importance in mathematical analysis, and takes its rise at the commencement of algebra.

When we first begin to number, we easily make the transition from integers to fractions, because we are accustomed to consider ourselves as reckoning simple magnitude, of which each unit can be divided into parts homogeneous with itself. [Number, P. C.] Be the unit what it may, in the case of simple magnitude, it might as well have been any fraction of what it is, so far as the possibility of conceiving and performing arithmetical operations is concerned. But when we come to count operations, not magnitudes, the case is much altered; we can no longer say at pleasure that we can conceive or introduce fractions. Certainly, as to additions, we think we need not stop to learn what a fractional number of them means. If, after having thought for a moment of six additions of 20 and seven additions of 20, we ask ourselves what ought to be meant by *six and a half* additions of 20, we imagine that it must necessarily mean six additions of 20, followed by an addition of 10. But this notion, though the most simple, and therefore adopted as a basis, is not necessary.

The algebraist knows very well that having proved the equation $\phi(x, m)=x+mb$ to be true whenever m is an integer, he has not proved it to be true when m is a fraction: in fact, $\phi(x, m)=x+mb\cos 2m\pi$ would equally satisfy his demonstration, and an infinite number of other solutions might be named.

When we come to reckon numbers of multiplications, we begin from unity, and say, let a^n signify that unity is multiplied n times following by a. Now this symbol is, from the beginning, distinctly conceivable, whether a be integer or fractional, under the usual and easy extension to fractions of the idea of multiplication; but it is not, or ought not to be, so intelligible when n is a fraction. What are four and a half multiplications by 36? The beginner will say, four multiplications by 36, followed by a multiplication by 18: but this mode of defining breaks down immediately, for the two half operations would make more than the whole: two successive multiplications by 18 are equivalent to more than a multiplication by 36. It is multiplication by 6 which is the *half-operation* to multiplication by 36. It is true that we do not apply the phrase *fraction of an operation* in our descriptive language; but we apply the symbol in our symbols. For just as every a^1 in a^n denotes one multiplication by a, every $a^{\frac{1}{2}}$ denotes that multiplication which twice repeated is equivalent to one multiplication by a. In like manner $a^{\frac{3}{7}}$ is the multiplier which, being used 7 times, gives the same result as a used 3 times. We are not going to give the theory of simple powers, but only to put it in connexion with what follows; and the reader will do well to observe, that in the very first ideas of ratios [ADDITION OF RATIOS, P. C.] the notion of numerical quantity entering as a multiplier in repeated operations was so much in the minds of those who framed Euclid's language, that they spoke of what were really multiplications as if they had been additions. The same thing may be traced in calling 100 to 1 the duplicate ratio of that of 10 to 1 [RATIO, P. C.], and 10 to 1 the subduplicate ratio of that of 100 to 1: duplicate means double, and subduplicate means half. The beginner must learn to understand numbers with reference to their force as indices of operation, and even the advanced student may require more study of this part of the subject than he suspects himself of wanting.

Again, to establish the equation $\phi(x, m)=x^m$ when m is an integer, is not the same thing as establishing

$$\phi\left(x, \frac{m}{n}\right) = \sqrt[n]{x^m}:$$

in fact the symbol $x^{\frac{m}{n}}$ in algebra is well known [ROOT, P. C.] to be in its complete meaning

$$\sqrt[n]{x^m}\{\cos\frac{m}{n}.2k\pi+\sqrt{-1}\sin\frac{m}{n}.2k\pi\}$$

where k is any integer.

Next after the operations of powers and roots, nothing occurs more frequently in mathematical formulæ than successions of multiplications in which the multiplier is not always the same, as $1.2.3\ldots.n$, $a(a+b)(a+2b)\ldots.(a+\overline{n-1}b)$. The various hints which had been given of the interpolation of fractional meanings, such as that of Wallis [WALLIS, P. C.], and others of Leibnitz, the Bernoullis, Stirling, &c., have been extended with great power by the French and German mathematicians of the last eighty years. Two different lines were taken in the two countries. The Germans first began to consider how the ordinary notation might be extended. Vandermonde proposed to denote $m(m-1)(m-2)\ldots.$ to n factors by $[m]^n$; the brackets distinguishing it from m^n in the usual sense. Hindenburg, followed by Kramp and most of the Germans, proposed a much better notation. Considering x^m as denoting m unaltered factors, they made room in the symbol for a part expressive of the permanence of the factor, and wrote it $x^{m|0}$. Thus it became a particular case of $x^{m|a}$, which was made to stand for m factors, the first of which is x, and which alter by a at every step; giving

$$x^{m|a}=x(x+a)(x+2a)\ldots\ldots(x+\overline{m-1}a)$$
$$x^{m|-a}=x(x-a)(x-2a)\ldots\ldots(x-\overline{m-1}a)$$
$$(x+\overline{m-1}a)^{m|-a}=x^{m|a}$$
$$1^{n|1}=1.2.3\ldots\ldots n=n^{n|-1},$$

and so on. This notation certainly opens the road to convenient expression of a large number of striking formulæ. take its binomial theorem for instance,

$$(x+y)^{n|a}=x^{n|a}+nx^{n-1|a}y^{1|a}+n\frac{n-1}{2}x^{n-2|a}y^{2|a}+\ldots$$

which is perfectly analogous to the ordinary theorem.

Also the following:—

$$(1+A^{1|a}x+A^{2|a}\frac{x^2}{2}+A^{3|a}\frac{x^3}{2.3}+\ldots)^m=$$
$$1+(mA)^{1|a}x+(mA)^{2|a}\frac{x^2}{2}+(mA)^{3|a}\frac{x^3}{2.3}+\ldots\ldots$$

which is true for all values of m, and gives the binomial theorem if $A=1$, $a=-1$, and the exponential theorem if $Ax=1$, $a=0$. The analogous theorem to Taylor's is

$$\phi(x+h)=\phi x+\frac{\Delta\phi x}{\Delta x}h^{1|-\Delta x}+\frac{\Delta^2\phi x}{\Delta x^2}\frac{h^{2|-\Delta x}}{1.2}+\ldots.$$

which is well known.

We think it is to be regretted that this notation has not been more adopted in England: we do not remember at this moment any writer who has made much use of it, except Mr. Peter Nicholson, in his works on Involution and on Increments.

A name was to be found for this extension. The notion of calling x^2, x^3, x^4, &c. the *powers* of x, was an extension of the term as used by Euclid, which applied to the square on a line only. Not that the square on a line was originally called its power, but that the power of a line was measured by the capacity of its square. The object of the old geometers was to reduce every area to a square, which enabled them to describe it by one line; and hence a line seems to have been considered as having more or less power (of enclosing space) according as its square was greater or less: the power being measured by the magnitude of the square. The phraseology seems to have reached those who were not geometers: thus Diogenes Laertius tells us that Pythagoras discovered that* the 'subtending side of a right-angled triangle is as powerful as the two containing sides together.' But those who will smile at the idea of the power of a line residing in its square, will laugh outright at the notion of Kramp, who proposed, seeing x^n represents the *powers* of x, that the symbol $x^{n|a}$ should represent its *numerical faculties* (facultés numériques). From the powers and the faculties, we might have reached, possibly, the feelings and opinions, had it not been for Arbogast, who proposed to call the different cases, of $x^{n|a}$ by the name of *factorials*, a term which has now gained considerable currency among the German writers, and was approved by Kramp himself.

The French, on the other hand, follow Euler and Legendre in connecting the factorials from the outset with definite integrals, and the latter in adopting a specific notation, not derived from that of powers. Legendre signifies $1.2.3\ldots.n$ by $\Gamma(n+1)$, and hence the name of *gamma-functions* has been applied to them.

We shall give a slight account of the subject so far as it is in the way to be speedily reckoned among the elementary parts of mathematics.

A series or a product of n terms, is only distinctly conceivable when n is integer, but if it can be represented by a function in which n enters as a usual symbol of magnitude, and not as a number of terms or operations, then the function is intelligible, though not the representative of the series, when n is a fraction. To take a very simple case: it would be absurd to demand the value of $1+2+3+\ldots..+(n-1)+n$, when n is a fraction; but this series is $\frac{1}{2}n(n+1)$, which is always intelligible.

The equation

$$1+2+3+\ldots\ldots+n=\tfrac{1}{2}n(n+1)$$

is absurd except when n is a positive integer. In the times when the phrase 'less than nothing' was invented, it would have been said boldly that $2\frac{1}{2}$ terms of this series are $\frac{1}{2}\times2\frac{1}{2}\times3\frac{1}{2}$, or $35\div8$, and that -7 terms of it are $\frac{1}{2}(-7)(-6)$ or 21. All that we should now say is that the function which, when n is integer, is equal to $1+\ldots..+n$ becomes $35\div8$, and 21, when

---

* We translate quite literally, to show that Laertius was not geometer enough to know that the subtending and containing was said of the *right angle*, not of the *triangle*. His words are *ἴσον δύναται*, which Kraus, who in his turn was not geometer enough to venture the rendering of *ὀρθογώνιον* into Latin, translates *tantundem valere*. We take Laertius as meaning that the hypothenuse was as powerful as the two sides together: whether he understood his own phrase, or only caught it from the geometers, is another question. For other uses of the same phrase, see IRRATIONAL, P. C.

n is $2\frac{1}{2}$ and -7. Whether we are likely to be the gainers by refusing extensions of language which naturally present themselves, remains to be seen: it seems to us that '-7 terms of the series $1+2+\dots+n$' is a very innocent abbreviation of 'the value, when $n=-7$, of the function which, when n is an integer, is always equal to $1+2+\dots+n$.' But at any rate, mathematicians are now in the habit of passing from expressions in which n is an index of number of operations, to the equivalents in which n is only an index of magnitude, and of using the latter in the most general sense.

But there is an infinite number of ways of representing, for example, a function which is $1+2+\dots+n$ when n is an integer. If ϕn be a function which is unity whenever n is an integer, such as $\cos 2\pi n$, $1+\sin 2\pi n$, &c., then $\frac{1}{2}n(n+1)\times\phi n$ answers the condition as well as $\frac{1}{2}n(n+1)$. It is usual however to start with a radical function which is free from periodic multipliers, and there is generally no difficulty in deciding upon the selection. In all the cases which are most useful, the radical function is the one which is clear of all sines and cosines.

But it is to be remembered that in this branch of the subject we have not advanced so far as to make it coextensive with the theory of powers: it is in fact precisely in the condition of the theory of powers before the discovery of the multiplicity of values in x^n when n is fractional. We are thus limited to an arithmetical view of the subject. Some writers have censured Legendre for employing a new symbol $\Gamma(n+1)$, when $1^{n|1}$ was already in use: if, which may be doubtful, he had heard of the latter before he invented the former, he would, in our opinion, still have acted judiciously in inventing the additional symbol. He might have argued that it would not be wise to associate the second symbol with notions which are only true of the arithmetical case of it. As soon as the complete theory of the expression shall be given, $1^{n|1}$ is ready for it: in the mean while $\Gamma(n+1)$ expresses the arithmetical case of it, just as $\sqrt[n]{x^m}$ expresses that of $x^{\frac{m}{n}}$

The following are some of the cases, which are strictly intelligible when n is an integer, and in which the radical function remains intelligible when n is fractional:—

$$1+\tfrac{1}{2}+\tfrac{1}{3}+\dots\dots+\tfrac{1}{n}=\int_0^1\frac{1-v^n}{1-v}\,dv$$

$$1\times2\times3\dots\times n=\int_0^\infty\varepsilon^{-v}v^n dv$$

$$p\,(p+q)\dots(p+\overline{n-1}\,q)=q^n\frac{\int_0^\infty\varepsilon^{-v}v^{h+n-1}\,dv}{\int_0^\infty\varepsilon^{-v}v^{h-1}\,dv}$$

where $h=p\div q$.

The second equation, which may be thus written,

$$\Gamma(n)=\int_0^\infty\varepsilon^{-v}v^{n-1}\,dv$$

is the most important. The following are its principal properties:

1. Γn is finite when n is positive, but is infinite when n is 0 or negative. This draws a great distinction between it and $1^{n|1}$; for the general formula which connects factorials of positive and negative exponents, with a common augment, is

$$x^{-n|a}\times(x-na)^{n|a}=1$$

Γn, which is infinite when $n=0$, diminishes from thence very rapidly, becomes 1 when $n=1$, and thence further diminishes until $n=1{\cdot}461632\dots$, when it is least, being then $\cdot8856032\dots$. From thence it begins to increase, being 1 again when $n=2$, 1.2 when $n=3$, 1.2.3 when $n=4$, and so on.

2. The equation $\Gamma(n+1)=n\Gamma n$, so obviously true when n is an integer, is always true; giving also

$$\Gamma(n+1)=n\,(n-1)\dots\dots(n-m)\,\Gamma(n-m)$$

for every integer value of m. Hence a table of values is sufficient which extends through one unit: and the most convenient interval is that from $n=1$ to $n=2$. If, for instance, we wanted to calculate from such a table the value of $\Gamma(5\frac{1}{2})$ we should reduce it to $4\frac{1}{2}\times3\frac{1}{2}\times2\frac{1}{2}\times1\frac{1}{2}\times\Gamma(1\frac{1}{2})$, and take $\Gamma(1\frac{1}{2})$ from the table. Similarly Γn, when n is less than unity, would be found from $\Gamma(1+n)\div n$. When n is very small, Γn is $1\div n$ nearly.

3. The labour of calculating the table is much lessened by the following equation:—

$$\Gamma n\times\Gamma(1-n)=\frac{\pi}{\sin n\pi}$$

which is true when n lies between 0 and 1. One very useful result of it is $\Gamma\frac{1}{2}=\sqrt{\pi}$.

4. There is a constant to be introduced, which we shall call γ, the importance of which may in time compete with that of π and ε. It is the limit of the expression $1+2^{-1}+3^{-1}+\dots+x^{-1}-\log x$, as x is increased without limit: it is also the value of

$$\int_0^1\left\{\frac{1}{1-v}+\frac{1}{\log v}\right\}dv \text{ and of } -\int_0^\infty\varepsilon^{-v}\log v\,dv:$$

its value is

$$\gamma=\cdot5772156649015328606065\dots$$

5. If S_n represent $1^{-n}+2^{-n}+3^{-n}+\dots$ ad infinitum (See SUMMATION, P. C., for some of the values; also 'Differential Calculus,' *Library of Useful Knowledge*, p. 554), the logarithm (Naperian) of Γx may be found in either of the following ways:—

$$\log\Gamma(1+x)=-\gamma x\times\frac{1}{2}S_2\,x^2-\frac{1}{3}S_3\,x^3+\frac{1}{4}S_4\,x^4-\dots$$

$$=\frac{1}{2}\log\left(\frac{\pi x}{\sin\pi x}\right)-\frac{1}{2}\log\left(\frac{1+x}{1-x}\right)$$

$$+(1-\gamma)x-\frac{1}{3}(S_3-1)x^3-\frac{1}{5}(S_5-1)x^5-\dots$$

$$=\frac{1}{2}\log(2\pi)+\left(x+\frac{1}{2}\right)\log x$$

$$-x+\frac{1}{12x}-\frac{1}{360x^3}+\dots$$

6. A table of the values of comm. log. $\Gamma(1+x)$ is given by Legendre, for every thousandth of a unit from $x=\cdot000$ to $x=\cdot999$: an abridgment of this table, with means of completing it, is in the 'Diff. Calc.' *L. U. K.* p. 587. This function Γx is a fundamental mode of expression for the results of large classes of definite integrals. [INTEGRALS, DEFINITE, P. C. S.]

7. The function $\Gamma(n+1)$ is the value, or one of the values, of $1^{n|1}$, and we have

$$p^{n|q}=q^n 1^{\frac{p}{q}+n-1|1}\div1^{\frac{p}{q}-1|1}$$

$$=q^n\,\Gamma\left(\frac{p}{q}+n\right)\div\Gamma\left(\frac{p}{q}\right)$$

which holds whenever the second side is real and finite.

The student who desires to know more of the theory may consult Kramp's 'Analyse des Réfractions Astronomiques,' Strasburg, 1799, 4to., and the article 'Factorielles,' in the Supplemental (or third) volume of Montferrier's 'Dictionnaire des Sciences Mathématiques,' Paris, 1840, 4to. Also the article 'Facultat' in Grunert's Supplement to Klügel's 'Worterbuch der Reinen Mathematik,' Leipzig, 1836, 2 vols. 8vo. On the form Γx see Legendre's well known works the 'Exercices du Calcul Integral,' and that on Elliptic Functions. Some of the substance of these is in the treatise on the Differential Calculus, in *Library of Useful Knowledge.*

FACTORIES. The word 'Factory' has, within the last few years, acquired a more definite and circumscribed meaning than it before held. As a commercial term, it applies to the establishments for conducting trade in certain foreign or colonial parts, such as the 'York Factory' of the Hudson's Bay Company in America, the 'English Factory' at Canton, and so forth. As a manufacturing term, it is applied somewhat vaguely to any manufactory or large workshop where industrial operations are carried on. But in a legislative sense, as defined by a recent statute, the word *Factory* is taken to mean 'all buildings and premises situated within any part of the United Kingdom of Great Britain and Ireland wherein or within the close or curtilage of which steam, water, or any other mechanical power shall be used to move or work any machinery employed in preparing, manufacturing, or finishing, or in any process incident to the manufacture of cotton, wool, hair, silk, flax, hemp, jute, or tow, either separately or mixed together, or mixed with any other material, or any fabric made thereof.' It is in this limited sense that factories will be considered in the present article.

Legislative Provisions.—In the year 1833 a foundation was laid for the permanent supervision of cotton factories and others of a similar kind. There were, it is true, earlier enactments bearing on the subject. For instance, in 1802 an act was passed for the preservation of the health and morals of apprentices and others employed in cotton and other factories; the act directed the local magistrates to report whether the factories were properly conducted, and to adopt such sanatory regulations as they might think fit. Another act, in 1816, made various regulations as to the employment of children in cotton factories. Others were passed in subsequent years; and in 1831 an act, commonly known as Sir John Hobhouse's Act, and applying to cotton factories alone, provided that no child could legally be employed in such a factory under 9 years of age; that no person under 18 years of age should be allowed to remain in the factory more than 12 hours a day, and that the working hours on Saturdays should not exceed 9 hours. But these enactments were limited to cotton factories; and there was no efficient machinery for enforcing their observance: the act was therefore repealed in 1833, consequent on the proceedings of a committee of the House of Commons in 1832, on the condition of the persons working in factories.

The act of 1833 (3 & 4 Wm. IV. c. 103) contains numerous details; but the chief matters that relate to the subject are the following:—1. After January 1, 1834, no person under 18 years of age shall be allowed to work in the night, that is, between a quarter past eight P.M. and half-past five A.M., in any cotton or other factory in which steam or water, or any other mechanical power, is used to propel the machinery, except in lace factories. 2. No person under 18 shall be employed more than 12 hours in one day, nor more than 69 in one week. 3. There shall be allowed in the course of every day not less than 1½ hours for meals to every person restricted to the performance of 12 hours' work. 4. After January 1, 1834, no child shall be employed under 9 years of age, except in silk-mills. 5. After March 1, 1834, no child, except in silk-mills, shall be employed in any factory more than 48 hours in any one week, nor more than 9 hours in any day, who shall not be 11 years old; nor after March 1, 1835, who shall not be 12 years old; nor after March 1, 1836, who shall not be 13 years old; and these hours of work shall not be exceeded, even if the child has worked during the day in more factories than one. 6. Children and young persons, whose hours of work are regulated, shall be entitled to 2 holidays and 8 half-holidays in the year. 7. Children, whose hours of work are restricted to 9 hours a day, are not to be employed without obtaining a certificate from a physician or surgeon, certifying that they are of the ordinary strength and appearance of children of the age before mentioned, which certificate is to be countersigned by some inspector or justice. 8. The crown is to appoint, during pleasure, four persons to be inspectors of factories, with extensive powers as magistrates, to examine the children employed in the factories, and to inquire respecting their condition, employment, and education; and one of the secretaries of state shall have power, on the application of an inspector, to appoint superintendents to assist in carrying out the provisions of the act. 9. The inspectors are to make all rules necessary for the execution of the act, and to enforce the attendance at school, for at least two hours daily out of six days in the week, of children employed in factories, from whose weekly wages a deduction, not exceeding a penny in every shilling, is to be made for the expense of schooling. 10. No child shall be employed who shall not, on Monday of every week, give to the factory master a certificate of his or her attendance at school for the previous week. 11. The interior walls of every factory shall be whitewashed every year. 12. A copy or abstract of the act shall be hung up in a conspicuous part of every factory. 13. The inspectors shall regularly, once a year, report their proceedings to one of the secretaries of state. There are other clauses regulating the hours of working where a water-wheel disturbs the uniformity of the working power; the steps to be taken in order to obtain regular certificates of age for the children requiring them; the erection of schools, where necessary; and the mode of enforcing the provisions of the act.

In the following year a short explanatory act was passed, to render more clear the meaning of the legislature on certain points; but with this exception, no further change was made till last year (1844). Committees of the House of Commons sat in 1840 and 41, and bills were from time to time introduced by individual members; but the Act of 1833 remained the groundwork of all the proceedings in respect to factories. The Act itself was in great part the result of a Commission which had been appointed in the early part of 1833, and which had collected information by means of district commissioners in all the factory districts. This local machinery formed a groundwork for the inspectorship afterwards established by the government when the act was obtained. Four inspectors were appointed, and the British Islands were mapped out into four great divisions; the cotton and woollen district of Yorkshire, Lancashire, and the immediate neighbourhood, forming the 1st; the eastern and southern counties of England the 2nd; some parts of the West of England, nearly the whole of Wales, and the southern half of Ireland, constituting the 3rd; the northern half of Ireland, the whole of Scotland, and the four northern counties of England, the 4th. Each district was placed under one inspector, who made arrangements for becoming personally acquainted with every factory in his district employed for textile manufactures. Surgeons were appointed to grant the certificates required for the children; a system of occasional supervision was established; the inspectors communicated with the chief mill-owners on any points of difficulty which occurred; and the schooling of the children was gradually entered upon. One great difficulty however was this, that many manufactories, as a means of escaping from the provisions of the Act, gradually discharged the children who were within the specified ages, and employed others of an age to which the education and the working-hours clauses did not apply; and many young children were thrown out of employ in consequence.

The Act rendered imperative some sort of schooling for the factory children; but it did not lay down rules for its government. The arrangements accordingly became of a very crude and heterogeneous character. Mr. Saunders, one of the Factory inspectors, in his Report for 1843 (*Parl. Pap.* 1843, vol. xxvii. p. 355), states that the factory children receive their education from five different sorts of schools, which he classes as *Sunday Schools*, *Dame Schools*, *Factory Schools*, *Church Schools*, and *Dissenters' Schools*. The disposal of the children on Sundays is a matter which does not come under the control of the inspectors; but the four classes of week-day schools are those which affect the daily regulations of the factories. The dame-schools or private schools, kept by a master or mistress for their own profit, and not under the control or management of any other person, are of a very mean and inefficient kind, utterly wanting, in respect to instruction, books, and discipline, in the means of working out the required object. The factory-schools are such as are held in or near the factory where the children are employed, and are under the control and management of the owner of the factory. 'Some mill-occupiers have in a most praiseworthy manner spent large sums of money in school accommodation, and have taken great care in the selection of teachers. In these cases, particularly if the mill occupier continues to interest himself in the management of the school, such a factory-school will be as efficient as any other school conducted on the same principle. Some of the schools are supported wholly at the expense of the factory master. Other masters guarantee the payment of all expenses, but require each child to pay a weekly school-fee.' (p. 356.) The Church Schools and the Dissenters' Schools, supported in many cases by powerful religious denominations, partake of the general character of such classes of schools, in respect to education and discipline.

Mr. Saunders remarks that the efficiency of the education depends not so much on whether the school be of one or other of the above four classes, as on the mode in which it is conducted. Many of the factory-schools, where the owner cares very little about the matter, are as bad as the dame-schools. In one factory the schoolmaster was an overlooker, who had to attend both to spindles and to scholars. In another he was a cotton-warp winder. In a third he was an old disabled soldier. Every week (as before stated) each child has to bring to the factory a certificate of attendance at school; and Mr. Saunders gives fac-similes of four of these certificates, to show the efficiency of the teachers who wrote them. They run thus:—'I do hereby certfy that my scholors have attend 2 hours every day durang the last week, May 2, 1843.' 'Hi do her testify that these children Have tended the school too hours during last whek, May 2, 1843.' 'These children have attended My school 2 howers every day last week, May the 2, 1843.' 'This is to certify that these children attends regular the school six days a week, two hours a day. May the 2, 1843.' (p. 379.) These, as may be supposed, are the most unfavourable examples. In many cases the mill-owners take great interest and expend considerable sums in giving efficiency to the schools. At Messrs. Marshall's, at Leeds, for instance, there is near the factory a neat red building erected purposely as a school-room for the factory children. 'It contains, besides private apartments for the master and mistress, a boys' school, measuring eighty feet by thirty-six, a girls' school nearly as large, and a class-room for lectures, &c. between the two. One of the rooms contains an organ. In the boys' school there are benches arranged on the class or monitorial system, each bench having a kind of shelf beneath it, on which the boys place their caps, and a monitor's seat, which is also a box for containing books. Although intended principally for the factory children, yet these schools are open to all the children in the neighbourhood whose parents choose to adopt the regulations laid down for its good governance. In the operation of the Factories Act, all the children in a factory are bound to attend school for a certain period each day; those who work in the forenoon must attend school in the afternoon; those who work in the afternoon are at school in the forenoon. Hence there is a distinction in the schools belonging to Messrs Marshall between the "half-time hands" and the other scholars; the former being those engaged in the factory, and under the influence of the Factories Act, and the latter being other children living in the neighbourhood. Altogether there are about three hundred and fifty boys, and a hundred and eighty girls, who are under the care of a master and mistress engaged expressly for the school. The school-rooms are comfortably warmed by hot-water apparatus, and there is a large plot of ground outside the building which serves as a play-ground.' ('Penny Magazine,' No. 754.)

In 1844 an act was passed (7 & 8 Vict. c. 15) which came into operation in October of the same year, and effected certain changes in the law as to factories. An 'Office of Factory Inspectors' is to be established in London. Persons beginning to occupy a factory must send notice of it to this office. The powers of inspectors to enter factories and schools is increased. The certifying surgeons are to be appointed by the inspectors; and the certificates are to have a definite form and expression. The whitewashing or painting of a factory is placed under strict regulations. Provision is made for the protection of children from the effects of the water in 'wet-flax spinning,' and from accidents by the machinery while in motion. Children may be admitted and employed at eight years of age (the former minimum having been nine years). The maximum amount of daily work for each child is seven hours, subject to diminution in certain cases. All females are regarded in the same light as 'young persons' (i. e. from thirteen to eighteen years of age), in respect to the limitation of the hours of work. The recovery of lost time by the stoppage of machinery, the regulation of the meal-times in the factories, the holidays given to the children, the control of their attendance at school, the inspection of dangerous machinery, and many other points, are modified or extended in this act; which however preserves the general character of the act of 1833.

Statistical Details.—One result of the act just alluded to, viz. that of 1833, has been a more intimate knowledge of the statistics of factory operations than would otherwise have been obtainable.

The number of power-looms employed is, to a certain degree, an index to the extent of factory operations; since the substitution of a power-loom for a hand-loom involves the substitution of a large and well-organized factory for, perhaps, the humble cottage of the hand-loom weaver. In a return made to government, two or three years after the appointment of the factory inspectors (*Parl. Pap.*, 1836, vol. xlv. p. 14), the number of power-looms then employed is stated to have been—

	Cotton.	Wool.	Silk.	Linen.
In and near Manchester .	47,039	758	340	0
Clothing District of Yorkshire .	3,114	3,128	0	0
Cheshire and Derbyshire .	18,849	432	0	0
Scotland . . .	17,531	22	0	168

together with a small number scattered in other districts.

The same volume (p. 51) gives a return of the number of factories, and of the persons working therein, in 1836. For brevity we will call the four districts, into which the kingdom is divided in respect to factory inspectorship, the East Anglian, the West Anglian, the North Anglian, and the Scotch.

	Cotton.		Wool.		Silk.		Flax.	
	Mills.	Persons.	Mills.	Persons.	Mills.	Persons.	Mills.	Persons.
East Anglian District	69	8,613	106	4,102	76	10,099	48	1,489
West Anglian ,,	11	1,648	855	16,439	26	1,510	5	1,003
North Anglian ,,	817	134,986	717	46,643	30	6,538	77	11,284
Scotch ,,	190	36,945	114	4,129	6	686	211	18,024

By the commencement of 1839 (*Parl. Pap.*, 1839, vol. xlii.) the numbers had thus risen:—

	Cotton.		Wool.		Silk.		Flax.	
	Mills.	Persons.	Mills.	Persons.	Mills.	Persons.	Mills.	Persons.
East Anglian District	202	20,833	943	55,462	71	10,559	60	7,996
West Anglian ,,	199	39,304	416	15,761	162	17,498	38	2,126
North Anglian ,,	1,309	159,050	236	8,916	80	5,498	71	6,451
Scotch ,,	216	40,198	143	6,307	5	763	223	26,914

Another return (*Parl. Pap.* 1843, vol. lvi. p. 36) gives a series of numbers under three different points of view; the first being classed according to the kind of textile material; the second, according to the location in different parts of the empire; and the third, according to the ages and sexes of the workpeople.

	No. of Factories.	Horse-power employed.	Persons employed.
Cotton . . .	1,819	55,785½	259,385
Wool . . .	1,738	15,564½	86,446
Silk . . .	268	2,977	34,318
Flax . . .	392	9,585	43,487
Total . .	4,217	93,912	423,636
England . .	3,475	77,804½	347,008
Scotland . .	492	12,448½	59,313
Ireland . .	95	3,001	14,870
Wales . . .	155	657½	2,446
Total . .	4,217	93,911½	423,636

Males under 21	100,654
Males 21 and above . . .	77,999
Females under 21 . . .	163,252
Females 21 and above . .	81,566
Total	423,471

There are one or two trifling discrepancies in the sum-totals not explained in the Report. It may be well to remark that these numbers relate to the workpeople actually employed within the factories at one or other of the above four kinds of textile manufacture. The whole number who earn a living by the clothing arts, including those engaged in hand-loom weaving, stocking-making, calico-printing, dyeing, bleaching, &c., very greatly exceeds the above, and has been variously estimated by different writers.

In a work published in 1840 ('Cotton Manufacture of the United States,' by James Montgomery) a comparison is drawn between certain features of the factory-system as observable in America and in England:—'In every department the rate of wages is generally higher in the United States than in Britain; nor do I think that they will for many years be so low in this country as in Great Britain. The price of living here is higher, and the hours of labour longer; besides, the greater part of the factory workers being connected with farming, whenever wages become reduced so low as to cease to operate as an inducement to prefer factory labour above any other to which they can turn their attention, then a great many factories will have to shut up. During a stagnation of trade, it is common for the manufacturers here to stop a part or the whole of their factories, and then the workers retire to their farms; such was the case in 1837, when a vast number of factories were entirely shut up. Yet it seemed not to affect the workers very materially: indeed, many of the girls who had been some time in a factory seemed to rejoice and to regard it as a time of recreation' (p. 137). Factories may be shut up in England, or work half-time, but the workers do not turn their hands again to agricultural pursuits. The whole tenor of the evidence collected by the Commissioners and Inspectors seems to show, that however low factory wages may be, it is very rarely indeed that any of the workers turn to field employment.

Although it was so late as 1790 that the cotton manufacture was established in the United States, there were in 1831, in full operation 801 factories; containing 33,433 looms and 1,246,703 spindles; employing 18,590 adult males, 38,927 adult females, and 4691 children; and consuming 77,457,316 pounds of cotton yearly.

The factories at Lowell in Massachusetts exemplify more than any others the rapid progress of factory labour in America. The territory of Lowell, comprising an area of four square miles, was until the year 1819 a barren spot, but provided with good water-power. Mr. Boot, a wealthy Boston merchant, discovered its resources, and established a company for turning them to account. This was followed by the formation of other companies, by whom the textile manufacture was carried on with great energy. A period of twenty years raised the district from almost a wild state to the position of a flourishing seat of manufacture, possessing a population of twenty thousand inhabitants. In 1839 there were at Lowell 29 factories, exclusive of print-works and dye-works; 163,404 spindles; 5094 looms; consuming weekly 347,300 pounds of cotton; and dyeing and printing 255,000 yards of woven goods per week.

From the Sixth Decennial Census of the United States, taken in 1840, the following information was obtained respecting the textile factories manufactures:—

Woollen.—Number of fulling-mills, 2585; woollen factories, 1420; value of manufactured goods, 20,696,999 dollars; persons employed, 21,342; capital invested, 15,765,124 dollars.

Cotton.—Number of factories, 1240; number of spindles, 2,284,631; dye-works and print-works, 129; value of goods, 46,350,453 dollars; persons employed, 72,119; capital invested, 51,102,359 dollars.

Silk.—Number of pounds, reeled, thrown, or made, 15,745; value of goods, 119,814 dollars; males employed, 246; females and children, 521; capital invested, 274,374 dollars.

Flax.—Value of goods, 322,205 dollars; persons employed, 1628; capital invested, 208,087 dollars.

Mixed Fabrics.—Value of goods, 6,545,503 dollars; persons employed, 15,905; capital invested, 4,368,991 dollars.

The statistical returns made to parliament respecting manufactures on the Continent, though full of valuable information, are scarcely complete enough to furnish a classified list of textile factories, in the limited sense employed in this article.

FAGOPYRUM, a genus of plants belonging to the natural order Polygoneæ. It has a 5-parted perianth, 8 stamens, 3 styles, a 1-seeded trigonous nut, a central embryo, and large foliaceous, contorto-plicate cotyledons. There is but one British species of this plant, the *F. esculentum*. This is the *Polygonum Fagopyrum* of Smith, and known as the common Buck-Wheat. It has an erect stem without prickles, the flowers in cymose panicles, 8 stamens, leaves cordate, sagittate acute, a triquetrous acute nut with entire angles. This is a valuable plant, as it grows on the worst and poorest soils, and is often sown as food for game. Though now admitted into the British Flora, there can be no doubt that it was originally a native of Persia and other Asiatic countries. It was introduced into Europe by the Crusaders; and hence in many parts of France, where it is commonly grown, is called Saracen Corn; and so much is it esteemed in Belgium, that M. Bory St. Vincent says he was shown the tomb of the person who is reported to have first brought it into that country. [Buck-Wheat, P. C.]

(Babington, *Manual of British Botany*; Burnett, *Outlines of Botany*.)

FAHRENHEIT, GABRIEL DANIEL, an able experimenter in natural philosophy, was born at Danzig near the end of the seventeenth century, but the precise year of his birth is unknown. His father intended that he should engage in a mercantile occupation, but his own taste inclining strongly to scientific pursuits, he used every opportunity of employing himself in such physical researches as his circumstances permitted.

Having travelled through different parts of Germany in order to acquire information respecting the subjects of his studies, he came to Holland, and established himself at Amsterdam as a maker of philosophical instruments.

He considerably improved the aræometer [Aræometer, P. C. S.], but he is chiefly distinguished for the invention of that particular scale which he applied to thermometers [Thermometer, P. C.], and has ever since been generally in use in this country. The fluid which he employed in the construction of the thermometer was mercury; and to the bulb, instead of a globular, he gave a cylindrical form. The graduations were generally executed on paper which was wrapped about and made to adhere to the tube, and the instrument was contained in a glass cylinder.

Fahrenheit was elected a Fellow of the Royal Society of London in 1724; and in the 'Philosophical Transactions' for that year are papers by him on the heat of liquids in a state of ebullition, on the freezing of water in vacuo; on the specific gravities of certain bodies; also on an improved barometer and aræometer. He contrived a machine which he intended to be used for the purpose of draining marshes; but his death, which took place in 1740, prevented him from completing it.

FAITHORNE, WILLIAM. This distinguished English engraver of the time of Charles I. was born in London, but in what year is not known. He was instructed by Mr., afterwards Sir Robert Peake, painter and printseller, with whom he worked three or four years before the breaking out of the rebellion; and when Sir Robert Peake was made Lieutenant-Colonel, and intrusted with a command in Basing-House, Faithorne enlisted under him, and they were both taken prisoners together. Faithorne was brought to London and confined in Aldersgate, where he resumed the graver; he was however shortly afterwards released and permitted to go to France. He returned about 1650, and opened a print-shop in the Strand, near Temple Bar, and prosecuted his art at the same time. About 1680 he gave up this shop, removed to Printing-House Yard, Blackfriars, and in addition to engraving pursued portrait-painting in crayons. He died in 1691, and was buried in St. Anne's, Blackfriars.

In 1662 Faithorne published a treatise on engraving, dedicated to Sir Robert Peake, entitled 'The Art of Graveing and Etching, wherein is expressed the true way of Graveing in Copper. Also the manner and method of that famous Callot, and M. Bosse, in their several ways of Etching.'

Walpole has given a considerable list of Faithorne's prints, of which the following are some of the best:—His own Head looking over his shoulder, with long hair; Sir William Paston, Bart., 1659, which Walpole terms his most perfect work; Lady Paston, same date, probably after Vandyck; Margaret Smith, widow, wife of Sir Edward Herbert, after Vandyck; Montagu Bertie, second Earl of Lindsey, after Vandyck; Sanderson, 1658, prefixed to his *Graphice*, after Zoust; Anne Bridges, Countess of Exeter, after Vandyck; Thomas Hobbes, ætat. seventy-six; Henrietta Maria, with a veil, executed in Paris; a large full-length emblematical print of Cromwell, in armour; Queen Catherine, in the dress in which she arrived in England; Barbara, Countess of Castlemaine; Prince Rupert, after Dobson; Dr. Harvey, bust on a pedestal; Sir Thomas Fairfax, after Walker; John Milton, ætat. sixty-two, drawn by Faithorne himself, &c., &c.; and four illustrations to Taylor's 'Life of Christ,' the Last Supper, Christ Praying in the Garden, the Scourging, and the Marriage of Cana. His works were chiefly portraits. His son William, called William Faithorne the Younger, engraved portraits in mezzotint, but he was of dissipated habits, and he died towards the close of the seventeenth century, aged about thirty. There are heads by him of Mary, Princess of Orange, Queen Anne, Prince George of Denmark, Charles XII. of Sweden, Dryden, &c. (Walpole, *Catalogue of Engravers*, &c.)

FALCONET, ETIENNE MORICE, a sculptor of considerable, but transient, reputation, was born of poor parents at Vevay in Switzerland, in 1716. He studied several years under Lemoine, and first made himself known by a group of Milo destroyed by the Lion, for which he was elected a member of the French Academy of Painting and Sculpture in 1745, and of which he was subsequently made a professor, and eventually rector.

In 1766 Falconet was invited by Catherine II. to St. Petersburg; and here he executed his most celebrated work, the colossal equestrian statue of Peter the Great, which is fixed on a large piece of rock, on the place in front of St. Isaac's Church; it occupied him three years. He returned to Paris in 1778, and died there in 1791. Falconet wrote several theoretical works upon the arts, as 'Reflexions sur la Sculpture,' &c., which appeared originally separately, but were published together at Lausanne, in 6 vols. 8vo. in 1782, and at Paris in 3 vols. 8vo. a few years afterwards. He was a zealous critic, and frequently very warm in the expression of his opinions, especially his censures. But in his own practice he was mannered. His works display little of the proportions or character of the antique. He never was in Italy.

(*Biographie Universelle.*)

FALKLAND, LUCIUS CARY, VISCOUNT, was the eldest son of Henry Cary, Viscount Falkland [Falkland, Henry Cary, Viscount, P. C.], and was born in 1610. His father was Lord-Deputy of Ireland from 1622 till 1629, and during this time he was educated at Trinity College, Dublin, but afterwards at St. John's College, Cambridge. Before he was of age he inherited an ample fortune from his grandfather, and soon afterwards went over to the Netherlands, with the intention of taking a command, but finding the campaign inactive, he returned to England. Having conceived a desire to be able to read accurately the Greek authors, he secluded himself at his seat near Burford in Oxfordshire, and prosecuted his design with such vigorous industry that he became a master of the language in an incredibly short time. His house was only about ten miles from Oxford, and Chillingworth and other learned men of the University were at this time in the habit not only of visiting him, but of residing with him. In 1639 he joined the expedition against the Scotch. His peerage, being Scotch, did not entitle him to sit in the House of Lords, and in 1640 he was elected member for Newport, Isle of Wight, in the parliament which assembled on the 13th of April, and was again elected for the same borough in the parliament which met on the 3rd of November in the same year.

Lord Falkland was free from any party bias, and thinking that the leaders of the popular party were in certain instances pushing their measures to an extent which was illegal and fraught with danger, he opposed them strenuously: hence he came to be regarded as an advocate of the court, and Charles I. invited him to become one of his privy council, and offered to make him secretary of state in the room of Sir Henry Vane, whom the king had dismissed. Lord Falkland was much disinclined to associate himself with the court party, but after much persuasion by Lord Clarendon and other personal friends, he was prevailed upon to accept the king's offers. His severity of moral principle was ill fitted to harmonise with Charles's duplicity and unconstitutional designs, but the civil war having commenced, he adhered to him with inflexible firmness, using every effort to reconcile the contending powers, and, though without any military command, attending the king on all occasions of conflict or danger. But his alacrity of spirit had deserted him, and when sitting among his friends, after long silence and frequent sighs, he would ejaculate, 'Peace, Peace,' in a mournful tone, and passionately profess that 'the very agony of the war, and the view of the calamities and desolation the kingdom did and must endure, took his sleep from him, and would shortly break his heart.' He insisted on making one in the first rank of Lord Byron's cavalry at the battle of Newbury, September 20, 1643, and on the first encounter was shot in the belly with a musket-ball; he instantly fell from his horse, and his body was not found till the following day.

Lord Clarendon, who was his intimate friend, has pronounced a long and eloquent eulogium on his character, which indeed appears to have been worthy of the highest admiration. His chief work was 'A Discourse on the Infallibility of the Church of Rome,' which Swift, in his 'Letter to a Young Clergyman,' praises for its purity and simplicity of style.

(*Biographia Britannica;* Clarendon's *History of the Rebellion*, book vii.)

FALKLAND ISLANDS. Since the article Falkland Islands was published in the P. C., much new information about them has been obtained, and these islands have been made a British colony. They are situated between 51° and 53° S. lat. and between 57° and 62° W. long., and form a group of islands in the Southern Atlantic, consisting of two principal islands, East and West Falkland, with a considerable number of smaller islands clustered around them and in the straits between them. East Falkland is about 90 miles long, and on an average 40 miles wide; West Falkland is about 80 miles long with a mean width of about 25 miles. The smaller islands, about two hundred in number, vary considerably, from sixteen miles in length and eight in width to mere islets of half a mile in diameter. East Falkland is computed to contain 3000 square miles; West Falkland is estimated at 2000 square miles. If the adjacent islands are added, the whole group may be estimated to contain about 6000 square miles, or nearly two hundred more than Yorkshire.

Tides and currents.—The rise of tide is about four feet at neap and eight feet at spring tides. The principal swell comes from the south-east. Scarcely any tidal current is perceptible on the south-east coast of East Falkland. But along the south, east, and west shores it increases in strength, until among the Jason Islands it runs six miles an hour, and causes heavy and dangerous races. The tide flows from both openings into Falkland Sound, or the Straits separating East and West Falkland, and meets near the Swan Islands.

There is a perpetual current setting past the group from south-west to north-east, which continually brings drift-wood to its southern shores. On all parts of the southern shores that are open to the south-west, the beaches or rocks are covered with trees, which have drifted from Staten Land or Tierra del Fuego. This current continues to a distance of two hundred miles to the north-eastward of Berkeley Sound, as is indicated by great quantities of drift-kelp, water-worn trunks, and branches of trees, which are carried so far. But this current never runs more than two knots an hour, and in all probability its usual rate is even less than one knot.

Coasts.—The whole group is deeply indented by sounds, bays, harbours, creeks and inlets. Perhaps there is no country in the world which exhibits such an irregular coast line, and is so full of harbours and creeks. On West Falkland and some small islands near it, there are high precipitous cliffs in a few places exposed to the western seas; but other places, and especially the southern portions of East Falkland, are so low that they cannot be seen from the deck of a vessel five miles distant.

Surface and soil.—We know very little of West Falkland. Fitzroy states that the average height of it is greater than that of East Falkland, though the highest hills seem to be in the last-mentioned island, with which we have become pretty well acquainted within the last twenty years. A chain of high hills, called the Wickham Heights, runs across it in a due east and west direction from Port William to Port Sussex on Falkland Sound. Many of them rise to the elevation of mountains, as Mount Usborne, near Port Sussex, which is 2300 feet above the sea level; the other hills vary in height from 800 to 2000 feet. They consist of stratified quartz rock, which is extremely rugged at the summits, where it sometimes assumes the most wild and fantastic forms. The summits terminate in points or ridges, are seldom rounded, and never tabular.

The country north of the Wickham Heights has a hilly surface, and at several places these hills rise to some hundred feet above the general level. That portion of the island which lies south of the Wickham Hills may be considered as a level plain, gently declining towards the southern shores. This plain is traversed by a number of wide and shallow depressions running from the base of the mountains to the sea. They are frequently a mile and more wide, and the tracts between them rise on an average fifty or sixty feet above their bottoms. Thus the country exhibits an undulating surface. Governor Moody says that this is the best tract of land that he has seen in the Falkland Islands.

In some parts of the island the bottoms of the valleys are covered by great angular fragments of quartz rocks. The blocks vary in size from that of a man's chest to ten or twenty times as large, and occasionally they are still larger. They do not occur in irregular piles, but are spread out in level sheets or great streams. These streams of stones vary from a hundred feet to a mile in width. The bottom of a valley about ten miles from Port Louis is entirely covered with such stones, an area of about three miles and a half by one mile.

A view of the country from one of the heights is dismal indeed. Moorland and black bog extend as far as eye can discern, intersected by numerous streams and pools of yellowish brown water. On that account the earlier voyagers have spoken with contempt of these islands; but when it was known that the cattle which had been left there by the European settlers had not only increased in number, but also in size, it was supposed that the soil must possess a considerable degree of fertility. The most general description of soil is of a very fine dark, almost black, peaty quality, compact, and from a few inches to two feet in depth, lying upon a subsoil of red gravelly clay where the underlying rocks consist of clay-slate. On the hills the subsoil is chiefly a stiff dirty white clay. The last-mentioned districts are wet and swampy, producing coarse wiry grasses and mosses. Where the subsoil consists of gravelly clay, the land is much drier, the soil more earthy, and the grasses of good quality, although even these tracts contain many spots of swampy land and peat-bogs a few feet in depth, arising from springs and rivulets which do not find a ready escape. About one-fourth of the island has a very thin soil, which produces a few grasses, but chiefly heath and some shrubs. In all cases, where the peaty soil has become mingled with the subsoil, as in the bottoms of many of the valleys, by the sides of the streams, and almost always at the mouths of the streams, the soil is of the richest quality and the grasses remarkably thick and verdant. This kind of soil abounds south of the Wickham Heights.

Rivers and Lakes.—There are few rivers. The San Carlos is the largest. It winds very much, and is only about thirty miles in length, and navigable for boats about eight miles from its mouth. There is, however, a great number of springs and rivulets, and also many fresh-water lakes or ponds, varying in size from thirty yards to three or four miles in circumference.

Climate.—The climate resembles that of England, but is still more equable; the summers are not so hot and the winters not so cold. The thermometer ranges in general between 30° and 50° in winter, and between 45° and 70° in summer; sometimes, but rarely, it rises to 80°, and descends to 25° or even 20°. There is little snow or ice in winter; the ice seldom exceeds half an inch in thickness, and the snow is rarely more than ankle-deep, and remains a very short time upon the lower lands. There is very little foggy weather, and thunder and lightning are extremely rare. Light passing showers are frequent, but a day of constant rain seldom happens. The total amount of rain which falls in the year is probably less than in England, and certainly not more.

The prevalent direction of the wind is westerly, shifting between north-west and south-west. Easterly winds are very rare. Northerly winds are more frequent, and they bring gloomy wet weather. Hard gales blow from between south-east and south-west, but they rarely last more than twenty-four hours. The westerly winds commonly commence at nine o'clock, blow with a force frequently bordering on a gale through the day, and die away about four or five in the afternoon. The nights are generally calm, and the contrast of the bright, still, early mornings and calm evenings with the stormy mid-day is very great and striking. Gales and stormy weather are much more frequent in summer than in winter.

Productions.—There are no trees in these islands; but it is thought that some of those which grow in Tierra del Fuego would succeed here, if properly managed. There are, however, three different kinds of bushes which are used as fuel. But the numerous peat moors yield a fuel of a dark black colour, which is of excellent quality. The grasses, which at present must be considered as constituting the most important production of the group, are long and apparently coarse, but they possess very nourishing qualities. One of them, called *tussac*, has especially attracted the attention of naturalists and graziers. It is a gigantic sedgy grass of the genus *Carex*, whose blades generally measure seven feet in length and three-quarters of an inch in width. It covers the great mosses, and grows on the worst soil, but in its natural state is only found near the sea, and it hardly ever extends more than half a mile from the beach. Another grass of very nutritious quality, the *arundo alopecurus*, is more abundant and universally distributed over the whole country. Of other natural vegetable productions useful to man we find mentioned the balsam bog (*Bolax glebaria*), the wild celery (*Apium graveolens*), the tea plant (*Myrtus nummularia*), whose leaves are used as a substitute for the Chinese herb, the little cress (*Cardamine glacialis*), the scurvy-grass (*Oxalis enneaphylla*), and the native spinach, a species of *Adriplex*.

The attempts to introduce our vegetables have generally succeeded: turnips, cabbages of all sorts, lettuces, radishes, and potatoes grow to perfection, and it is thought that with proper attention, cultivation, and good seed, all the common garden productions would succeed. It is still doubtful if grain, especially wheat, will grow. It has been proved that flax will grow well, but hemp has not been tried.

Indigenous animals are not numerous. The only quadruped is the warrah or wolf-fox, a peculiar species confined to this archipelago. It is about the size of an English hound, but slender, with long legs. Rats and mice had unintentionally been introduced by the Europeans. The other animals which are found in a wild state have been brought there with the intention of being left, or remained there when the European settlements were broken up. The most important are the wild cattle, which are met with everywhere: the number in East Falkland is stated to amount to 30,000 head, though large numbers have been killed by the crews of whaling-vessels, or others which have resorted to the numerous harbours of the islands. The animals appear to be at least equal in size to the best English breeds. Wild horses are only found on East Falkland, north of Wickham Heights. They are of a small breed, about 14 hands high, and in general ugly animals. Sheep thrive admirably in these islands; their number is stated to be about three thousand. Wild pigs are only found on some of the smaller islands. Rabbits are found in incredible numbers at several places, and their skins are exported.

Wild fowl is abundant,—two kinds of wild swans, three kinds of geese, four or five kinds of ducks, two kinds of snipe, teals, shags, penguins, rock-hoppers, sand-pipers, gulls, Cape-hens, white-birds, albatrosses, owls, a large kind of carrion-hawks and rooks, with some other smaller species.

Hair and fur seals, which were formerly so abundant about these islands, have considerably decreased in number. Black whales are still numerous in the sea west of West Falkland, where many American and French vessels are employed in taking them, and appear sometimes even in Berkeley Sound. The supply of fish is abundant, but there is no great variety. The most common are a kind of mullet and the smelt; the former attains a large size. There are no frogs or reptiles of any kind, and only a few flies and spiders.

Bituminous coal, fit for a variety of purposes, is found on Sussex Harbour, East Falkland; and excellent peat occurs almost everywhere.

History and Settlement.—It must remain doubtful if Amerigo Vespucci, on his third voyage, which by Humboldt has been identified with that of Pedro Alvarez Cabral, had seen the Falkland Islands. The latitude given by Vespucci agrees pretty well, but the description of the country is so much at variance with the physical geography of the group that it has suggested to Captain Fitzroy the idea that Vespucci must have seen New Georgia. We know with certainty that these islands were seen in 1592 by Dr. John Davis, who accompanied Cavendish in his second voyage; and Hawkins, who sailed along them in 1594, called them Hawkins's Maiden Land. In 1690 Strong sailed through the channel which separates East and West Falkland, and called it Falkland Sound, which name afterwards was transferred to the whole archipelago. Several vessels from St. Malo passed near the islands between 1706 and 1714, and from these they were named by the French, Isles Malouines. In 1764 the French, under the auspices of the famous navigator Bougainville, established a colony on one of the harbours of Berkeley Sound on East Falkland, and called it St. Louis; and two years later the British formed a settlement on West Falkland, under Captain Macbride, on the inlet, called Port Egmont. Soon afterwards the French, in 1767, ceded their settlement, from political motives, to the Spaniards, who in 1770 attacked the English colony with a superior force and took it. After some negotiations, which nearly led to a rupture between the two countries, Port Egmont was restored to the English. But as the place for the colony had not been well chosen, and none of the advantages which had been expected from its establishment resulted to the nation and its commerce, the British abandoned the colony, but did not give up the rights of possession. The Spaniards also withdrew their garrison from Port Louis, but the precise time at which it took place is not known; probably it was in the beginning of this century.

In the beginning of this century, the whale fishery in the Southern Atlantic began to be prosecuted on an extensive scale by some European nations and the North Americans. Most of these vessels visited the Falkland Islands, especially to kill wild cattle and refresh their crews. They soon discovered that the islands were visited by a great number of hair and fur seals, and these animals attracted a considerable number of other adventurers. Thus some persons were almost always found on Berkeley Sound. This induced the government of the newly established republic of Buenos Ayres to take possession of the island in 1820. England protested against this step in 1829. Meanwhile the government of Buenos Ayres had formed a settlement at Port Louis in 1823, but Great Britain asserted its rights, and the colony was given up to the English in 1833. For some years only a lieutenant of the navy with a boat's crew resided at Port Louis, but as it appeared that this force was unable to keep in order the numerous crews of the whaling and sealing vessels which resorted to the island, the British government resolved in 1840 to colonize this group, and to send there a governor and a small force. They settled at the old establishment in Port Louis; but on examining the country in its vicinity, it was found that Port William, south of Berkeley Sound, offered greater advantages as a naval station and port of refuge, and in 1844 Governor Moody laid out a town on the southern shores of Stanley Harbour, a land-locked inlet, sheltered from every wind. The settlement at Port Louis, called Anson, however is also to be preserved.

(Weddell's *Voyage towards the South Pole*; Fitz-Roy and Darwin, in *Narrative of the Surveying Voyages of the Adventure and Beagle*; and Reports of the Colonial Land and Emigration Commissioners in 1843, 1844, and 1845.)

FALSE IMPRISONMENT is an unlawful arresting or imprisoning, either without just cause or without proper legal process. In whatever manner the unlawful detention arises, it is false imprisonment, for which an action in damages lies. Where there is a colour of authority, the usual form of the action for false imprisonment is an action 'on the case;' in other cases the form of the action is that of 'trespass.'

When erroneous process issues out of a court having jurisdiction in the matter, a bailiff or officer who arrests a party in execution of it may excuse himself in an action for false imprisonment by showing that the court had jurisdiction; but if the court out of which the process issues has no proper cognizance of the cause, then, as the whole proceedings are *coram non judice*, the officer will be liable.

If an arrest be made by one who is not a legal officer, or who has not at the time a warrant, or is not named in it, it is a false imprisonment, for which an action lies. If a sheriff or his bailiff arrest a man out of his county, or upon a warrant of a justice whose commission has expired, or arrests the wrong party, he is liable.

Mere irregularities in lawful process may constitute false imprisonment, and the judges will discharge the party upon condition of his waiving his right of action.

All persons concerned in a wrongful imprisonment are liable in an action of false imprisonment, and the party aggrieved may sue any one of them. Thus, if the plaintiff in a suit brings an unlawful warrant to the sheriff, or if he bring a good warrant, but direct the sheriff to the wrong man, the action will lie against both.

FAMILIES OF PLANTS. The word family in botany is mostly applied to a group of plants of the same value as a natural order. In this sense it has been mostly employed throughout the pages of this work. At the same time, in the arrangements of some writers, a family is made a group of less value than an order; whilst in the writings of others the term is loosely applied to distinguish any group of plants of higher value than a single species. It is thus sometimes employed synonymously with genus. The names of natural orders being mostly those of a genus, which serves as a type for the rest of the group, are easily Englished by adding the word family. Thus the order Gentianaceæ is called in English the Gentian family, and so on. By this means the word family is sometimes restricted to the species of a genus. Another word used synonymously with natural order by Dr. Lindley is tribe. In his natural system, all the orders having typical genera with English names have been called tribes, with the English names attached. Thus, Cinchonaceæ, the Coffee tribe; Pistiaceæ, the Duck-weed tribe; Euphorbiaceæ, the Euphorbium tribe. At the same time tribe is frequently used to express a group of less value than an order, as in the larger orders, Umbelliferæ, Leguminosæ, Compositæ, Cruciferæ, &c. The following plan will give an idea of the relative value of terms used in the subdivisions of plants:—

- Class.
  - Subclass.
    - Group.
      - Alliance.
        - Order.
          - Suborder.
            - Tribe.
              - Subtribe.
                - Division.
                  - Subdivision.
                    - Genus.
                      - Subgenus or Section.
                        - Species.
                          - Variety.

The divisions, groups, and alliances between the subclass and order are adopted by Lindley in his natural system, and frequently occur in this work. It is only a few orders, such as Compositæ, that require the subordinate divisions above, and only the larger genera require to be divided into subgenera.

FAN, an instrument or machine for agitating the air by the wafting or revolving motion of a broad surface, for the purpose of producing artificial currents. Large revolving fans, driven by machinery, are frequently used either to facilitate the cooling of fluids or the process of winnowing, or as blowing-machines to urge the combustion of a fire, or to assist in ventilation. Another application of such an apparatus is for the purpose of regulating or checking, by the resistance of the air to its rapid motion, the velocity of light machinery. A familiar example of such a use is afforded by the revolving fans of a musical snuff-box.

In its more ordinary acceptation the name fan is limited to the well known instrument employed by ladies for producing refreshing coolness, the use of which, under the names *flabellum* or *flabellulum* in Latin, or ῥιπίς or ῥιπιστήρ (diminutive, ῥιπίδιον) in Greek, was well known to the antients, whose fans, however, according to the article 'Flabellum' in the 'Dictionary of Greek and Roman Antiquities,' edited by Dr. Smith, were not, like most of those now used, 'so constructed that they might be furled, unfurled, and fluttered, nor were they even carried by the ladies themselves,' so that, as the writer of that article observes, the various manœuvres so wittily described in the 102nd number of the 'Spectator' as the 'exercise of the fan' were wholly unknown to the antients. From the numerous references given in the article above referred to, it would appear that while antient fans were often of elegant forms, of delicate colours, and of costly and splendid materials, such as peacocks' feathers, they were stiff and of a fixed shape. Some were made of separate feathers joined at the base, and further united by a thread passing along their tips, and another tied to the middle of the shaft of each feather; others appear to have been made by fastening together, back to back, the two wings of a bird, and attaching a handle at their base; while others again were formed of linen stretched upon a light frame. They were usually held by female slaves, beautiful boys, or eunuchs, whose duty it was to wave them so as to produce a cooling breeze; and the employment of such attendants was not confined to ladies, for we read in Suetonius that the Emperor Augustus had a slave to fan him while asleep. Fans of a softer kind, to which the name of *muscarium* or μυιοσόβη was applied, were used for driving off flies from living persons, from articles of food, and from things offered in sacrifice; and another kind of fan was employed for urging the combustion of a fire, a practice which, to conclude our quotations from the source already indicated, 'gave origin among classical writers to expressions corresponding to ours, meaning to fan the flame of hope, of love, or of sedition.'

Fans are much used in China, India, and other Eastern countries, and those of the Chinese are made to fold up in the same way as those commonly used by European ladies. Among this people fans are used by both sexes, a fan enclosed in a worked silk sheath being one of their frequent accoutrements. Representations of such a fan with its sheath, and of a fop making use of one, are given in Davis's 'Chinese' (Weekly Volume edition, vol. ii. pp. 36 and 41). These appear to be of either paper or silk, but with the Chinese, as well as the Europeans, fans are sometimes made of elegantly carved or perforated slips of ivory. Whatever be the materials employed, much skill is often displayed in the decoration of fans, and in some cases artistic talent of a high order has been applied in painting them. The mode in which they are constructed to open or fold together at pleasure is too well known to need description.

In the ceremony of ordaining deacons in the Greek church a fan is put into their hands, to indicate the duty which devolves upon them of keeping flies off the priests during the sacraments.

FANTUZZI. [Trento, Antonio da, P. C. S.]

FARINA'TI, PAOLO, a celebrated painter of Verona, where he was born in 1522. He studied first under Niccolò Giolfino, at Verona, and afterwards under Giorgione and Titian at Venice. There are several excellent works in fresco and in oil by him in the principal cities about Verona, where he and his wife died, in 1606, on the same day. His style of design is robust and vigorous, similar to that of Julio Romano, and his colouring has much of the character of that of the Venetian school. He etched a few designs from sacred and mythological history: they are described by Bartsch.

(Ridolfi, *Vite de' Pittori*, &c.; Lanzi, *Storia Pittorica*, &c.; Bartsch, *Peintre-Graveur*.)

FARRIERY. [Horse, P. C.]

FAUNA, a term employed by naturalists to express the whole of the members of the animal kingdom living in a particular district or at a particular time. Thus all the animals living in Great Britain constitute the British Fauna. Those inhabiting the land form the terrestrial Fauna; those found in the seas constitute the marine Fauna. It is often applied collectively to all the animals of the world, the extinct species constituting the fossil Fauna, and the living species the recent Fauna of the world. The word is derived from the Fauni [Faun, Faunus, P. C.], who were supposed to be the patrons of wild animals.

The word Flora is also applied in the same way, to comprehend the whole of the plants of a district, and admits of the same applications as the term Fauna. It is derived from Flora, the goddess of flowers. [Flora, P. C.]

FAVOSI'TES, a genus of fossil Zoophyta, common in the Silurian strata of Norway and Wales (Murchison, *Sil. System*).

FAVULA'RIA, a generic title of certain fossil plants allied to Sigillaria, as F. tessellata, from the coal formation (Sternberg).

FEATHERS, considered anatomically, as the covering of birds, are treated of under Birds, P. C., p. 426. We may here add a few words on the uses to which they are applied as an article of trade, a subject which is more fully treated of in two articles on the nature and uses of feathers, in Nos. 606 and 607 of the 'Penny Magazine,' to which, and to the article 'Feathers' in Dr. Ure's 'Dictionary of Arts,' &c., we are chiefly indebted for the following particulars.

The principal uses to which feathers are applied are for personal decoration, as plumes for ladies' head-dresses, or for the hats of military officers; as a soft and highly elastic material for filling beds, cushions, and pillows; or, in the case of the larger quill-feathers, as writing-pens, or small tubes for the manufacture of hair-pencils, or similar purposes. For the first of these purposes their elegant appearance is their great recommendation; for the second, to which only the smaller feathers are applied, their exquisite softness, and that elasticity and peculiarity of structure which renders them less liable to clot together, under the influence of pressure, than any kind of woolly or hairy substance which is applied to the same purpose; while the last-mentioned use depends on their possession of a hollow quill or barrel of a horny texture, which, though found in all feathers, is only sufficiently large and strong in those of the wings and tail to be useful for such a purpose.

Of the various kinds of feathers employed as plumes for head-dresses, the most important are those of the ostrich [Struthionidæ, P. C., p. 141], of which there are various qualities. Those of the male bird, according to Dr. Ure, are preferred, as being the whitest and most beautiful; those upon the back and above the wings being considered the best, those of the wings next in quality, and the tail-feathers the least valuable. The *down*, which is black in the males and grey in the females, consists of the smaller feathers from other parts of the body, which vary in length from four to fourteen inches. The finest white feathers of the female bird are somewhat grey towards the end, which lessens their value. 'These feathers,' Dr. Ure states, 'are imported from Algiers, Tunis, Alexandria, Madagascar, and Senegal, this being the order of their value.' Probably that which Dr. Ure styles *down* is what is referred to by Mc. Culloch (*Dictionary of Commerce*, art. 'Feathers') in the remark that 'the coarsest part of the ostrich plumage is generally denominated *hair*, to which it bears a resemblance, and is used in the manufacture of hats.' The mode of preparing ostrich feathers for use, and of dyeing them of various colours, is minutely described by Dr. Ure, who observes that most other feathers used by the plumassier are prepared in the same way. They are first washed or *scoured* by rubbing with the hand (being previously tied up in bundles) in a lather of white soap and water, and subsequently in clear water, as hot as the hand can bear. They are then bleached by three successive operations, the first being to immerse and agitate them well in hot water mixed with Spanish white, after which they are rinsed in three clear waters in succession; the second, which is termed *azuring*, to pass them quickly through a bath of cold water containing a little indigo tied up in a fine cloth; and the third, *sulphuring*, or exposing them in a close vessel to the vapour of burning sulphur, in the same way as in the bleaching of straw hats and bonnets. The feathers are then dried by hanging upon cords, during which they are shaken from time to time to separate their fibres. To increase their pliancy the ribs are scraped with a bit of glass cut circularly; and to impart the requisite curly form to the filaments or fibres, the edge of a blunt knife is drawn over them. The directions for dyeing we need not quote, further than that, for all colours except black, the feathers should be previously well bleached by exposure to the action of sun and dew, which is effected by cutting the end of the quill or tube to a sharp point, and sticking or planting the feathers singly in grass ground, where they are left for fifteen days.

We find from allusions to feather-beds in a statute of the reign of Henry VII., quoted in the 'Penny Magazine,' as above, that they were known and used in England upwards of three centuries ago. Goose feathers, which, owing to their superior elasticity, are preferred for this purpose, are considered best when they are plucked from the living bird; and in the districts where geese are chiefly kept, this cruel operation, which is alluded to under Poultry, P. C., p. 482, is repeated from three to five times in a year. While most writers condemn this practice for its apparent barbarity, and some assert that, in cold weather, many birds die in consequence of being subjected to it, it is asserted in the article 'Lincolnshire,' in the recent edition of the 'Encyclopædia Britannica,' that the breeders deny the imputation of cruelty, and say that they, for their own profit, pluck only such feathers as are very near falling off, and the removal of which consequently gives but little pain, because as such as are firmly fixed have a little blood at the end, they are less valuable. However such a plea may be received in extenuation of the custom as practised by the more humane or enlightened breeders, there is evidence enough of the barbarity of the practice in other cases. Young birds are plucked as well as those of mature growth, early plucking being supposed to promote the rapid growth of the feathers. Goose feathers are divided into white and grey, the former being deemed the most valuable. The less valuable kind of feathers, known by the general name of *poultry feathers*, are obtained from turkeys, ducks, and fowls. Wild-duck feathers are both soft and elastic, but their value is impaired by the great difficulty of removing the disagreeable odour of the animal oil which they contain. Various methods are practised of cleansing feathers from their oil, and the Society of Arts presented a reward of twenty guineas in 1805 to Mrs. Richardson for a process considered superior to any then practised, in which the feathers were immersed for three or four days in lime-water compounded of 1 lb. of quick-lime to a gallon of water. After being steeped for this time the feathers were placed on a sieve, to allow the lime-water to drain away; they were then washed with clear water and spread upon nets to dry, the whole being shaken from time to time, by which the dried feathers fell through the meshes of the nets. The whole process occupied about three weeks, and at its conclusion the feathers were said only to require beating for use. Lime is used by the Irish in the preparation of feathers, but, being applied too plentifully, they become loaded with dust, and consequently bear an inferior character in the market. In small quantity it appears likely to aid in the preservation of the feathers, to which small portions of animal fibre will occasionally adhere; but Dr. Ure seems opposed to its use, observing that 'bleaching with lime-water is a bad thing, as they can never be freed from white dust afterwards.' 'Their only preparation,' he states, 'when cleanly gathered, is a slight beating to clear away the loose matter, but for this purpose they must be first well dried either by the sun or a stove.' Judging however from the communications made to the Society of Arts ('Transactions,' vol. xxiii. pp. 210-215), it would appear that the plan above described was successful in cleaning some feathers in a perfectly raw state, and others which, after being stoved for the usual period of three days, retained their unpleasant smell.

The purification of bed-feathers by the agency of steam has recently been practised on an extensive scale in London by Mr. Herring. By the process employed, which is secured by patent, and is applicable either to new feathers or to such as have become deteriorated by use, the feathers are so greatly improved in softness and elasticity that a much less quantity of them than of feathers prepared in the ordinary way suffices to make a good bed. From a testimonial addressed to the patentee by Dr. Ure, it appears that the surplus feathers, removed in consequence of this improved elasticity, from three beds which were submitted to this process, were found sufficient to make a fourth bed of excellent quality, of 40 lbs. weight.

The softest and finest kind of feathers employed for bedding are those from the breast of the eider-duck, known in commerce as eider-down, of which an account is given under Fuligulinæ, P. C., p. 6. Dr. Ure says that this exquisitely soft down should never be slept upon, as it thereby loses its elasticity, but should be used only as a covering. A similar substance, though in less quantity, is procured from the swan, the goose, and some other birds.

For the third of the above-mentioned uses of feathers the quills of the goose are most generally employed, though, for purposes where great size and strength are required, those of the turkey and swan are highly prized. When geese are plucked several times in a year for other feathers, the quills are only taken at the first plucking, about the end of March. As taken from the bird, the horny substance of the barrel of the quill is covered, both internally and externally, with a vascular membrane, which adheres very closely to it, and the substance of the quill itself is opaque, soft, and tough. The quills must therefore be subjected to certain operations by which the membranes may be detached and dried up, and the barrel rendered transparent, hard, and somewhat brittle; previous to which they are sorted into *primes*, *seconds*, and *pinions*, the first of which consists of the largest and longest barrelled quills, and the others of such as possess these characteristics in a less degree. They are further sorted into right and left wing feathers, in order that all tied up in one bundle may have the same curvature; and before tying up for sale the *barb*, or feather proper, is usually stripped off from the inner edge of the stem, in order that they may lie compactly together. In a goose's wing it is only the five exterior quills which are fit for making pens, and of these the first is the hardest and roundest, but the shortest, and the second and third are considered the best.

'Dutch quills,' observes Dr. Ure, 'have been highly esteemed, as the Dutch were the first who hit upon the art of preparing them well, by clearing them, both inside and outside, from a fatty humour with which they are naturally impregnated, and which prevents the ink from flowing freely along the pens made with them.' 'The Dutch,' he adds, 'for a long time employed hot cinders or ashes to attain this end; and their secret was preserved very carefully, but it at length transpired, and the process was then improved.' In the improved method the barrel end of the quill is plunged for a few seconds in a sand-bath, heated to about 140° Fahr., and then rubbed strongly with a piece of flannel. After this it appears white and transparent. 'Both carbonate of potash and sulphuric acid,' observes our authority, 'have been tried to effect the same end, but without success.' The above process is, however, sometimes followed by a brief immersion in dilute muriatic acid, which gives the appearance of age to the quills. They must afterwards be made perfectly dry. The above is described by Dr. Ure as the French process; he notices two other modes adopted by London quill-dealers, the first of which is styled the Dutch method. In it the workman, who is styled a Dutcher, sits before a small stove fire, into which he thrusts the barrel of the quill for about a second. Immediately upon withdrawing it from the fire, he draws it under the edge of a large blunt-edged knife, called a *hook* (shaped somewhat like a patten-maker's knife, and, like it, having a fulcrum at one end, formed by a hook and staple, and a handle at the other end, by which pressure may be communicated), by which it is forcibly compressed against a block or plate of iron, heated to about 350° Fahr. By this process the barrel, which is rendered soft and elastic by the heat, is pressed flat, and stripped of its outer membrane, without danger of splitting. It springs back to its natural form, and the dressing is completed by scrubbing with a piece of rough dog-fish skin. The principal workman employed in this operation can pass 2000 quills through his hands in a day of ten hours. In the other method alluded to, which is considered inferior as regards the quality of the quills for pen-making, although it makes them somewhat more pleasing to the eye, the quills are first stained yellow by steeping them for a night in a decoction of turmeric, then dried in warm sand, and subsequently scraped by the Dutcher in the manner above described. Steaming for four hours has also been suggested as a good mode of dressing or preparing quills. By whatever process the external membrane is removed, that inside the quill remains, separated from it, and shrivelled up in the centre of the barrel, until it is cut open to convert it into a pen.

FEDERI'CI, CAMILLO, an Italian dramatic writer of note (born at Garessio in Piedmont, April 9th, 1749), whose real name, Giovanni Battista Viassolo, is, like that of Poquelin (Molière), quite lost in one which he assumed on joining a company of actors and beginning to write for the stage, and which he took from the title of his first dramatic effort, 'Camillo e Federico.' Intended by his family for either the church or the bar, he was educated accordingly at Turin, but a passionate taste for the theatre, which had captivated his imagination while he was yet in his boyhood, prevailed over all other considerations, and urged him to a step which he afterwards regretted, only because it had distressed his parents—more especially a tenderly attached mother. After being for some years in different companies in the double capacity of a performer upon the stage and a writer for it, he had, in 1777, the good fortune to find an excellent wife in the widow of Vicenzo Bazzigotti, who had realized some fortune by the theatre as a manager. The union was a happy one on both sides, for his wife was not only an amiable, but an intelligent and well-educated woman, possessing considerable literary taste. Cured of his youthful illusions and desirous of enjoying the repose of domestic life, Federici quitted the 'boards,' and settled at Padua, where he employed himself in composing a succession of new pieces for the theatres of both that city and Venice. The juncture was a favourable one, for Goldoni's popularity was upon the wane, Gozzi [Gozzi, Carlo, P. C.] had ceased to write for the stage, and Chiari was altogether forgotten. Without treading in the footsteps of Goldoni, Federici showed himself a worthy successor to him, inferior in comic force, but equally fertile in invention, and more varied in his subjects, many of his pieces being of a serious and sentimental kind—then just brought into fashion in Germany—accordingly answering better to the title of domestic drama than comedy. Federici's fame was not confined to the applause of the public whose favour he had more immediately in view, for his pieces were brought out with equal success in almost every theatre throughout Italy. But this full tide of prosperity, which might else have gone on unabated, was suddenly checked by a calamity that human prudence could neither foresee nor avert. He was attacked in 1791 by a malady of the chest, that rendered him incapable of all exertion, either bodily or mental, nor did he ever afterwards recover from it further than to be able to dictate either to his wife or one of his sons, who served him as amanuenses. To add to his distress, soon after his disorder first seized him, he learnt that Pellandi, the manager of one of the companies for which he had written, had surreptitiously sold twenty-nine of his pieces to a publisher at Turin—an injury which the increased celebrity it brought to his name could hardly soften. The best consolation which he received during the years of protracted suffering to which he was doomed while yet in the meridian of life, was that afforded him by the affectionate attentions of his wife and his two sons (Carlo and Giuseppe, who, after distinguishing themselves at the University of Padua, practised successfully—the one in his legal, the other in his medical career). Federici died December 23rd, 1802, leaving a more unblemished moral character than can usually be claimed for writers of his class. Amiable and unassuming, he had invariably resisted every proposal to his becoming a member of any literary or learned society, but he could not prevent one public mark of honour being paid him, namely, a medal being struck, with the head of Alfieri on one side, and his own on the other—as the effigies of the two dramatic writers whom Piedmont had reason to be proud of having given birth to. The high reputation he obtained did not rest upon what might else pass for the undue partiality of his countrymen, since it has been confirmed by the testimony of foreign critics. One quality that recommends his productions is the healthy tone of morality that generally pervades them; neither is it the least of his merits, that he enlarged the resources of the Italian stage, by bringing subjects upon it that were calculated to amend and improve as well as amuse. Besides his serious pieces—and the serious drama of human life is not confined to any one rank of society—he produced a few tragedies, which would, however, hardly have associated him in the manner above-mentioned with Alfieri. The most complete collection of his works is that published under the title of 'Opere Teatrali di Camillo Federici,' Padova e Venezia, 1802-16, in fourteen volumes.

FE'DIA. [Valerianella, P. C.]

FEE FARM RENT. [Rent, P. C.]

FEIGNED DISEASES. There are few subjects attended with more difficulty than the detection of feigned diseases, especially when they are the result of a system which permits of a constant refinement of the deceit by practice. This has been especially the case in France, where the object has been to escape the conscription. Foderé has observed, 'that it was brought to such a perfection as to render it as difficult to detect a feigned disease as to cure a real one.' The motives which usually lead to this practice are—1, A release from obligation. This is frequently the case in the army and navy, where the men will pretend to be ill to escape duty or to gain their discharge. In this form it has got the name of *Malingering*. Beggars, too, often feign illness when they are offered work, preferring the easy task of soliciting charity to the labour of an occupation. 2, The hope of gain. This motive comes into operation where the object is to obtain relief from the parish, to impose upon the benevolence of private persons, to procure the allowances of benefit-societies, clubs, &c., to get admitted into an hospital, or to obtain compensation for some pretended injury. 3, To procure release from confinement or an exemption from punishment. This motive is a source of deceit with boys and girls at school, persons committed to prison, &c. To these may be added the love of exciting the sympathy or gaining the attention of others, where no hope or need of gain exists. This motive acts in all classes of society, and leads individuals of otherwise the highest moral character to imitate all forms of disease. It is observed most frequently in young and unmarried females, and is frequently carried to the extent of feigning diseases for which capital operations are required; and instances are not wanting where surgeons (not much however to their credit) have removed legs, breasts, and arms at the solicitation of such patients.

There is no natural limit to diseases which may be feigned; but some being much more easily imitated than others, and less easily detected, are most frequently assumed. Feigned diseases may be divided into, 1, those which are obvious to the senses; 2, those depending upon the description of the impostor, and, 3, those of a complicated nature, presenting symptoms of both kinds. Amongst diseases obvious to the senses are an increased or diminished size of parts, wounds, malformations, ulcers, discharges, spasmodic and paralytic affections. A favourite mode of increasing the size of parts, and producing tumors, is by injecting air beneath the cellular membrane. In this way such diseases as dropsy, local and general, hernia, hydrocele, varicose veins, elephantiasis, œdema of the extremities, may be simulated. Pressure also, by means of ligatures, &c. on the veins, will produce swellings of parts of the body. Swellings also of the joints, so as to resemble white swellings, are produced by the application of various acrid plants, as the ranunculus acris and sceleratus to the part. Polypi, hydatids, malignant tumors, and hæmorrhoids, are imitated by affixing in some manner the intestines and other viscera of animals to the parts of the body in which these diseases occur. Cancer has been imitated by a cow's spleen, and by a sponge moistened with milk fixed under the arm-pit. The various malformations of the body are feigned by obstinate and long-continued flexion of the part, aided by inaction and the use of tight bandages. Sometimes these contractions are accompanied by a wound, in order to prove that they have been effected by a burn. Many means have been proposed for detecting this class of impositions, such as compressing with a tourniquet the nerves that supply the contracted muscles; applying a wet bandage tightly round the limb, so that when it becomes dry it may overcome the contraction; moving the contracted limb during natural sleep or that produced by narcotics; or making extension whilst the person is under the influence of an emetic, or when his attention is directed to other objects, recommending the coast of Africa, or some other disagreeable thing, as a cure. Wounds and sores are produced in a variety of ways. Wounds, when self-inflicted, will always be in positions where persons can get at the spot where they exist, with their own hands. Accomplices are however sometimes engaged even in this. Ulcers are among the most common of feigned diseases. They are produced by red-hot iron, by caustics, as corrosive acids and alkalis, and the juices of various plants, as of the ranunculus acris and sceleratus, the spurge-laurel, the euphorbium, arum maculatum, and juniper. Where persons are suspected of keeping up ulcers in their legs by irritants, the placing their legs in a box and locking them up will allow the ulcers to heal. The various forms of cutaneous disease are produced by the application of irritants to the skin, as pounded garlic, euphorbium, cantharides, gunpowder, nitric acid, bay salt, &c. The discoloration of jaundice is imitated by various dyes, as well as the appearance of bruises. Ophthalmia is a disease often feigned, and is commonly produced by the application of irritants, as snuff, pepper, tobacco, blue vitriol, salt, alum, &c. The progress of the inflammation in these cases is usually more rapid than in the idiopathic form. It is mostly also confined to one eye, for obvious reasons; and when occurring in the army it may be suspected, if epidemic, when it only comes on in privates and non-commissioned officers. Diseased discharges are often simulated. Vomiting is effected by pressing on the pit of the stomach, by swallowing air, by strong and sudden action of the abdominal muscles, by tickling the fauces, and the use of emetics. Diarrhœa and dysentery are produced by taking drastic purgatives. Fragments of brick, slate, small pebbles, pieces of quartz, and flint, have been introduced into the urethra, to bear out the alleged existence of urinary calculus. Hæmaturia has been simulated by tinging the urine with various colouring matters, and the disease has really been brought on by the taking of savin, cantharides, and turpentine. Spitting of blood is a favorite assumed disease. It is simulated by placing a sponge in the mouth filled with bullock's blood, by cutting the mouth and gums, and by sucking blood from other parts of the body. A vomiting of urine and fæces have taken place by the stealthy introduction of the contents of the bladder and rectum into the stomach.

The spasmodic diseases to which the system is subject have been imitated with great success, and none more so than epilepsy. It has for its peculiar recommendation, that the person who is subject to it may be well at intervals and assume the attacks when it best suits him. The best criterion of imposition is the want of the total insensibility which characterises the true fits. In the feigned disease the application of stimulants will seldom fail to elicit indications of sensibility. Hartshorn or burning sulphur may be introduced under the nose; alcohol and turpentine may be dropped into the eye, and mustard or common salt placed in the mouth. Pricking the skin with sharp-pointed instruments has also been recommended. This however is frequently resisted. Dr. Guy recommends 'flecking' the feet with a wet towel. He says he has by this means aroused a patient from a mesmeric slumber when all other mechanical stimulants and cold affusions had failed. Convulsions are often imitated; but where they are fictitious they cannot be sustained for any length of time without great exhaustion. Chorea is also often imitated. Electricity and cold affusions are the best remedies for this disease, and are likely to be effectual in the case of impostors. Hysteria, catalepsy, tetanus, hydrophobia, some forms of tonic spasm, stammering, strabismus, and difficulty of swallowing, are other diseases of the nervous system which are often imitated. Paralytic affections are also frequently simulated. The treatment resorted to for the cure of these diseases, when natural, would be found a trying ordeal for most impostors. Cases however are related in which impostors have resisted the most active treatment; and a case of simulated lethargy is on record, in which an individual resisted with only a single groan the operation of trephining.

Another class of feigned diseases are those which depend chiefly upon the description given by the impostor. These are all embraced in increased and diminished sensations. Increased pain of one or many organs is commonly feigned. It is easily assumed but not easily detected, as many pains, such as that of tic douloureux, come on in an apparently healthy state of the system; and many pains of a severe character are dependent on exceedingly obscure causes. There are no rules which can be laid down for the detection of simulated pain; and it is only those who have extensively observed the effects of real pain on the system, that can readily distinguish that which is pretended. Of diminished sensations, blindness and deafness are those most frequently feigned. Amaurosis may be really produced for a time by the application of belladonna, henbane, spurge laurel, and tobacco; but under these circumstances it disappears when the impostor is carefully watched. Deafness is often assumed, but it may be detected by unexpectedly or sharply calling out the name of the individual, by calling him by name when asleep, or letting a piece of money fall close to him. Dumbness has been successfully feigned, and cases are recorded which resisted every attempt at discovery. It may be frequently detected by giving the person a sudden and unexpected knock, or a prick with a pin.

Sometimes general diseases are assumed, embracing a collection of symptoms. Of these, the most frequently assumed are fever, ague, rheumatism, phthisis, asthma, dyspepsia, jaundice, inflammations of the bowels, stomach, and kidneys. These feigned diseases are only to be detected by a knowledge of the real diseases, when a correct diagnosis is not often difficult. Of diseases involving complicated symptoms, that of unsoundness of mind is most frequently and most successfully feigned. The success however does not depend so much on the ease with which the symptoms of true insanity are imitated, as upon the ignorance that prevails of the distinguishing characters of real insanity. When these are once known an impostor may be easily detected. The most frequent form of assumed madness is general mania. In addition to the characters of the true disease, special tests have been proposed, such as the use of the whirling chair, and 'repeating to the suspected person a series of ideas recently uttered, when the real maniac will introduce new ideas; the impostor, on the contrary, will deem it expedient to repeat the same words.' (Guy.)

The following general rules for detecting feigned diseases have been given by Zacchias:—

1. The first is, that the physician must in all suspected cases inquire of the relatives and friends of the suspected individual what are his physical and moral habits. He must ascertain the state of his affairs, and inquire what may possibly

be the motive for feigning disease, particularly whether he is not in immediate danger of some punishment from which this sickness may excuse him.

2. Compare the disease under examination with the causes capable of producing it—such as the age, temperament, and mode of life of the patient. Thus artifice might be suspected if a person in high health and correct in his diet should suddenly fall into dropsy or cachexia; and again if insanity should suddenly supervene without any of its premonitory symptoms. It is contrary to experience to find such diseases occur without some previous indications.

3. The third rule is derived from the aversion of persons feigning disease to take proper remedies. This indeed will occur in real sickness, but it rarely happens when severe pain is present. Anything that promises relief is generally acceptable in such cases; those on the contrary who feign delay the use of means.

4. Particular attention should be paid to the symptoms present, and whether they necessarily belong to the disease. An expert physician may thus cause a patient to fall into contradiction, and lead him to a statement which is incompatible with the nature of the complaint. To effect this it is necessary to visit him frequently and unexpectedly.

5. The last direction is to follow the course of the complaint and attend to the circumstances which successively occur.

(Beck, *Medical Jurisprudence;* Thomson, A. T., *Lectures on Medical Jurisprudence;* Guy, W. A., *Principles of Forensic Medicine.*)

FELT, FEL'TING. [Sheep, P. C., p. 356; Hat, P. C., p. 64; Woollen and Worsted Manufactures, P. C., p. 552.]

FEME COVERT. [Wife, P. C.]

FENESTE'LLA, a beautiful and abundant genus of fossil Zoophyta, allied to Retepora, which occurs in the whole Palaeozoic series (Lonsdale, *Sil. System*, &c.).

FERNS. [Filices, P. C. S.]

FERO'NIA, the name of a genus of plants belonging to the natural order Aurantiaceae. The flowers are often polygamous. The petals are usually 5 in number, occasionally 4 or 6, spreading. The calyx is flat and 5-toothed. Stamens 10; filaments dilated and united at the base; anthers linear-oblong, tetragonal. The ovary is seated on the elevated disk, 5- occasionally 6-celled; ovules numerous in each cell. It has scarcely any style and an oblong stigma. The fruit is enclosed in a hard rind, 5-celled and many seeded, which seeds are immersed in a fleshy pulp. The leaves are pinnated with from 5 to 7 leaflets nearly or quite sessile, very slightly crenulated, with pellucid dots along the margin, inconspicuously dotted elsewhere; the racemes are axillary, terminal, and few-flowered.

F. elephantum is the Elephant or wood apple of the Coromandel coast, where it is very generally eaten. The branches of this tree are armed with small spines. The leaflets, which vary in number from five to seven, are small, obovate and smooth; when very young they are thin, and when bruised have a most fragrant smell resembling anise. The native practitioners of India consider them stomachic and carminative. After a certain age however the leaves become tough and almost coriaceous. The fruit is fleshy, and extremely acid before it arrives at maturity; but when ripe, it contains a dark brown agreeable subacid pulp. In appearance the fruit is large, spheroidal, rugged and often warted externally; the seeds are in five parcels and are flat and woolly, adhering to the branched placentae by means of long cords.

A transparent oily fluid exudes from the trunk of this tree when an incision is made into it, which is used by painters for mixing their colours. A clear white gum may also be obtained from the tree very much resembling gum-arabic. The wood is likewise valuable on account of its durability, whiteness, and hardness.

F. pellucida has leaves full of transparent dots; the common petiole round, pubescent: this tree usually attains a height of twenty feet, and is a native of the East Indies, where the fruit is generally eaten. The flowers are white.

In cultivation these trees thrive well in a mixture of turfy loam and peat: and ripened cuttings will strike root in sand under a glass exposed to heat.

(Lindley, *Flora Medica;* Don, *Gardener's Dictionary.*)

FERRA'RI, GAUDENZIO, a celebrated Lombard painter and sculptor, of the Milanese school of Lionardo da Vinci. He was born in Valdugia in 1484, was instructed by Luini, and worked under Raphael at Rome. He is enumerated by his countryman Lomazzo among the seven greatest painters of modern times, which is an absurd eulogy. He was correct in design, laborious and careful in his execution, and extremely brilliant in his colouring; but his works are quite void of tone, though his figures are well rounded, and he can have had no knowledge of or feeling for harmony of colour. His outline is also hard, and the accessary parts, though laboured, are very indifferently executed. His colouring is extremely gay, but he used the positive or primary colours beyond all natural proportion. His principal works are in Milan, and are exclusively illustrative of the origin or mysteries of Christianity. He died in Milan in 1550. (Lanzi, *Storia Pittorica*, &c.)

FERRI, CIRO, a celebrated Roman fresco painter, born in 1634. He was the most distinguished scholar of Pietro da Cortona, and greatly assisted that painter in his extensive works in fresco, both in Rome and in the Palazzo Pitti at Florence. After the death of Pietro, Ferri was the first fresco painter in Rome, and the leader of the so-called *machinists*, a great faction, opposed to the school of Sacchi, at the head of which was Carlo Maratta. [Roman School of Painting, P. C.] Ferri's works are of the same character as Pietro da Cortona's; many of them have been engraved. He died at Rome in 1689.

(Baldinucci, *Notizie dei Professori del Disegno*, &c.; Lanzi, *Storia Pittorica*, &c.)

FETI, DOME'NICO, called Il Mantuano, was born at Rome in 1589. He was the scholar of Cigoli, but was appointed his court painter by Ferdinando Gonzaga, duke of Mantua, whither he removed from Rome; whence his name of Mantuano. He died at Venice in 1624, aged only thirty-five.

Feti executed several works at Mantua, of which his oil pictures were the best; many have been engraved: his masterpiece is the Feeding of the Five Thousand, in the Academy of Mantua.

(Baglione, *Vite de' Pittori*, &c.; Lanzi, *Storia Pittorica*, &c.)

FEUILLEA, a genus of plants belonging to the natural order Cucurbitaceae, and named in honour of Louis Feuillée, a traveller in Chili, the author of several works on botany. The flowers of this genus are dioecious. The staminiferous flowers have the calyx 5-cleft beyond the middle; 5 petals rather joined at the base; 5 stamens inserted with the petals, and alternating with them; sometimes there are 10 stamens, but when this occurs 5 of them are always sterile. The pistiliferous flowers have the tube of the calyx adnate to the ovarium, with a 15-cleft limb. They have 5 petals, distinct or joined at the base, and oblong; 3 styles. Stigmas broad and bluntly bifid. Fruit globose, fleshy, with a circular scar round the middle, and five other scars, 3-celled, with a solid bark, and a large fleshy trigonal central axis. The ovules are numerous, standing erect upon the axis. The seeds oval and compressed. Cotyledons flat and rather fleshy. This genus is a native of the tropical regions of America, and most of the species are frutescent climbing herbs. They have alternate, stalked, cordate, smooth leaves, and small flowers. The tendrils are axillary, spirally twisted, in place of peduncles. The seeds are oily and of a bitter taste; their unctuous matter causes them to be used for burning, and their excessive bitterness renders them good anthelmintics; they are also cathartic.

F. punctata has 3-lobed or ternate leaves, beset with glandular dots on both surfaces along the nerves, but more especially beneath. The lobes of the leaves are lanceolate and rather cut. It is a native of St. Domingo.

F. trilobata has leaves which are rather glandular on both surfaces, 3-parted or trifid, the lower lobes obtuse, the upper ones acute. This species is a native of Brazil. It is the *Feuillea scandens* of some authors, and the celebrated Nhandirhoba or Ghandirhoba of South America, where it is held in great repute as an antidote to various poisons, animal and vegetable. The natives employ it not only against serpent-bites, but also to counteract the baneful effects of the Manihot and Manchineel. M. Drapiez, after having made experiments expressly to test its power, states that animals poisoned with hemlock, nux-vomica, the Rhus Toxicodendron, &c. were restored by the administration of the seeds of this plant. He recommends that the seeds be bruised in a little water, and asserts that it is equally efficacious as an antidote whether taken internally or applied to a poisoned wound. These seeds act with great rapidity as emetics and purgatives.

F. cordifolia has glandless, cordate, acuminate leaves, somewhat 3-lobed and rather serrated. It is a native of the West Indies, and has likewise a reputation as a preventive of the ill effects of vegetable poisons.

F. Javilla has glandless roundish leaves sinuately cordate and acuminate. It is a native of New Granada in the woods near Turbaco, where it is known by the name of Javilla. The seeds have winged margins; hence this species agrees with the genus Zanonia.

The fruit of the Feuillea is as large as an apple, and from a fancied resemblance it is called the 'shaving-box.'

A light rich soil is found to suit best the species of Feuillea, and cuttings will easily take root in a hot-bed or glass frame exposed to heat. Being creeping plants, they are well adapted for training up rafters in stoves.

(Don, *Gardener's Dictionary*; Lindley, *Flora Medica*; Burnett, *Outlines of Botany*.)

FIAMMINGO. [CALVERT, DENIS, P. C. S.]

FICA'RIA. [RANUNCULUS, P. C. S.]

FICOIDITES. [STIGMARIA, P. C. S.]

FIELD, NATHANIEL, whose name is for several reasons interesting in the history of the old English drama, was professionally a player. As early as the year 1600 he was one of the Children of the Chapel, afterwards called Children of the Revels, youths who were trained to act plays before the court, and he continued in that company till after 1609. He then became a member of Shakspere's company, the players of the Globe and Blackfriars theatres, among whom he is named in the list prefixed to the folio of Shakspere's works printed in 1623. Two years later his name disappears; and in 1641 he is mentioned as 'gone,' which probably means that he was then dead. Besides these circumstances, the only ones known in his history are such as show him to have been poor and distressed. He was the writer of the famous begging-letter, addressed to Henslowe, by himself, Daboone, and Philip Massinger: and among Henslowe's papers are two other letters of the same melancholy tenor. Field wrote a part, and perhaps Gifford does him less than justice in the quantity he assigns to him, of the fine tragedy of 'The Fatal Dowry,' printed among the works of its other poet Massinger. He is also the author of two comedies, both good, and one of them excellent, both of which were written between 1605 and 1611; 'A woman is a Weathercock,' first printed in 1612, and 'Amends for Ladies,' first printed in 1618, and again in 1639. Both are included in a small collection, 'The Old English Drama,' 4 vols. 12mo., 1830; and in Collier's 'Supplement to Dodsley's Old Plays,' 1833. They abound in spirit, incident, and variety.

FIE'SOLE, FRA GIOVA'NNI DA, frequently called, from his character, Beato Angelico, is one of the most celebrated of the early Italian painters. His real name was, according to Vasari, Giovanni Guido, and he was a distinguished member of the brotherhood of Predicant monks at Fiesole. His name is however variously given, as for instance, Santi Tosini, and Giovanni di Pietro di Mugello. He was apparently born in Mugello in 1387, and he entered the order of the Predicants at Fiesole in 1409; little or nothing further is known either of his origin or his education. He early distinguished himself for his miniature illuminations of religious books, of which there are still some in the convent of San Marco at Florence, where he painted several works for Cosmo de' Medici, of which the history of the Passion of Christ in the refectory is still in comparative preservation. Giovanni learnt the art of illuminating or miniature painting from an elder brother, Fra Benedetto di Pietro di Mugello, or, Latinised, Benedictus Petri de Mugello.

He painted also many admirable works in the Carthusian church, in Santa Maria Novella, and in the Nunziata and other churches in Florence; in San Domenico at Fiesole; in the cathedral of Orvieto; at Cortona; and in the chapel of San Lorenzo in the Vatican, and in the Minerva, at Rome. He was invited to Rome by Pope Niccolò V., who offered him the high dignity of the archbishopric of Florence, which however Giovanni was too modest to accept; he pleaded that to govern or to lead was alike incompatible with his nature. The appointment was given to another monk of the same order as Giovanni, Fra Antonino, who was canonized by Adrian VI.

The frescoes in the chapel of Niccolò V. are in great part still in a good state of preservation, though they have been restored. The chapel was long neglected, and public attention was first called to these frescoes by Hofrath Hirt, of Berlin. The principal subjects represent the leading events of the lives of Saints Stefano and Lorenzo, and their martyrdoms; on the ceiling are the four evangelists; around the chapel also are the doctors and fathers of the church, Saints Thomas Aquinas, Bonaventura, Athanasius, and John Chrysostom; Augustin, Ambrose, Jerome, and Gregory; and a Descent from the Cross was painted above the altar, but it has been whitewashed over. This chapel is described in Platner and Bunsen's 'Description of Rome,' and there are small outlines of the frescoes in D'Agincourt's 'Histoire de l'Art par les Monumens,' and larger in a special work by Giangiacomi, 'Le Pitture della Capella di Niccolò V., opere del B. Giov. Ang. da Fiesole,' Rome, 1810. Also two of the principal subjects, the Preaching of St. Stephen, and St. Lawrence giving alms, are etched in Ottley's series of plates after Florentine paintings. These works of Fra Giovanni, as well as those in the convent of Saint Mark at Florence, and others elsewhere, though as mere abstract designs or works of art they are comparatively crude and feeble, and inferior to the works of Masaccio, are with reference to their subjects perfect in their sentiment, and in expression admirable, and have not been surpassed even by the works of any of the great painters who followed him. His works are exclusively religious or ecclesiastical; and they breathe the purest piety and humility, which are the vivid impressions of his own mind and character, not acquired or imitated, but proceeding from himself in untutored reality, pure nature. The genuineness of his sentiment and expression was so self-evident, that his works became in a great degree, mediately when not immediately, the type of character for religious art, to his own and to subsequent generations.

Though his works have not as regards style that plastic development which we find in Masaccio, the inferiority is not great, but he survived Masaccio some years. Giovanni's execution is sometimes extremely elaborate and often beautiful, especially in his small easel panels painted in distemper. There is a small gallery of these works in the Academy at Florence, of which the most remarkable piece is a Last Judgment containing a great variety of figures.

Fra Giovanni was remarkably methodic in his habits; it was his maxim that whoever would represent the works of Christ must be always with Christ; he accordingly never commenced any work without praying, and he always carried out the first impression, believing it to be an inspiration: he never retouched or altered anything once left as finished. He died in 1455, twenty-eight years before the birth of Raphael.

(Vasari, *Vite de' Pittori*, &c., and the notes in Schorn's German translation; Speth, *Kunst in Italien*; Rumohr, *Italienische Forschungen*.)

FILA'GO, a genus of plants belonging to the natural order Compositæ, tribe Senecionideæ, subtribe Gnaphalieæ, division Helichryseæ. The outer florets are female, filiform in several rows, the outermost ones intermixed with the inner scales of the involucre or paleæ, central florets few, hermaphrodite, tubular. Pappus capillary. The receptacle conical with a scaly margin. Involucre subconical, imbricated, the scales lanceolate, and longer than the florets. The species of this genus were formerly referred to Gnaphalium.

F. germanica is a cottony plant with yellow florets, the stem proliferous at the summit from 4 to 12 inches long. It has lanceolate wavy leaves, heads in axillary and terminal globose clusters, the outer involucral scales cuspidate, cottony, with glabrous points. It is a native of Great Britain, as well as the two following species:—

F. minima is distinguished by having its stem dichotomously branched, and the outer involucre scales bluntish, cottony, with glabrous points. The florets are yellow with very small heads. Like the other species it is found in dry, sandy, and gravelly places.

F. gallica has linear, acute, revolute leaves, the heads conical in axillary terminal clusters, shorter than the leaves. This species is very rare.

(Babington, *Manual of British Botany*.)

FILAMENT, in Botany, the part of the stamens which bears the anther. It is sometimes long and slender, hence its name filament. In some plants however it is nearly or altogether absent, and not unfrequently flat and broad. [STAMEN, P. C.]

FILE, a steel instrument having flat or curved surfaces so notched or serrated as to produce a series of fine teeth, or cutting edges, which are employed for the abrasion of metal, ivory, wood, &c.

Files are indispensable for the working of all metallic and many other hard substances, and without their aid few articles of machinery could be produced. Holland observes that the use of the file must have preceded every step in the progress of finishing articles composed of iron and steel in all cases where any intricacy of shape precluded the operation of grinding. He considers that, great as is the antiquity of the revolving grindstone, the file must have preceded it, and refers, in confirmation of this opinion, to the passage in the first book of Samuel (chap. xiii. v. 21), in which the file is mentioned as the means of sharpening the mattocks, coulters, and other edged instruments of the Israelites. He also refers to a passage in the Odyssey in which Vulcan is represented as using the hammer and file in fabricating the net in which he entangled Mars and Venus, as a proof of the great antiquity of this tool.

Files always are, or should be, made of steel of superior quality, as there are few instruments in which a defect in the metal is so completely destructive of utility. An axe, saw, or almost any other cutting instrument, though of inferior metal, may be made to do its duty by repeated whetting; but for a bad file, as Holland observes, there is no remedy,—no process of restoration. 'Let it,' he says, 'be too soft, and immediately on application the whole toothed surface of the file is crushed down, and ceases to be of any use for its intended purpose: if too hard, on the other hand, the teeth, so soon as they come into contact with the body to be acted upon, fly off with every stroke; the file thenceforward becoming, if not quite useless, certainly a coarse irregular rubber.' The importance, therefore, of a guarantee of excellent quality gives a high value to files bearing the marks of manufacturers of established reputation, and leads unprincipled tradesmen to imitate them. 'One of the most famous of these marks,' Holland observes, 'was that granted many years ago by the corporation of Sheffield to Daniel Brammall; and as an illustration of its value may be mentioned the fact, that in 1825 the rightful user obtained a verdict of 2000*l.* damages against a Birmingham file-maker for having struck it fraudulently on articles made by himself.'

Steel for making files, being required to be of unusual hardness, is more highly converted than for other purposes, and is sometimes said to be *double converted*. Small files, according to Dr. Ure, are mostly made of cast steel, which, he says, would be the best for all others, though its higher price prevents its use. 'It is,' he remarks, 'much harder than the blistered steel, and from having been in the fluid state, is entirely free from those seams and loose parts so common to blistered steel, which is no sounder than as it comes from the forge before conversion.' The very large files called smiths' rubbers are generally forged immediately from the converted bars, which are, for convenience, made square while in the state of iron. Smaller files are forged from bars or rods which are drawn or wrought as nearly as may be to the required form and size by the action of tilt-hammers, either from blistered bars, or from ingots of cast steel. These bars are cut into pieces suitable for making one file each, which are heated in a forge fire, and then wrought to the required shape on an anvil by two men, one of whom superintends the work, and is responsible for the goodness of the file, while the other acts as general assistant. Files being of many different shapes and sizes, as square, triangular, and flat, round, and half-round, in their cross section, and parallel or tapering more or less towards the end, and ranging from the minute watchmaker's files of two or three inches to the ponderous rubber of two or three feet, there are of course many varieties in the forging process. The square and flat files are generally shaped by the hammer only, but for those of a triangular or half-round section grooved bosses or dies of the required shape are attached to the anvil. Round files are made by means of the instrument known to smiths as a *swage*, which may be compared to a pair of such dies, one of which is inverted upon the other to receive the blows of the hammer. The projecting tang by which the file is to be inserted in a wooden handle is formed at this time, and the manufacturer's mark is impressed with a steel punch.

The next operation upon the files, or rather the blanks which are to be converted into files, is that of softening or annealing, technically called lighting or lightening, to render the steel capable of being cut with the toothing instruments. The ordinary mode of performing this operation is to pile them loosely upon the bottom of a brick oven, and heat them with a fire kindled beneath and around them, the heat being regulated by dampers. When the fire has been maintained sufficiently long (about twenty-four hours according to Holland, but merely long enough to make them red-hot, according to some other authorities), the pile is smothered with ashes, every aperture by which air could enter the oven is carefully closed, and the whole is left to cool gradually. The access of air during the heating tends to the oxidation of the steel, and is consequently injurious. A better plan, therefore, is to inclose the files in a box or trough with a close cover, filling the interstices with sand, and to cause the fire to play as gradually and uniformly as possible around it, until the whole mass becomes red-hot. The cooling, in this, as in the other process, must be gradual; and if the cover be not removed until the whole is quite cold, the steel will be found quite free from the scaliness produced by oxidation, and of a silvery-white colour. If it be suspected that the steel is *too kind*, or has too little carbon, powdered charcoal may either be substituted for, or interstratified with, the sand in which the files are imbedded.

After annealing, the surface of the metal must be rendered very smooth and even before cutting the teeth. This may be done either by *stripping*, or filing, first across, and afterwards along the surface, or by grinding upon very large grindstones. The stripping process, which is tedious and laborious, was formerly in common use, and is still practised by some file-makers, especially in Lancashire, where excellent files are manufactured; but the other is now the most common. The production of a level or even surface being the principal end of this operation, it has been questioned whether equal perfection could be attained by grinding as by the use of the file; but this is a matter mainly dependent on the skill of the operator; and the greater expense of the stripping process is sufficient to preclude its general adoption.

The cutting of the teeth is usually performed by workmen sitting astride upon a board or saddle-shaped seat, in front of a well-lighted bench, upon which is fixed a kind of small anvil. Laying the blank file across the anvil, the cutter secures it from moving by a strap which passes over each end and under his feet, like the stirrup of the shoemaker. He then takes in his left hand a very carefully ground chisel made of the best steel, and in his right a peculiarly shaped hammer, the handle of which is fixed at such an angle that the operator can, while making a blow, pull the hammer rather towards him. If the file be flat, or have one or more flat surfaces, the operator places the steel chisel upon it at a particular angle or inclination, and with one blow of the hammer cuts an indentation or furrow, completely across its face, from side to side, but most commonly in an oblique direction, the metal displaced by this operation not being taken away, but thrown up in the form of a prominent angular ridge, with a sharp cutting edge, on one side of the furrow. He then moves the chisel a little, and by a second stroke cuts another precisely similar furrow parallel to, and at a very short distance from, the first; and thus proceeds stroke by stroke until the whole surface is furrowed, beginning at the point and ending at the tang-end In the course of cutting, the file is gradually moved from the operator by relaxing the pressure of the strap from time to time. In this state, the file is said to be *single cut*, or *single float*; and files so cut are used for brass and the softer metals, which are liable to clog a file of any other kind. For working iron and some other materials, *double-cut* or *cross-cut* files are used, in which the first row or series of cuts is crossed at an oblique angle by a second; the effect of which is to convert the surface, which in a single-cut file consists of a succession of minute parallel scrapers, into a collection of very small angular teeth, admirably adapted for the abrasion of hard substances. In making cross-cut files, a fine file is gently passed over the first series of cuts or teeth to reduce the prominences to an even surface before the second set is cut. Files for wood are usually cut with a triangular pointed punch or chisel, instead of one with a flat edge reaching across the whole width of the file, the cuts or indentations of which produce single independent teeth, which are ranged in rows, the teeth of one row being opposite to the intervals of the other. Such files, as well as some of the deepest and coarsest cross-cuts, are called *rasps*. If the file be round or half-round, or have any curved surface, it is still cut with the same kind of tool; but as a straight-edged cutting tool can only make a short indentation upon a convex surface, it is necessary to go round the file by degrees, making several rows or ranges of minute cuts contiguous to one another.

Hitherto we have only spoken of the cutting of one side but as most files are cut upon two or more sides, it is necessary to make some provision for protecting the surface first cut from injury while cutting the others. This is done by interposing a piece of lead, or of an alloy of lead and tin, between it and the anvil. When the files are triangular, round, or half-round, a block of the same soft metal, with a groove in which the file will lie steadily, is used in like way.

In addition to variations in the form and arrangement of the teeth of files, their size varies extremely. The largest and coarsest smiths' files are called rubbers; and others, arranged in order of fineness, are technically known as rough, bastard, second-cut, smooth, and dead-smooth files, the latter producing so fine a surface when applied to metal that the subsequent application of a burnisher is sufficient to polish it.

In the art of file-cutting, as observed by Mr. Dodd in the work referred to below, there are many points worthy of remark. 'In the first place, the angle at which the cuts are made depends greatly on the purpose to which the file is to be applied, and is made an especial object of the cutter's attention. In the next place, the cut is not a mere indentation, made without reference to form; it is a triangular groove of particular shape, the production of which requires a most discriminating tact in the management both of the hammer and of the cutting-tool. Then, again, the strict parallelism of the several cuts can only be brought about by practised accuracy of hand and eye, since there is no guide, gauge, or other contrivance for regulating the distance. In a round file, too, the several rows or cuts are brought side by side in such an exact manner that it is difficult to conceive them to be formed singly and by hand.' 'We may,' he adds, 'adduce as an instance of what skill and long practice can effect in this respect, a file about ten inches long, flat on one side and round on the other; the flat side is cut with a hundred and twenty teeth to an inch, so that there are about twelve hundred teeth on that side; the round side has such an extent of curvature that it requires eighteen rows of cuts to compass it; each little cut on this side is not much above a twentieth of an inch in length; and the number is thus so great that for the whole file there are twenty-two thousand cuts, each made with a separate blow of the hammer, and the cutting-tool being shifted after each blow.' The degree of fineness indicated in this example may be said to be unusual; but the calculation refers only to a single set of cuts, and consequently, were the same file cut double with teeth of half the degree of fineness, the number of cuts required would be the same.

Several highly ingenious machines have been contrived for superseding the tedious operation of file-cutting by hand, and descriptions of some of these are given in the works referred to at the end of this article; but, suited as the process may appear to be for the use of machinery, it has been found to present such great difficulties that we believe no file-cutting engine has been brought successfully or extensively into operation. One very serious difficulty arises from the circumstance that if one part of the file be either a little softer than the adjacent parts, or narrower, so as to present less resistance to the blow of the hammer, a machine would, owing to the perfect uniformity of its stroke, make a deeper cut there than elsewhere; 'whereas,' as Dodd observes, 'a workman who has been employed in the trade from a boy (and none others, it is said, can acquire the requisite skill), can feel instantly when he arrives at any variation in the quality or condition of the steel, and at once adapts the weight of his blow to it.' Holland, after describing one of the machines contrived for this purpose, observes, that the applicability of such an apparatus to the toothing of extremely fine-faced files seems conceivable, because 'in such the *set* or direction of the teeth is a matter of much less importance than perfect equality of surface;' thus intimating that a great difficulty arises in this apparently attainable point. 'The double dead-cut files of the French,' he adds, 'exhibit such a beautiful uniformity of delineation when examined with a magnifier, that no doubt seems to be entertained, by many persons conversant with the art, of their being cut by machinery of some sort. But although the French are so successful in the production of this exquisitely delicate cutting, they are not equally so in the execution of the rougher sorts; and, consequently, English files are in high reputation in Paris, whither large quantities are regularly transmitted.' This writer mentions a French manufacturer of watchmakers' files, some of which, cut in the common manner, but with exquisite neatness, by his daughters, were regarded with suspicion by many, simply from the opinion that they must be machine cut.

The final process in the manufacture of files is the hardening of the steel, a process in which different manufacturers vary in practice. 'Some descriptions of rasps,' observes Holland, 'especially such as are used upon wood and other soft substances, are left in their soft state after being cut, not only because little hardness is required, but mainly that they may be sharpened up with a file occasionally.' 'Some sorts, too,' he adds, 'have been made of iron, and case-hardened.' The carbonaceous matter for such a process of case-hardening may be obtained from blood, or from any of the soft parts of animals, but the refuse of shoemakers and curriers is the most convenient. After the volatile parts of such animal matter have been distilled over, from an iron still, a bright shining coal is left behind, which, when reduced to a powder, is fit to be mixed with the salt in combination with which it is to be used. Equal parts, by bulk, of this powdered carbon and salt may be mixed with water to the consistence of cream, or the carbon may be mixed with a saturated solution of salt to the same consistency. Steel files, when intended to be very hard, may be covered with this composition previous to the hardening process; and by its use, files made of iron, which in itself is incapable of hardening, acquire a superficial hardness sufficient to answer the purposes of any file whatever. 'Files of this kind,' says Holland, quoting his account from some other work, though he does not say what, 'may be bent into any form, and, in consequence, are rendered useful to sculptors and die-sinkers.'

In the ordinary process of hardening steel files three things must be particularly observed,—first, to cover the surface of the file with some composition which, acting as a protecting varnish to it, may guard it from oxidation and scaling when exposed to the action of the fire, that the sharpness of the teeth may not be impaired, nor the surface rendered rough, which would cause it to clog when in use; secondly, to heat it very uniformly throughout to a red heat; and, thirdly, to cool it suddenly, by immersion in the freshest and coldest water, in such a manner as to impart the greatest degree of hardness, and to avoid the tendency to warping, which in long thin files is a difficult matter. A mixture very commonly used for the first-mentioned purpose consists of the grounds of malt liquor, yeast, and common salt. Formerly the ale grounds were applied alone, and powdered salt was thrown on to the wet files; but the plan of dissolving the salt in the liquor is the best and most economical. In the present plan the salt is dissolved in water to saturation, which requires about three pounds of salt to a gallon of water; and ale grounds, or the cheapest kind of flour, such as that of beans, is mixed with the liquid to bring it to the consistence of thick cream. The use of the flour or grounds is chiefly to enable the files to retain a greater quantity of salt, which fuses, and forms a protecting varnish when in the fire; for, as Dr. Ure observes, the carbonaceous matter of vegetable substances does not combine with iron with sufficient facility to produce any effect during the brief application of heat in hardening. Animal carbon, applied in the way above described, forms a very desirable addition to the mixture for all files intended to be very hard, especially for saw-files. The heating is usually effected in an open fire of clean cokes, the file, if small, being held by the tang end in a pair of tongs, and frequently withdrawn, to see that no part becomes over-heated. The proper temperature is indicated by a cherry-red colour. A kind of oven is sometimes used for large files, to facilitate the uniform application of heat, the oven being formed of fire-bricks, open at one end to receive the files and fuel, and the fire being urged by bellows. Some file-makers put sulphuric acid or other substances into the quenching-water, with a view to procuring the greatest possible hardness; but Dr. Ure thinks that 'clear spring water, free from animal and vegetable matter, and as cold as possible, is the best calculated for hardening files of every description.' All files should be immersed quickly; those of a flat, square, triangular, or round form, being plunged perpendicularly into the water, while the half-round, though kept perpendicular, should be moved a little horizontally in the direction of the round side, to prevent its becoming crooked. With every precaution the files are liable to take some degree of warp or curvature in this process, to remove which they are withdrawn from the water before they become quite cold, 'and being placed, the point under a staple and the middle across some competent support, the workman leans with his weight upon the opposite or tang end, meanwhile ladling the water with his hand upon the superior surface.' 'By this means,' observes Holland, whose account we have quoted, 'a degree of crookedness amounting in some cases to almost a quarter of an inch in a foot, is effectually reduced; and what appears most remarkable in this manipulation is, that the file in this only partially cooled but absolutely hardened state never breaks under a stress more than fifty times sufficient ot snap it when cold.' 'This phenomenon of latent temper,' he adds, 'is more particularly observable in the hardening of half-round files, which, in order to counteract the superior contraction of the convex side during the immersion, are previously bent to about the same extent in the opposite direction, and plunged horizontally; at the same time often requiring a very violent effort on the part of the workman to overcome the distortion.' Owing to their hardness, files are unavoidably brittle, and they are especially liable to break by the tang, owing to their reduced substance, to remedy which some makers temper the tang end by dipping it in a bath of melted lead.

During the war of the French revolution, the supply of English files being impeded, the French file-makers were excited to great efforts to supply the deficiency, and, according to an article published in the 'Repertory of Arts' for 1801, translated from the register of the French Lyceum, it would appear that a man named Raoul succeeded in producing files so hard that they would cut or abrade the best English files which, in a series of public experiments, were brought into competition with them. Holland, who quotes the particulars of the trial, says it was the opinion of Mr. Gill, a most competent authority in such matters, that the files of Raoul owed their superiority to being dipped or quenched in a composition of two pounds of mutton suet, *not rendered*, but simply chopped small, two pounds of hog's lard, and two ounces of white arsenic in powder. These ingredients being put into an iron vessel fitted with a cover, must be boiled until a handful of *mouse-ear* (Hieracium pilosella), fresh gathered, and which had been put into the mixture at first, shall become crisp and float on the surface, a proof that all moisture is driven off. This melting operation, as well as that of quenching the files in the composition, must be performed under the hood of a smith's forge-hearth, to carry off the noxious arsenical fumes, and the operator should cover his mouth and nostrils to avoid inhaling them.

After hardening, the files are scoured with a brush dipped in water mixed with a little sand or coke-dust; then thoroughly washed to remove any saline particles which might tend to rust the file, and dipped in water in which quick-lime has been dissolved, in order to neutralize the effect of any which may yet remain; and finally dried before the fire, brushed over with oil, or, according to some authorities, a mixture of olive oil and turpentine, and wrapped up in oiled brown paper for sale. Before packing, files are sometimes tested by striking them gently on a piece of hard steel, and also rubbing them gently from end to end, in doing which an experienced person can detect by the sound whether the internal quality of the steel is good, and can judge of the hardness by the friction and tremulous motion communicated to the fingers and wrist.

In using files to produce a smooth surface, the coarser kinds are employed first, and succeeded by the finer; and it is a general rule to lean heavy in the forward stroke, because the teeth are made to cut forwards, and in drawing the file back preparatory to a second stroke, to lift it above the work, so as to prevent it from cutting or rubbing.

When files, otherwise of good quality, are reduced to a useless state by wear, they are sometimes re-cut, the old teeth being completely removed by grinding. Previous to grinding they must be softened or annealed in the same way as in the original process of manufacture; and the subsequent processes of cutting and re-hardening are also conducted in the same way as at first. Re-cut files are, of course, somewhat thinner than when first made, but in all other respects they may be equally good, if the process is properly conducted. Owing to the superior quality of the steel, worn-out files bear a comparatively high value as old metal, and many are bought up for the purpose of converting them into screw-drivers.

(Holland, *Manufactures in Metal*, in Lardner's 'Cabinet Cyclopædia,' vol. i. pp. 297-315; Dodd, *British Manufactures*, *Metals*, in Knight's 'Weekly Volume' series, pp. 67-74; Dr. Ure, *Dictionary of Arts, &c.*; Hebert, *Engineer's and Mechanic's Encyclopædia.*)

FILIATION, ORDER OF. [Bastard, P. C. and P. C. S.]

FI'LICES, or FILICA'CEÆ, a natural order of plants, being the highest group of the class Cryptogamia or Acrogens. The species are flowerless plants, consisting of leafy fronds, which are produced from a rhizoma unfolding in a spiral manner, and traversed by veins which form definite parts on the under surface, and produce unilocular, rarely multilocular, cases containing reproductive sporules.

The parts of these plants which require most attention in their study, and on modifications of which modern classifications depend, are the veins and organs of reproduction. The veins are either produced equally from both sides of a mid-rib, or they radiate from the base or axis of development, or from one side of an eccentric or unilateral costa. They are either simple, or once or repeatedly dichotomously branched, or the primary veins are pinnate; the branches either simple or forked. Their apices are either free or they are combined by various forms of anastomosis. The organs of reproduction consist of a sporangiferous receptacle, which is a thickened point or lengthened portion of the ultimate venules or veinlets. It is generally superficial, sometimes immersed in the substance of the frond, or considerably elevated, and then globose or columnar. The sporangia, thecæ, or spore-cases are transparent, globose, oval or pyriform unilocular cases, each girded by a more or less complete elastic articulated ring, or destitute of a ring; then sometimes oblong, opaque and multilocular, and usually pedicillate. The sori are collections of sporangia, and have the same form, position and direction as the receptacles. They are either naked, or each sorus is furnished with a membranaceous covering of various forms which rises from the receptacle. This covering is called an indusium, and is a plane, or vaulted, or cup-shaped membrane, produced from the receptacle of each sorus, and is generally deciduous as it becomes replicate. Often the entire margin or lobules of the frond is changed in texture, and forms an accessory indusium. Sometimes the whole of the sori of each segment are included within a universal indusium which is formed by the revolute margin of fertile contracted fronds.

The position of the Ferns in a natural system of classification has not been a matter of much difference. Their imperfect organs of reproduction have at once led to their being placed by most botanists among Cryptogamia; nevertheless Bory St. Vincent elevates Ferns to the rank of a class intermediate between Monocotyledons and Acotyledons or Cryptogamia; at the same time he rejects the view of Jussieu, who from the mode of germination of their sporules placed the Ferns among the Monocotyledons. Their relation with the flowering plants is seen through Cycadaceæ, with which order they agree in their gyrate vernation and their pinnate leaves. Their affinity with cryptogamic plants is obvious in the Equisetaceæ and Lycopodiaceæ. The order of Ferns may be divided into the following sub-orders, which Lindley regards as of the rank and value of orders.

I. Gleicheniaceæ, the thecæ with a transverse or obliquely transverse, complete, elastic annulus or ring, bursting vertically. The species are tropical, or extra-tropical only in the southern hemisphere, of a harsh and rigid texture, simple or generally with copious dichotomous branches and gemmæ in the axils; the ultimate branches pinnatified. None of the genera of this order, as understood by Hooker, are British. It includes about forty species.

II. Polypodiaceæ, with the sori dorsal, often near or at the margin, various in form, sometimes constituting an uniform linear or spreading mass, naked or furnished with an involucre, the thecæ one-celled, with a longitudinal or oblique elastic articulated generally incomplete ring, bursting transversely and irregularly. This is a very extensive sub-order: the species inhabit almost every part of the world, from the tropics to the arctic and antarctic regions; they are exceedingly variable in size and appearance, including the largest tree-ferns and the smallest herbaceous species. It contains by far the largest number of genera of any of the sub-orders of the Ferns. Many of these are very extensive, and have no British representatives, as Cyathea, Hemitelia, Alsophila, Dicksonia, &c.

III. Osmundaceæ has the thecæ with an operculiform ring, or without one, reticulated, striated with rays at the apex, bursting lengthwise, and usually externally. The species of this sub-order are not numerous.

IV. Danæaceæ, the thecæ sessile, without any ring, concrete into multilocular sub-immersed masses, opening at the apex. This is also a small sub-order, with three genera—Danæa, Marattia, and Kaulfussia.

V. Ophioglossaceæ, the thecæ single, roundish, coriaceous, opaque, without ring or cellular reticulation, half 2-valved with a straight vernation. It embraces the genera Ophioglossum, Helminthostachys, and Botrychium.

The following is an arrangement of the British genera of Ferns.

Sub-order Polypodiaceæ.

Tribe. *Polypodieæ*, the sori nearly circular, without an indusium.

Allosorus.
Polypodium.
Woodsia.

Tribe. *Aspidieæ*, the sori nearly circular, covered by an indusium.

Lastrea.
Polystichum.
Cystopteris.

Tribe. *Asplenieæ*, the sori oblong or linear, covered by an indusium, opening longitudinally on one side.

Athyrium.
Asplenium.
Scolopendrium.

Tribe. *Grammitideæ*, the sori elongate, without an indusium.

Ceterach.

Tribe. *Adiantariæ*, the thecæ covered by a marginal or submarginal elongated part of the frond, or by a separated portion of the cuticle, resembling an indusium.

Blechnum.
Pteris.
Adiantum.

Tribe. *Hymenophylleæ*, the thecæ opening irregularly; the ring oblique, eccentric, transverse, complete; the receptacle terminating a vein at the margin of the frond.

Trichomanes.
Hymenophyllum.

Sub-order, Osmundaceæ.

Tribe. *Osmundeæ*, the vernation circinate; the rachis solid; the thecæ stalked.

Osmunda.

Sub-order, Ophioglossaceæ.

Genus, Ophioglossum.
Botrychium.

The ferns have a wide geographical distribution. The herbaceous and shrubby kind being found towards the north and south poles: whilst the tree-ferns rival the gigantic palms in the forests of tropical climates. It is these last which give a peculiar character to the vegetation of the countries where they grow, as their foliage and stems differ altogether from any that are observed amongst flowering plants. The proportion which they bear to other plants varies much in different parts of the world. In Jamaica they are in the proportion of 1 to 9; in New Guinea as 28 to 122; in New Ireland as 13 to 60; in the Sandwich Islands as 40 to 160. On continents they are less numerous. In equinoctial America 1 to 36; in New Holland 1 to 37; in France 1 to 63; in Portugal 1 to 116; in the Greek Archipelago 1 to 227; in Egypt 1 to 971. In the north their proportions are greater; they form in Scotland 1 to 31; in Sweden 1 to 35; in Iceland 1 to 18; in Greenland 1 to 10; and the North Cape 1 to 7.

The properties and uses of the ferns are not in proportion to their numbers in the vegetable kingdom. Many of them deposit starch in their rhizomata, from which food may be prepared. The roots of Nephrodium esculentum are eaten in Nipal; those of Angiopteris evecta are used in the same manner in the Sandwich Islands. Diplazium esculentum, Cyathea medullaris, Pteris esculenta, and Gleichenia dichotoma, all yield starch, and are employed as food in different countries. [Cyathea, P. C. S.] The Adiantum Capillus Veneris yields astringent and aromatic secretions. [Adiantum, P. C.] Some of the American polypodiums are said to possess powerful medicinal effects, and are used as anti-rheumatic, anti-venereal, and febrifugal remedies. The Angiopteris evecta yields an aromatic oil, which is used in the Sandwich Islands to perfume the fixed oils, as cocoa-nut oil. The stems of many species contain bitter principles, and have hence been used as tonics. Species of Aspidium and Asplenium have been used in European medicine. [Aspidium, P. C. S.; Asplenium, P. C. S.] The Brazilian negroes form tubes for their pipes from the stems of Mertensia dichotoma. Osmunda regalis had at one time a great reputation in medicine.

(Babington, *Manual of British Botany*; Lindley, *Natural System*; Hooker, *Species Filicum*; J. Smith, *The Genera of Ferns*; *Journal of Botany*, vol. iv.; Newman, *History of British Ferns*; Burnett, *Outlines of Botany*; Meyen, *Pflanzen-Geographie*.)

FILIPE'PI, SANDRO or ALESSANDRO, commonly called Botticelli, from the name of a goldsmith to whom he was apprenticed, was born at Florence in 1437. He studied painting under Filippo Lippi, and became one of the first painters of his time, though his chief excellence was in his invention and expression. He painted many pictures for the churches of Florence, some of which are still preserved, and are now in the gallery of the Florentine academy. He painted a small picture for the church of Santa Maria Novella, representing the adoration of the kings, in which the kings were portraits of Cosmo, Julian, and Cosmo's son, Giovanni Medici. This was one of Sandro's masterpieces, and was, in the early part of this century, in the possession of Mr. Young Ottley, the author of the 'Inquiry into the early history of Engraving.'

Sandro painted also for Sixtus IV., in the Capella Sistina, at Rome, three pictures from the history of Moses and the Israelites, his largest and best works. After the completion of these works he returned to Florence, neglected painting, and gave himself up to Savonarola, and to Dante's 'Inferno,' which he illustrated, and he attempted himself to engrave his designs; it is not known exactly how many he engraved, but those attributed to him are miserably executed; they are however scarce, and fetch very high prices. Nineteen altogether were engraved for an edition of Dante published by Nicolo di Lorenzo at Florence, in 1481, but they were nearly all engraved by Baldini from Sandro's designs. [Baldini, Baccio, P. C. S.] Sandro, after his connexion with Savonarola, neglected his worldly concerns to that degree that he would probably have starved had it not been for the bounty of Lorenzo de' Medici: he survived Savonarola many years, and died at Florence in 1515.

Botticelli was one of the last of the old Italian or *quattrocento* school of painting, which passed away at the appearance of the grand works of great *cinquecentisti*, Da Vinci, Michael Angelo, and Raphael. There are some works by Sandro in good preservation in the imperial gallery of Florence and in the gallery of the Academy; in the former is his picture of Calumny, from Lucian's description of the picture by Apelles of Ephesus. [Antiphilus, P. C. S.]

(Vasari, *Vite de' Pittori*, &c.; Lanzi, *Storia Pittorica*, &c.; Rumohr, *Italienische Forschungen*; Ottley, *History of Engraving*.)

FILTER, FILTRATION. In addition to what is given on this subject under Filter, P. C. p. 269, we may refer to Water-Works, P. C. pp. 122, 123, for a notice of plans for the filtration of water upon an extensive scale, and to Sugar, P. C. p. 230, for an account of a vacuum filter for separating molasses and colouring matter from sugar. Further details on the various modes of filtering water, oil, and other liquids, with representations of several kinds of apparatus employed for the purpose, are given in Dr. Ure's 'Dictionary of Arts, &c.,' and Hebert's 'Engineer's and Mechanic's Encyclopædia.' Among these, some have for their object the maintenance of a uniform pressure of the fluid upon the filtering surface by a self-acting contrivance, which admits the fluid from a reservoir just as fast as it passes off through the filter. On a small scale this may be done by inverting a bottle, filled with the liquid to be filtered, with its open neck or mouth in the funnel or other vessel at the bottom of which the filtering materials are placed. So long as the fluid in the funnel is above the level of the mouth of the bottle, no fluid will flow from the bottle into the funnel: because no air can enter the bottle to take its place; but so soon as, by the process of filtration, the fluid in the funnel falls below the mouth of the bottle, air enters it, and consequently liquid flows out into the funnel until it rises high enough again to prevent the admission of air. An apparatus on the same principle, adapted for use on a large scale, is represented by Dr. Ure. In other cases, the admission of fluid to the filter is regulated by a ball-cock, or valve connected with a float. In some cases, as in the vacuum filter above referred to, hydrostatic or pneumatic pressure is employed to increase the rapidity of filtration, by closing the filtering cylinder, and forcing the fluid into it either by a force-pump, or by a pipe from an elevated cistern; by producing pressure by air or steam upon the surface of the fluid; or by occasioning a partial vacuum beneath the filter, in the vessel which receives the fluid after it has passed through it. When such pressure is applied, the water or other fluid is sometimes caused to *ascend* through the filtering materials, or to pass through them horizontally, or in any required direction. In some filters, the action is compounded of descent by gravity and ascent by hydrostatic pressure; by which arrangement the fluid may be compelled to pass through a great quantity of filtering material in a small space. Hebert gives the details of a kind of ascending filter designed for removing the salt from sea-water, by forcing it through a mass of compressed sand; but though the contrivance is simple, and well adapted for purifying water from floating impurities, the chemical combination of the saline constituents of sea-water would probably, as he apprehends, render it ineffectual for the intended purpose. He likewise represents a kind of filter, which is also alluded to by Dr. Ure, in which the filtration is carried on without any exposure to the access of air; both the vessel into which the impure fluid is put, and that which receives it after filtration, being hermetically closed. These two vessels are connected together by a small air-pipe, through which the air displaced from the lower vessel by the dropping of the fluid into it ascends into the upper vessel to occupy the space which it has just vacated. The process therefore is conducted without the contact of any more air than the vessels contain at its commencement, and without the escape of any vapours from the fluid; so that the most volatile liquids may be filtered without loss, and the injurious effects which in other cases might arise from the free admission of air are avoided.

FINIGUERRA. [Engraving, P. C., p. 438.]

FIORILLO, JOHANN DOMINIK, a distinguished German painter and author, was born at Hamburg in 1748. He went to Rome in 1761, and was for four years the pupil of Pompeo Batoni; he studied also some time at Bologna, where he was elected a member of the academy in 1769. In 1784 he was appointed to the professorship of art in the university of Göttingen, where he died in 1821. He is the author of several essays relative to the history of modern art, but his great work is his history of painting, comprising the 'Geschichte der Mahlerey' (History of Painting) in Italy, France, Spain, and England, in five volumes, and the 'Geschichte der Zeichnenden Künste in Deutchland und den Vereinigten Niederlanden' (History of the Arts of Design in Germany and the United Netherlands), in four volumes, 8vo. The whole forms a very useful compilation; but he has introduced notices of so many artists of utter historical insignificance, that he has not been able to give sufficient space to the important artists, and the first five volumes are a mere chronological series of short biographies, but they contain much interesting matter of the latter centuries of the middle ages. The German portion is a work of great research, merit, and utility, especially where he treats of early times.

Fiorillo painted to the last, but he did not execute many pictures: his master-piece is considered a large picture of 'The surrender of Briseis to the Heralds of Agamemnon,' from Homer.

(Meusel, *Miscellaneen Artistischen Inhalts*; Nagler, *Künstler-lexicon*.)

FIRE-BOTE. [Estovers, P. C.; Common, Right of, P. C.]

FIRE-PROOF BUILDINGS. The most obvious method of rendering houses and other buildings indestructible by fire, is to construct them entirely of incombustible materials, such as stone, brick, and iron, to the exclusion of timber, at least in the framing and floors. Such a mode of construction, however, though very well adapted for some classes of public buildings, where cost of construction is not an object, and where domestic comforts and conveniences are not required, is of very limited application. The use of iron, and especially of cast-iron, in buildings, has indeed increased very much, and many plans for the construction of dwelling-houses almost entirely of that material have been brought forward, although the great advantages which they promise have not succeeded in dissipating the popular prejudices which oppose the introduction of so startling a novelty. It was stated in the 'Mining Journal,' in 1842, in a paragraph quoted in No. 665 of the 'Penny Magazine,' that a large number of cast-iron houses were then about to be manufactured in Belgium and England for the citizens of Hamburg, whose habitations had been burnt in May of that year; and it was remarked that, as the walls of such houses would be hollow, they might be easily warmed by a single stove placed in the kitchen. A three-story house, containing ten or twelve rooms, it is observed, will not cost more than 1100*l.*, regard being had to the manner in which it may be ornamented; and a house of this description may be taken to pieces and transported from one place to another at a very moderate expense.

Nicholson, in his 'Architectural Dictionary,' dismisses the subject of Fire-Proof Houses in very few words. He says, that in their construction, vaulted or cast-iron floors and roofs should be employed in every apartment, and observes, that while vaulting is well adapted to the lower story of a building, if it be used in the upper stories the walling must be carried up very thick, in order to resist the thrust of the arches, and this extra substance not only darkens the apartments, but also occasions enormous expense. The most convenient substitute, he says, is a floor sustained by cast-iron joists, the intermediate spaces between which are either vaulted with brick, or covered with cast-iron boards flanged and keyed together. A much fuller account of various plans of fire-proof construction is given in Hebert's 'Engineer's and Mechanic's Encyclopædia,' article 'Fires, Prevention of.' These and some others we may briefly notice under two classes, the first, consisting of plans for the use of fire-proof materials in lieu of timber; and the second, of methods for rendering timber itself incombustible.

Brickwork forms in this country the chief material of the external walls of houses, and [Building, P. C. S., p. 248] it is occasionally employed without any admixture of timber for the partition walls also, a plan which, in conjunction with other precautions, tends greatly to limit the damage done by a fire to the apartment in which it may happen to break out. To render brick partitions available for this purpose, however, iron must be employed instead of timber for beams or brest-summers, to support such walls as may have large openings beneath them (unless they are supported by arches), and also for any pillars employed to sustain such beams. Cast-iron pillars and brest-summers are very extensively employed in this way in modern London shops and warehouses, where the whole front on the ground floor is left open for shop-windows and doors. When the floors and other parts of a building are to be constructed of timber, and protected by some such means as are indicated below, it will in most cases be advisable to use only incombustible materials in such essential parts of the skeleton or carcase of a house. Fire-proof floors of the character alluded to by Nicholson are now often adopted, not only in public buildings, but also in the larger and better sort of private houses; the beams being either of cast or wrought-iron, shaped transversely, somewhat like an inverted T, and the brick vaultings, which abut upon the ledges of the beams, being often only half a brick, or four inches and a half thick, carefully turned in cement. The beams may be connected with one another by wrought-iron tie-rods, to prevent any lateral thrust on the walls, and the spandrils, which, owing to the flatness of the arches, are of very trifling depth, being filled up with concrete, so as to produce a solid level surface, upon which a flag or tile pavement, or a floor of cement, may be laid. In private houses it is usual to surmount the vaulting by a floor of wood, supported by the iron beams or ribs, which, in some cases, rises as high as the crown of the arches. [Floor, P. C. S.]

In Farrow's patent method of fire-proof building, described by Hebert, the floors are supported upon joists of wrought-iron, formed with a lateral projecting flange on each side, upon which are laid, stretching from joist to joist, a series of flat stones from two inches to two inches and a half thick, the upper surfaces of which lie flush with the upper edges of the joists. These produce a level stone floor, interlined with iron, which may either be used as such or be covered with planks. The ends of the joists are turned down and let into bond stone laid upon the walls, and cemented or run in with lead, which mode of fastening, combined with the weight of the superincumbent walls, prevents the joists from sagging, and consequently enables them, though slender, to bear an enormous weight. The advantages of such a mode of construction may be seen from the experiments of Mr. Smart, noticed under Trussing, P. C., p. 319, so far as the strength of the floor is concerned; but it is further advantageous as a means of tying the walls together. When it is intended to cover the floor with boards, provision may readily be made for securing them down in their place, and dowelling them together, without any nails or visible fastenings. The under surface of the stones may be *stabbed* or made rough, so that plaster may be applied immediately to it without the intervention of laths. A floor thus formed occupies a depth of from four to five inches only. Such floors have been successfully adopted in some sugar-refineries, and other buildings peculiarly exposed to accidents by fire. The same construction is applicable to roofs, and the patentee considers that a roof so constructed, and covered with mastic, is the cheapest roof ever invented, in addition to the combined advantages of being fire, air, and water proof.

Mr. Frost, another of the experimentalists on fire-proof building, has invented a mode of constructing floors and roofs of hollow square earthenware tubes, laid in strata crossing each other in direction, and united with cement in such a way that the whole floor becomes one solid flag-stone. The weight however is said to be not one-fifth that of stone, while the strength is asserted to be equal to that of timber. The tubes are made of brick earth, carefully prepared by machinery; and the cement, which also affords a convenient substance for protecting various parts of a building from the action of fire, consists of chalk mixed with about thirty per cent. of clay, both being ground in water, and the finer portions floated off to a reservoir. The moisture is drained off, the residuum allowed to evaporate to dryness, and afterwards broken up, burnt in a kiln, ground to powder, and packed in casks ready for use. Another mode of constructing fire-proof floors and roofs, employed in the building of Buckingham Palace, but invented long before, and first used at Lord Thurlow's seat at Knight's Hill, near Dulwich, consists in the use of arches composed of hollow earthen coombs or pots, springing from stone abutments resting upon the flanges of iron girders. The spandrils, in a roof constructed on this plan, are filled up with brickwork, so as to form a level surface, which is covered with hot cement composed of chalk, coal-tar, and sand. The first coat of cement is levelled with heated irons, and suffered to harden, after which a second coat is laid, and slates are imbedded in it before it cools. The use of earthen pots in building, as may be seen by referring to Circus, P. C., pp. 197, 199, was known to the Romans. Fire-proof roofs are perhaps, in ordinary buildings, less important than fire-proof floors; but they are easily constructed in various other ways than those above indicated, by the use of iron framing and some light metallic covering. The staircase, although it is one of the most important parts to secure from fire, is too often one of the chief means of communicating it from one part of a house to another. Wherever the expense can be borne, a stone staircase, with a metallic balustrade or hand-rail, or, under certain circumstances, a staircase formed entirely of iron, is highly desirable as a means of security against fire.

The cheapness of timber, the facility with which it may be worked into any required shape, and the ideas of domestic comfort connected with the use of wood for floors and other parts of a house, combine to render very important any method by which it may be rendered incombustible. Solutions of muriate of ammonia, muriate of soda (common salt), sal-ammoniac, borax, alum, and several other salts and alkalies, with which wood may be impregnated, or which may be applied to its surface, possess this quality in a limited degree; and by Payne's wood-preserving process [Timber, Preservation of, P. C. S.], timber is made, for all practical purposes, completely incombustible. It may also be rendered almost unassailable by fire, by simply preventing the passage of air through its joints, or by covering it with some substance which is a bad conductor of heat. In the first of two papers on the prevention and extinction of fires, published in the 'Penny Magazine' in 1840 (Nos. 531 and 532), it is stated that early in the last century Dr. Hales communicated to the Royal Society a method of checking the spread of fires by the non-conducting properties of earth or sand, with which he proposed to cover such parts as might, during a fire, be in danger of igniting. He found by experiment that a layer of damp mould one inch thick, spread upon a fir plank of about half that thickness, was sufficient to prevent the plank from being burnt through in less than two hours by a fierce fire lighted upon the earth, and continually urged by bellows; and even when the wood was at length ignited, it burned without flame. About seventy-five years ago Mr. Hartley brought forward a plan for protecting buildings from fire by nailing thin plates of iron to the tops of the joists, beneath the flooring-boards, and in other places, in order to prevent the communication of flame from one part to another of the timber-work of a house; and about the same time Earl Stanhope introduced another method of accomplishing the same object. 'He proposed,' according to the paper above referred to, 'to fix oak or fir laths crosswise between the joists, and to coat the whole, both joists and laths, with a thick layer of plaster: this plaster was composed of one measure of common rough sand, two of slacked lime, and three of chopped hay, mixed with water and beaten up into a stiff mortar. A layer of sand was placed on the plaster which covered the joists and laths; and when the plaster and sand were quite dry, the flooring-boards were to be laid down.' Both Mr. Hartley and Earl Stanhope made several satisfactory experiments to prove the efficacy of their plans, yet neither of them was adopted to any extent.

Many similar attempts have been since made to force this important matter on public attention. Among the plans thus introduced Hebert mentions one which has been occasionally adopted in Edinburgh, of laying wooden floors with planks two and a half or three inches thick, so closely jointed and neatly fitted to the walls as to be practically air-tight. Some similar floors constructed at Manchester have the planks ploughed on the edges to receive thin iron tongues, which enter some distance into each board. Such floors, laid upon iron joists, would be very difficult to ignite, either from above or below, especially if the ceilings beneath them were formed of a composition more fire-proof than the common plaster. Professor Fuchs, of the Academy of Science at Munich, invented a composition consisting of ten parts potass or soda, fifteen parts fine silicious earth, and one part charcoal, mixed together with water, which, when applied to the surface of wood, forms a vitreous coat, capable of effectually resisting the action of fire. Hebert states that after some decisive experiments had established the efficacy of this plan, the Royal Theatre of Munich was protected with this composition. The surface covered was upwards of 400,000 square feet, and the expense is said not to have exceeded 5000 francs, or about 200*l.* He gives also the following English composition for the like purpose, which is said to form a very strong and adhesive coating, both fire and water proof:—one part, by measure, of fine sand, two parts wood-ashes, and three parts slacked lime, ground together in oil, and laid on with a painter's brush, the first coat thin, and the second thick. Within the last few years a company has been formed for bringing into use a kind of fire-proof cement or composition similar to the above, invented by Mr. Davies. Among several public experiments which have been made to prove its efficiency is one which is thus noticed in the paper above quoted from the 'Penny Magazine':—'A house, or rather the shell of a house, was purchased near London, and the whole of the timbers, floors, ceilings, stairs, and other portions of woodwork were completely coated with a certain composition. When this was dried, some of the rooms were furnished with the common articles of domestic furniture, small in value, but of the usual nature as to combustibility, &c. A large quantity of shavings and pieces of wood were strewed on the floors of the several rooms; and on a given day each room was set on fire. Every article in each room was completely consumed; but in no case did the fire penetrate to the woodwork of the room, or pass from one room to another: some gunpowder was placed between the ceiling of one room and the floor of the one above it; but neither the fire above nor that beneath had any effect on the gunpowder.'

We may close this article with the concluding remarks of the paper above quoted, that public attention is now so much directed to this subject 'that we may fairly expect the time to be not far distant when the principle of fire-prevention will form part of the system by which most houses will be built;' and that 'until this is done, we may look for the repetition of the same kind of distressing calamity by fire which so often comes before the public eye.'

FIRE-SHIP is a vessel laden with combustible materials, which is sent, or left, in a burning state among the ships of a hostile fleet for the purpose of setting them on fire.

The Greek fire, which is said to have been discovered by a Byzantine engineer in the seventh century, appears to have been employed for the destruction of ships in naval actions, also for dispersing troops in engagements on land, and for setting fire to houses in besieged towns. It is supposed to have been a composition of sulphur, bitumen, and naphtha, which, being contained in an earthen vessel, was thrown by the hand or projected from some engine. The writers in the time of the crusades describe the missile as resembling a great dragon flying through the air with a stream of fire issuing from its mouth, and they add that water thrown on it only made it burn more fiercely; it could be extinguished however by pouring on it vinegar, and covering it with sand.

But a fire-ship of the nature above defined began to be employed at a much later period; one such was contrived by Giambelli, an Italian engineer; and this 'infernal machine,' as it was designated, was employed in 1585 to destroy the bridge laid across the Schelde when Antwerp was besieged by the Prince of Parma (Strada, *De Bello Belgico*, decas secunda, lib. vi.): three years afterwards the Spanish armada, while at anchor off Calais, was dispersed by eight fire-ships which the English admiral sent against it. Fire-ships were also used by the English and Dutch at the sieges of St. Malo, Hâvre-de-Grace, and Dunkirk, in the reign of William III., but none of these appear to have succeeded. One of these ships is described as having the lower hold filled with sand, above which were barrels containing in all 20,000 pounds of powder; over these were laid a bed of stones and a quantity of loaded shells and carcasses: these were also covered with stones, and above the latter were barrels containing wood and tar.

In fire-ships of the most recent construction there is formed between decks, on both sides, a stage four feet wide, consisting of timbers four inches square, disposed horizontally with intervals between them equal to their breadth: these timbers are attached at one end to the ship's sides, and at the other they rest on a longitudinal timber supported on props which are set up at intervals along the ship. On this stage is a groove six inches wide and three inches deep, which goes quite round the ship; and timbers, in which are similar grooves, extend at intervals across it: these grooves contain the hose carrying the powder by which fire is to be communicated to the materials; and when the hose is placed in them, they are covered with planks.

The stage is entirely covered with a tarpauline on which is strewed loose powder, and on this are placed the combustible materials. These consist of faggots of wood and bundles of hemp steeped in a mixture of resin, turpentine, saltpetre, and mealed gunpowder; billets of wood dipped in saltpetre and pitch; casks filled with chips of wood mixed with pitch and turpentine; and among these are distributed loaded shells and carcasses. Faggots soaked in pitch are also fastened to the sides of the ship and are bound with copper wire about the props supporting the stage; and previously to lighting the fire the ports are opened, in order that the combustion may be increased by a current of air between decks.

The bowsprit and the ends of the yards are furnished with grappling-irons, which are suspended by ropes, in order that by swinging about they may take hold of the hulls or rigging of the ships to be destroyed.

A fire-grate is fixed near the stern; and when the commander has brought his ship in contact with one of those which belong to the enemy, he orders the crew to pass through a port in the stern into a boat which is provided for the purpose: he then puts fire to the wood in the grate; and, as soon as he has ascertained that the train of powder has begun to burn he quits the ship: the boat is then rowed off as fast as possible.

Fire-ships can only, with a prospect of success, be sent among such as, in an action, have been dismasted or otherwise rendered incapable of manœuvring; or among ships in a port, which consequently are unable, from want of room, to avoid the danger. It was thus the Turkish fleet, having been defeated by the Russians, was entirely destroyed by fire-ships sent into it, while at anchor in the bay of Tchesmé, in which it had taken shelter. Fire-ships are now, however, seldom used in warfare; and perhaps they ought only to be sent against ships which refuse to strike, after having been rendered incapable of continuing the action.

FIRENZUO'LA, A'GNOLO, was born September 28, 1493, in the city of Firenze (Florence). He was christened Michelagnolo Girolamo, but his name was afterwards contracted to Agnolo (Angelo). The family name was taken from the small town of Firenzuola, in Tuscany, between Florence and Bologna, in a valley among the Apennines, near the source of the Santerno. Negri, Niceron, and others who have followed them, appear to have been mistaken in stating that the family name was Nannini. Agnolo's father, Bastiano Giovannini da Firenzuola, and his grandfather Carlo da Firenzuola, were citizens of Firenze, and both of them held offices of trust in the city under the patronage of Cosmo de' Medici.

Agnolo Firenzuola lived in his native city devoted to the study of elegant literature till the age of sixteen, when he went to Siena, where he studied law with much labour but little satisfaction to himself; he also studied at Perugia, and practised for a short time as an advocate at Rome. While yet a young man he left the law for the church, assumed the habit of the monks of Vallombrosa, and in the year 1525 was elected abbot of the monastery of Santa Maria Ermita, at Spoleto. He was afterwards appointed abbot of San Salvatore, at Prato, where he chiefly resided during the rest of his short life. The year of his death is not known, but it was probably about 1542 or 1543, since he dates the dedication of his 'Discorsi degli Animali' on the 9th of December, 1541, and Lorenzo Scala, who published the work in 1548, speaks of his death as having occurred a few years before 1548. Tiraboschi doubts if Firenzuola ever was an abbot, but gives no reason for disputing the authority of other writers as well as of documents, than that his life was not sufficiently pure for the sacred office: a very insufficient reason as applied to the dignitaries of the church of Rome in those times. Scala calls him 'Il Reverendo Abate Messer Agnolo Firenzuola:' and addressing himself to Pandolfo Pucci, speaks of Agnolo as his 'caro e virtuoso amico' (his dear and virtuous friend).

His works were published in 1548, as already stated, partly by Lorenzo Scala and partly by Carlo Firenzuola, Agnolo's brother: they consist of 'Discorsi degli Animali;' 'Ragionamenti;' 'Novelle;' 'Epistola in Lode delle Donne;' 'Dialogo delle Bellezze delle Donne;' 'Discacciamento delle Nuove Lettere;' two comedies, 'I Lucidi' and 'La Trinuzia;' 'Asino d'Oro d'Apulejo rifatto in Lingua Fiorentina,' and 'Rime.'

Firenzuola is entitled to a high place among the early Italian writers. His works have been frequently reprinted, both separately and collectively, and are still much read. His two comedies, regarded merely as specimens of dramatic dialogue, are not surpassed by anything in the language. He has less power and originality of imagination than Ariosto, Machiavelli, and Divizio (Cardinal Bibbiena), who immediately preceded him, and Gelli, who was his contemporary; but his dialogue is always natural, spirited, appropriate to the characters, and in purity of idiomatic Tuscan is unsurpassed by any other Italian author. He is one of the 'testi di lingua,' or writers of the highest authority in the language, and as such is frequently quoted in the 'Vocabolario' of the Academy della Crusca. 'I Lucidi' is an adaptation of the 'Menaechmi' of Plautus, but the plot of 'La Trinuzia' (Triple Marriage) appears to have been invented by himself, except that the character of Rovino seems to have been modelled on that of Calandro, in the 'Calandria,' of Cardinal Bibbiena. Firenzuola's two plays are free from the indecencies which pollute his 'Novelle.' They are printed in the second edition of Biagioli's collection of Italian classic writers, 'Tesoretto della Lingua Toscana,' Paris, 8vo., 1822, with copious notes in French explanatory of the difficult idioms.

The 'Novelle,' of which there are ten, are short tales in the manner of Boccaccio, inferior in invention and perhaps in descriptive power, but of equal elegance of narrative and dialogue; some of them however are little less licentious than many of those of Boccaccio himself.

Firenzuola's version of the 'Golden Ass' of Apuleius is partly adapted and partly translated. The time is changed from the 2nd century to the 15th; the Greek towns are converted into Italian towns, and the Lucius of the original work becomes Agnolo in the version. The leading circumstances are retained, but altered as far as is necessary to suit the change of time and country; the alteration however is by no means an improvement of the original narrative, though the composition, as a specimen of Italian prose, is admirable.

Firenzuola's other prose works, which are mostly in the form of dialogue, are delightfully written; his 'Dialogo delle Bellezze delle Donne' especially, abounds in descriptions of exceeding delicacy, conveyed in a style so graceful and flowing, as to give to a series of remarks all the attraction of an interesting narrative. The 'Discacciamento' was written in opposition to the party who were then attempting to introduce certain letters not previously in use into the Florentine alphabet, such as the letter K. Firenzuola, in a sonnet, addresses the literary reformers as 'kandidi ingegni.'

As a writer of verse Firenzuola has considerable merit; his sonnets, indeed, are less delicate in thought and expression than those of Petrarch, but his satirical verses are of a high class, very effective, and in elegance and facility hardly inferior to those of Berni.

(*Vita di Agnolo Firenzuola*, prefixed to his *Opere*, Pisa, 6 vols. 18mo., 1816; Ginguené, in *Biographie Universelle*; Tiraboschi, *Storia della Letteratura Italiana*.)

FIRESTONE, a local term for the upper green-sand, as it occurs along the edges of the chalk hills south of London, as at Mesterham and Petersfield. (Fitton, 'On Green-sand,' in *Geol. Trans.*)

FISCHER VON ERLACH, JOHANN BERNHARD, together with his son Joseph Emanuel, Baron von Erlach, distinguished architects, designed or superintended the building of all the principal public and private edifices which were erected at Vienna in their time. Johann the father was born either at Prague or Vienna in 1650, and studied under Bernini at Rome, and all his works are in the style of that architect. His first work was the palace of Schönbrunn, commenced in 1696 for Joseph I., to whom, and Charles VI., he was court architect; he died in 1724.

Joseph finished the works which his father left incomplete, the principal of which is the magnificent church of St. Karl Borromaeus, finished in 1737. He was created Baron von

Erlach by Charles VI. He was born in 1680, but the year of his death is not known, though it was after 1740. He was the first to introduce the steam-engine into Germany. There is a notice of these architects and their works in the Austrian 'National Encyclopädie' of 1835, ii. 147.

FISCHER, KARL VON, founder of the Munich school of architecture, was born at Mannheim, September 19, 1782; and at the age of fourteen was placed by his father, Hofrath von Fischer, who had observed in him an unusual inclination for drawing, especially for drawing buildings, with Ober-baudirector Verschaffelt, a man of great ability in his profession. On Verschaffelt's removing to Vienna in consequence of being employed by Prince Esterhazy, Fischer accompanied him thither, and remained in that capital from 1801 to 1806; and besides the advantage he derived from studying there at the Academy of Fine Arts, acquired much practical experience, being intrusted by Verschaffelt with the superintendence of some of the buildings he was engaged upon. It was while he was at Vienna that he first projected what afterwards became his greatest work, for, having made designs for an opera-house, and also for another theatre, which excited much admiration, he was commissioned to modify the plan of the latter so as to adapt it for the new 'Hof Theatre' which it was intended to erect at Munich. The scheme however was dropped for a time: so, on quitting Vienna, Fischer visited France first, afterwards Italy, in which latter country he spent about two years, diligently studying all the most remarkable examples of architecture, whether entire buildings or particular features of them, thereby enriching himself with a valuable collection of lessons both in general composition and detail. On his return to Germany in 1809, he went to Munich, where he was made Professor of Architecture at the Academy, of which office he continued, up to the time of his death, to discharge the duties with equal zeal and ability, being most earnest and anxious in promoting the advancement of the students. He afforded them free access to all his own drawings and books (afterwards purchased for the Academy at his death); and it was in consequence of his strongly urging it, that the Academy began to form a collection of architectural casts and models.

One of the first buildings erected by him at Munich was the mansion for the minister Salabert, at the entrance to the 'English Garden,' which was afterwards occupied by Prince Karl, and then called the 'Pavillon Royal.' When the Karoline-Platz and Maximilian Vorstadt were first laid out in 1810, he built fourteen of the principal mansions and houses in that quarter, introducing a nobler style of architecture than had hitherto been employed in constructions of that class. Among other private residences and hotels by him, the most remarkable are those for the then Crown-Prince of Bavaria, Baron von Asbeck, Count Pappenheim, and Baron von Zentner. The façade of the 'Ministerial-gebäude des Innern,' or Home-office;—the Auger-kirche and General Hospital were also by him. All these however were but minor works in comparison with the 'Hof Theatre,' which is still one of the principal ornaments of Munich, though numerous other stately edifices have been since added to the city. This magnificent theatre was begun in 1811, and first opened Oct. 12th, 1818, but within a short time it was destined to the fate which has proved destructive to so many structures of the kind, it having been nearly consumed by fire in 1823: it was however begun to be rebuilt the following year, according to the original designs. Plans, sections, and other drawings, fully illustrating this edifice, may be found in Förster's 'Bauzeitung' for 1841; and the dimensions of the theatre and stage are stated in the Table, page 299, THEATRE, P. C. Noble as is the order of the portico—a Corinthian octastyle, whose columns are 52 Bavarian or 49 English feet high—the portico itself (merely a monoprostyle) is by no means satisfactory as a whole, the wall behind the columns being pierced by two tiers of windows—a most unlucky union of fenestration and columniation, the former quite destroying the classical character so ambitiously aimed at by the latter. Fischer did not live to learn the fate of the structure reared by himself, as he died, after several months' severe suffering from a pulmonary disorder, Feb. 11th, 1820; leaving his father (then 73 years old), and a wife, and young daughter to regret his loss; and not them alone, but a numerous 'family' of pupils, sincerely attached to so excellent an instructor. Several of these have since greatly distinguished themselves, especially Friedrich von Gärtner of Munich, chief architect to the King of Bavaria.

FISHES, FOSSIL. For the successful investigation of the numerous specimens of fishes, generally imperfect, and difficult of interpretation, which occur in the various stratified rocks, we are almost wholly indebted to one naturalist. It is to M. Agassiz, following in the footsteps of Cuvier, that we owe the remarkable progress which has been made in this branch of Palæontology. The systematic thread by which this author has cleared away the obscurity of the subject of fossil fishes is already explained in the article ICHTHYOLOGY, P. C., and we propose here to give an enumeration of the genera and their geological distribution, as far as relates to the British Islands. The list is compiled from the reports of M. Agassiz to the British Association in the years 1843 and 1844. The geological classification is that developed in the Cyclopædia, articles PALÆOZOIC SERIES and SALIFEROUS SYSTEM.

TABLE I.—*General Distribution of the orders of Fossil Fishes.*

	Placoid.	Ganoid.	Ctenoid.	Cycloid.
Cainozoic Strata . . .	*	*	*	*
Mesozoic Strata . . .	*	*	*	*
Palæozoic Strata . . .	*	*		

Hence it appears that the two orders of Ctenoid and Cycloid fishes, which are the most abundant in existing nature, have no representatives yet discovered in the Palæozoic strata.

If we divide the two groups of Mesozoic and Palæozoic strata into their constituent parts we shall have additional results.

TABLE II.—*Distribution of the orders of Fossil Fishes in Mesozoic and Palæozoic Strata.*

	Placoid.	Ganoid.	Ctenoid.	Cycloid.
MESOZOIC:				
Upper . . .	*	*	*	*
Middle . . .	*	*		
Lower . . .	*	*		
PALÆOZOIC:				
Upper . . .	*	*		
Middle . . .	*	*		
Lower . . .	*			

Hence it would appear that the Placoid fishes (Onchus, &c.) are, geologically speaking, the most antient of the finny races; that the Ganoid fishes, Holoptychius, &c. begin in the middle Palæozoic series, and the Ctenoid and Cycloid only in the upper Mesozoic (Cretaceous) group. It is however very possible that this last statement may be modified by further research in the oolites. At present the distribution of Ctenoid and Cycloid fishes in the chalk is thought to favour the notion of the almost Cainozoic character of that deposit.

In the next four Tables (Tables III., IV., V., VI.) we give the geological distribution of the several families (some are merely provisional) under which M. Agassiz has ranged the British Fossil Placoid fishes.

TABLE III.—*Distribution of the Families of Placoid Fishes.*

	Ichthyodorulites.	Cestraciontes.	Hybodontes.	Squalides.	Rajes.	Chimerides.	
CAINOZOIC:							
Upper .	*	—	—	*	*	—	
Middle .	—	—	—	—	—	—	
Lower .	*	—	—	*	*	*	Period of greatest abundance.
MESOZOIC:							
Upper .	*	*	—	*	—	*	
Middle .	*	*	*	*	*	*	
Lower .	*	—	—	—	—	—	
PALÆOZOIC:							
Upper .	*	*	*	*	—	—	
Middle .	*	*	—	—	—	—	
Lower .	*	—	—	—	—	—	

Hence the most prolific periods for Placoid fishes seem to be the upper Palæozoic, the middle and upper Mesozoic, and the lower Cainozoic strata.

TABLE IV.—*Distribution of the Families of Ganoid Fishes.*

	Lepidioides.	Sauroides.	Cœlacanthes.	Pycnodontes.	Acipenserides.	Sclerodermes.	
CAINOZOIC:							
Upper .	—	—	—	—	—	—	
Middle .	—	—	—	—	—	—	
Lower .	—	—	—	*	*	—	Period of abundance.
MESOZOIC:							
Upper .	*	*	*	*	—	*	
Middle .	*	*	*	*	*	—	
Lower .	*	*					
PALÆOZOIC:							
Upper .	*	*	*	—	—	—	
Middle .	*	*	*	—	—	—	
Lower .	—	—	—	—	—	—	

The Ganoid fishes (singular forms, however) begin to abound in the middle Palæozoic series, and become rare above the lower Cainozoic series. They are also rare in existing nature. M. Agassiz once included the Glyptocephalus of Sheppey among the Ganoids, but in his later catalogue he has joined it to the Cycloids.

TABLE V.—*Distribution of the Families of Ctenoid Fishes.*

	Percoides.	Sparoides.	Teuthies.	Chetodontes.
CAINOZOIC:				
Upper . . .	—	—	—	*
Middle . .	—	—	—	—
Lower . . .	*	*	*	—
MESOZOIC:				
Upper . . .	*	—	—	—
Middle . . .	—	—	—	—
Lower . . .	—	—	—	—
PALÆOZOIC:				
Upper . . .	—	—	—	—
Middle . . .	—	—	—	—
Lower . . .	—	—	—	—

The account of the Ctenoid fishes in the lower Cainozoic strata is from the report of M. Agassiz to the British Association in 1844.

TABLE VI.—*Distribution of the Families of Cycloid Fishes.*

	Acanthopterygians.					Malacopterygians.						
	Scomberoides.	Xiphioides.	Sphyrænoides.	Labroides.	Blennioides.	Scomberesoces.	Clupeides.	Characins.	Gadoides.	Anguilliformes.	Doubtful.	Undetermined.
CAINOZOIC:												
Upper .	—	—	—	—	—	—	—	—	—	—	—	—
Middle .	—	—	—	—	—	—	—	—	—	—	—	—
Lower .	*	*	*	*	*	*	*	*	*	*	*	*
MESOZOIC:												
Upper .	—	*	—	—	—	*	—	—	—	—	—	*
Middle .	—	—	—	—	—	—	—	—	—	—	—	—
Lower .	—	—	—	—	—	—	—	—	—	—	—	—
PALÆOZOIC:												
Upper .	—	—	—	—	—	—	—	—	—	—	—	—
Middle .	—	—	—	—	—	—	—	—	—	—	—	—
Lower .	—	—	—	—	—	—	—	—	—	—	—	—

To complete this view of the geological distribution of fossil fishes, we append an abstract of the catalogues of M. Agassiz, which have been already referred to.

Silurian System.

PLACOID FISHES.

Ichthyodorulites.

Onchus, two species.

Family unknown:

Thelodus, one species
Sclerodus, one species
Plectrodus, two species
Sphagodus, one species
Pterygotus, one species. (This is probably a crustacean.)

Devonian System.

PLACOID FISHES.

Ichthyodorulites.

Onchus, two species
Parexus, one species
Ctenacanthus, one species
Ptychacanthus, one species
Clematius, one species.

Cestraciontes.

Ctenoptychius, one species.

GANOID FISHES.

Lepidoides.

Dipterus, one species
Osteolepis, four species
Acanthodes, one species
Diplacanthus, four species
Cheiracanthus, three species
Cheirolepis, three species
Cephalaspis, four species
Pterichthys, eight species
Coccosteus, three species
Chelonichthys, two species.

Sauroides.

Diplopterus, three species
Platygnathus, three species
Dendrodus, three species
Lamnodus, two species
Cricodus, one species
Megalichthys, one species.

Cœlacanthes.

Holoptychius, five species
Glyptosteus, two species
Phyllolepis, one species
Glyptolepis, two species.

Carboniferous System.

PLACOID FISHES.

Ichthyodorulites.

Onchus, six species
Ctenacanthus, six species
Ptychacanthus, one species
Sphenacanthus, one species
Asteroptychius, two species
Physonemus, one species
Gyracanthus, four species
Oracanthus, four species
Leptacanthus, two species
Tristychius, one species
Cladacanthus, one species
Cricacanthus, one species
Orthacanthus, one species
Pleuracanthus, three species.

Cestraciontes.

Orodus, two species
Helodus, nine species
Chomatodus, three species
Cochliodus, five species
Psammodus, four species
Pœcilodus, six species
Pleurodus, two species
Ctenoptychius, eight species
Ctenodus, three species
Petalodus, eight species.

Hybodontes.

Cladodus, eight species
Diplodus, two species.

Squalides

Carcharopsis, one species

GANOID FISHES.

Lepidoides.

Acanthodes, one species
Amblypterus, three species
Palæoniscus, six species
Eurynotus, two species
Platysomus, one species
Plectrolepis, one species.

Sauroides.

Megalichthys, two species
Diplopterus, two species
Pygopterus, three species
Acrolepis, one species
Orognathus, one species
Graptolepis, one species
Pododus, one species.

Cœlacanthes.

Cœlacanthus, two species
Holoptychius, eight species
Hoplopygus, one species
Uronemus, one species
Phyllolepis, one species.

Permian System.

PLACOID FISHES.

Ichthyodorulites.

Gyropristis, one species

GANOID FISHES.

Lepidoides.

Palæoniscus, five species
Platysomus, three species.

Sauroides.

Acrolepis, one species
Pygopterus, two species.

Cœlacanthes.

Cœlacanthus, one species.

Triassic System.

PLACOID FISHES.

Ichthyodorulites.

Hybodus, one species
Nemacanthus, two species
Leiacanthus, one species.

Cestraciontes.

Acrodus, one species
Ceratodus, ten species.

Hybodontes.

Hybodus, one species.

GANOID FISHES.

Lepidoides.

Gyrolepis, three species
Palæoniscus, one species.

Sauroides.

Saurichthys, three species.

(N.B. Agassiz includes the Bone-bed at the base of the Lias in the Triassic System.)

Oolitic System.

PLACOID FISHES.

Ichthyodorulites.

Leptacanthus, three species
Nemacanthus, one species
Myriacanthus, three species
Asteracanthus, five species
Hybodus, thirteen species
Pristacanthus, one species.

Cestraciontes.

Acrodus, eight species
Ceratodus, one species
Strophodus, six species.

Hybodontes.

Hybodus, ten species
Sphenonchus, three species.

Squalides.

Thyellina, one species
Oxyrhina, one species.

Raies.

Arthropterus, one species.

Cyclarthrus, one species
Squaloraia, one species.

Chimerides.

Chimæra, eleven species. (This includes several generic groups of Egerton.)

GANOID FISHES.

Lepidoides.

Dapedius, seven species
Tetragonolepis, fourteen species
Centrolepis, one species
Amblyurus, one species
Semionotus, one species
Lepidotus, thirteen species
Pholidophorus, twelve species
Nothosomus, one species
Ophiopsis, two species.

Sauroides.

Eugnathus, thirteen species
Ptycholepis, one species
Conodus, one species
Pachycormus, nine species
Caturus, three species
Thrissonotus, one species
Amblysemius, one species
Sauropsis, two species
Leptolepis, four species
Saurostomus, one species
Aspidorhynchus, two species
Belonostomus, three species
Macrosemius, one species.

Cœlacanthes.

Ctenolepis, one species
Gyrosteus, one species.

Pycnodontes.

Gyrodus, six species
Sphærodus, three species
Gyronchus, one species
Microdon, two species
Periodus, one species
Pycnodus, thirteen species.

Acipenserides.

Chondrosteus, one species.

Cretaceous System.

PLACOID FISHES.

Ichthyodorulites.

Ptychodus, five species
Hybodus, one species
Chimæra, one species
Spinax, one species.

Cestraciontes.

Ptychodus, five species
Acrodus, one species
Strophodus, two species.

Squalides.

Scylliodus, one species
Notidanus, two species
Corax, one species
Otodus, one species
Oxyrhina, one species
Lamna, three species.

Chimerides.

Chimæra, five species.

GANOID FISHES.

Lepidoides.

Lepidotus, one species.

Sauroides.

Caturus, one species.

Cœlacanthes.

Macropoma, two species.

Pycnodontes.

Acrotemnus, one species
Gyrodus, four species
Pycnodus, five species
Sphærodus, one species.

Sclerodermes.

Dercetis, one species.

CTENOID FISHES.

Percoides.

Beryx, three species.

CYCLOID FISHES.

Hypsodon, one species
Enchodus, one species
Saurocephalus, two species
Saurodon, one species
Tetrapterus, one species
Acrognathus, one species
Aulolepis, one species
Osmeroides, two species.

Tertiary System.

PLACOID FISHES.

Raies.

Myliobates, sixteen species
Zygobates, one (Crag.)
Aetobates, two species
Pristis, three species
Raia, one species.

Squalides.

Notidanus, one species
Glyphis, one species
Carcharodon, two species
Otodus, two species
Lamna, one (Crag.)

Chimerides.

Elasmodus, one species
Edaphodon, three species
Passalodon, one species
Psaliodus, one species.

GANOID FISHES.

Pycnodontes.

Pycnodus, one species
Periodus, one species
Gyrodus, one species
Phyllodus, six species
Pisodus, one species.

Acipenserides.

Acipenser, one species.

CTENOID FISHES.

Percoides.

Myripristis, one species
Cœloperca, one species
Eurygnathus, one species
Podocephalus, one species
Synophrys, one species
Brachygnathus, one species
Percostoma, one species.

Sparoides.

Sciænurus, two species.

Teuthies.

Ptychocephalus, one species
Pomaphractus, one species
Calopomus, one species.

CYCLOID (ACANTHOPTERYGIOUS) FISHES.

Scomberoides.

Cybium, one species
Cœlopoma, two species
Bothrosteus, three species
Phalacrus, one species
Rhonchus, one species
Echenus, one species
Scombrinus, one species
Cœlocephalus, one species
Naupygus, one species.

Xiphioides.

Tetrapterus, one species
Cœlorhynchus, two species
Phasganus, one species
Acestrus, one species.

Sphyrænoides.

Sphyrænodus, two species.

Labroides.

Auchenilabrus, one species.

Blennioides.

Laparus, one species.

CYCLOID (MALACOPTERYGIOUS) FISHES.

Scomberesoces.

Hypsodon, two species
Labrophagus, one species.

Clupeides.

Halecopsis, one species
Megalops, one species.

Characins.

Brychetus, one species.

Gadoides.

Rhinocephalus, one species
Merlinus, one species
Ampheristus, one species
Goniognathus, one species.

Anguilliformes.

Rhynchorhinus, one species

(Doubtful Family.)

Pachycephalus, one species
Rhipidolepis, one species
Glyptocephalus, one species
Gadopsis, one species
Loxostomus, one species.

NOTE.—In the preceding Lists the French titles of the families are retained, as given by Agassiz.

FISHES, *Geographical Distribution of.* [ICHTHYOLOGY, RECENT, P. C. S.]

FISTULA'RIA, a genus of Acanthopterygious fishes remarkable for the extreme elongation of the anterior part of the head, forming a tube, at the extremity of which is the mouth. The *Fistularia tabacaria* of the Antilles is the type. It lives on little fishes and crustacea, which it draws out from the interstices of stones and holes in rocks by means of its long trunk or beak. Two other species are known, the *F. serrata* and the *F. immaculata.* They are all small fishes, not reaching two feet in length, slender, and eel-shaped.

FIXTURES. The term 'fixtures' is frequently used to signify articles of a personal nature which have been affixed to land, whether removeable or not, and sometimes expressly to denote articles which are not by law removeable when once attached to the freehold; but the term 'fixtures,' in its correct legal sense, signifies such things of a personal nature as have been annexed to the realty, and which may be afterwards severed or removed by the party who annexed them, or his personal representatives, against the will of the owner of the freehold. When the article is not so removeable, it is to all intents and purposes part of the freehold, and subject to the rules and incidents of real property.

It is necessary, in order to constitute a fixture, that the article should be let into or united with the land, or to other substances previously connected therewith. Goods, and even buildings of the most ponderous description, do not fall under the description of fixtures, if they are merely laid and rest upon the earth without being let into it. Something more than mere juxta-position is required, as, for instance, that the soil shall have been displaced for the purpose of receiving the article, or that the chattel shall have been connected or otherwise fastened to some fabric previously attached to the ground.

The old rule of law was, that whatever was once fixed to the land was thereby made a part of it, so as to be irremoveable by any one but the owner of the fee-simple. But the strictness of this rule has been from time to time considerably relaxed, regard being had to the object of the annexation, the nature of the article, the relation of the parties between whom questions have arisen, and other considerations. Questions as to fixtures arise principally between three classes of persons. 1st, Between landlord and tenant; 2ndly, Between the executors of a tenant for life or in tail and the remainder-man or reversioner; and, 3rdly, Between the heir and the executor of the party who put up or attached the article to the premises.

1. As to the law of fixtures between landlord and tenant.

A tenant may in general remove articles which he has himself affixed to the premises solely for the purpose of trade and manufactures wherever the removal is not contrary to any prevailing custom of trade. It cannot however be said to be established that a tenant may remove substantial and permanent additions to his premises on the ground of their having been built exclusively for the purposes of his trade, such as workshops, storehouses, mills, or other buildings of that description; nor is it clear that trade-erections of a less substantial character, such as furnaces and flues of smelting or glass-houses, or the stories and floors of malting-houses, &c., are in all cases removeable by a tenant. In such cases, somewhat will depend upon the degree in which the freehold will be deteriorated by the removal of the article, or the article itself injured or destroyed before it can be taken away.

There are also instances in which articles which have been fixed to the freehold, partly for the purposes of trade and partly for other purposes, have been held removeable. Besides the above, many fixtures slightly put up for the ornament of a house or for domestic use may also be removed by the tenant, But things attached to the freehold for agricultural purposes only are not removeable.

The following lists, given by Mr. Chitty, in his treatise on the Law of Contracts, p. 359, show what fixtures have been decided or considered, according to judicial dicta, to be removeable or not as between landlord and tenant.

1. List of things held not to be Removeable by the Tenant:—

Agricultural erections
Alehouse bar
Barns fixed in the ground
Beast-house
Benches
Box planted in garden
Bricks fixed with mortar
Carpenter's shop
Cart-house
Chimney-pieces (in general)
Conservatories
Cornices, if fixed substantially
Doors
Dressers
Flowers
Foldyard walls
Fruit trees
Fuel-house
Glass windows
Hearth
Hedges
Improvements, permanent
Jibs
Keys
Locks
Millstones
Partitions
Pigeon-house
Pineries substantially affixed
Pump-house
Racks in stables
Strawberry beds
Waggon-house
Windows.

2. List of things held to be Removeable by the Tenant (though not Trade Fixtures):—

Arras hangings
Barn on blocks
Beds fastened to ceiling
Bells
Bins
Blinds
Book-cases
Buildings on blocks
Rollers, pillars, &c.
Cabinets
Chimney backs
Chimney-pieces (ornamental)
Cider mills
Cisterns
Clock-cases
Coffee-mills
Cooling coppers
Coppers
Cornices, ornamental, fixed with screws only
Cupboards
Dutch barns
Furnaces
Furniture, fixtures put up as
Granary on pillars
Grates
Hangings
Iron backs to chimneys
Iron chests
Iron malt-mills
Iron ovens
Jacks
Lamps
Looking-glasses
Malt-mills
Marble chimney-pieces
Marble slabs
Mash-tubs
Mills on posts
Mills laid on brick foundations
Ornamental fixtures
Ovens
Pattens, erections on
Pier glasses
Posts
Presses
Pumps slightly attached
Rails
Ranges
Sheds
Shelves
Sinks
Slabs of marble
Stable on rollers
Stoves
Tapestry
Tubs
Turret clocks
Vessels, &c., on brickwork
Wainscot, fixed with screws
Water-tubs
Windmill on posts.

3. List of Trade Fixtures decided or said to be Removeable by the Tenant:—

Accessary buildings, that is, accessary to a removeable utensil
Brewing vessels and pipes
Cider-mills
Cisterns
Closets
Colliery machines
Coppers
Counters
Cranes
Desks
Drawers
Dutch barns
Engines
Fire-engines
Furnaces
Gas-pipes
Glass fronts
Iron safes
Machinery, let into caps or steps of timber
Partitions
Plants and pipes of brewers, distillers, &c.
Presses
Pumps
Reservoirs
Salt-pans
Shelves
Shrubs planted for sale
Soap works, fixtures in
Steam-engines
Stills
Trees planted for sale
Varnish-house
Vats.

There are also certain fixtures as to which the right of removal is unsettled, but has been the subject of discussion, in determining some of the cases already referred to: of the doubtful articles the subjoined is a list:—

Brick-kilns
Cornices
Frames in nursery grounds
Furnaces in smelting and glass-houses
Glasses in nursery grounds
Green-houses
Hot-houses
Lime-kilns
Malting-floors, stoves, &c.
Pavements
Sheds
Storehouses
Tables, fixed or dormant
Verandas
Wind or water mills
Workshops.

It must not however be assumed that no circumstances can except the enumerated articles from the decisions respecting them. The particular circumstances of each case, the state or position of the fixtures in question, and the consideration of the degree of injury to be caused by their removal, are so much regarded by the courts that few decisions can be regarded as absolute authorities for other cases, even with respect to fixtures of a similar description.

The general rule is, that a tenant must remove his fixtures before the expiration of his tenancy, for he is not at liberty to insist on his claim afterwards. But it seems that if a tenant continue in possession after the end of the term, even against the will of his landlord, he is entitled to remove fixtures not previously taken away. And if the interest of the tenant is of uncertain character, as of a tenant strictly at will, or pur autre vie, it is the common opinion that he will be entitled to a reasonable time after the determination of his tenancy to remove his fixtures.

The rights both of landlord and tenant with respect to fixtures are frequently modified and controlled by the terms of the demise, according to the general principle that parties may, by entering into a special contract, vary their legal rights with respect to each other. Thus, a covenant by the tenant to keep in repair all erections and buildings erected and built, 'and thereafter to be erected and built,' and to surrender them at the end of the term, will preclude him from removing erections put up by himself, and which, but for the covenant, might have been legally removed as trade fixtures. And therefore a tenant, before severing an article from the freehold, must consider his right not only under the general law of fixtures, but as it may be affected by any express or implied covenant in his lease.

It should be observed that any erection or building, whatever be its purpose, and however substantial it be in itself, unless it be affixed to the freehold according to the definition of a fixture before given, will not belong to the landlord at the end of the term. Thus, if the tenant erects a barn, granary, stable, or other building upon blocks, rollers, pillars, or the like, the landlord will not be entitled to it as part of his freehold. The tenant may therefore, by adopting appropriate modes of construction, make many valuable additions to his premises without losing his property in them, and at the same time avoid the effect of a covenant to repair erections which are put up by him during the term.

2. As to the law of fixtures between tenants for life or in tail, or their personal representatives, and the remainder-man or reversioner.

There are only few cases in which the claims of tenants for life or in tail to fixtures have come before the courts; but it appears generally from the authorities, that fixtures set up either wholly or partially for the purposes of trade form part of the personal estate of a tenant for life or in tail, and are excepted out of the general rule in favour of the inheritance; and it may be inferred from the analogy of decisions in cases between heir and executor, that the exception will extend to certain articles put up for ornament or convenience, provided they are not united to the freehold by any permanent or substantial mode of annexation.

It is necessary to distinguish between the rights of tenants for life and in tail under the law of fixtures from those which they possess under the general principles of tenure as incident to their estates. A tenant in tail, by reason of the nature of his estate, may, independently of the law of fixtures, remove anything he has affixed to the premises. A tenant for life, again, is not in general entitled to commit any kind of waste; but if he holds his estate *without impeachment of waste*, he possesses powers arising out of his estate similar to those of the tenant in tail. [WASTE, P. C.] But in either case those powers must be exercised during the life of the tenant, as they cease at his death, and nothing survives to his representative except his right under the law of fixtures.

Ecclesiastical persons are considered as tenants for life of their benefices, and the rights of such persons or their representatives with respect to annexations made by them to the freehold resemble very nearly those of other tenants for life.

3. As to the law of fixtures between heir and executor.

There appears to be more uncertainty in the doctrine of fixtures as between the heir and the executor, than between any other class of persons. In the early periods of the law, the rule that whatever was affixed to the freehold should descend to the heir as parcel of his inheritance, was rigidly adhered to, and even in later times the decisions and dicta of the judges upon the subject are by no means easy to reconcile. It may however be inferred from them generally, that as between the heir and executor trade fixtures and fixtures erected partly for trade and partly for other purposes, are part of the personal estate. This will be the case when the fixtures have been put up for the purposes of a trade which is merely personal, and has no connection with the land, and even in some cases, as that of Cider-mills (see 3 Atk. 14), where the trade is connected with the profits of the land; but if the property in question is absolutely essential to the value and enjoyment of the land, as was decided with respect to Salt-pans (1 H. Bl., 260, *n.*), it cannot be removed by the executor, but will descend to the heir as part of the inheritance. There are some articles put up for ornament or domestic use to which the executor has been held entitled, such as pictures, mirrors, hangings, cornices, &c., where the degree of annexation is slight, and the freehold will not be much deteriorated by the removal.

In questions with respect to fixtures, whether between landlord and tenant, tenant for life or in tail and the person entitled in remainder or reversion, or between heir and executor, much will frequently depend, not only upon the nature of the article, but also upon its construction, and the mode of its annexation to the freehold. The rule as to severance is construed most liberally in favour of the tenant as against the landlord, not quite so strongly in favour of the tenant for life or in tail, as against the remainder-man or reversioner, and in favour of the heir rather than of the executor. This must always be remembered in drawing inferences from decisions between different parties. Thus a decision in favour of the executor against the heir may be relied on between whatever parties the question may arise, but decisions in favour of the tenant against the landlord cannot be relied upon as conclusive in cases between other parties.

With respect to the transfer of fixtures the general rule is, that a conveyance or mortgage in general terms of lands and houses includes personal chattels attached thereto, though such chattels might otherwise have been removed under the law of fixtures. When the conveyance is not general, but contains a stipulation that 'the fixtures are to be taken at a valuation,' the question what fixtures are included (in the absence of a schedule or specification) is to be determined by the relative situation in which the parties are placed by the conveyance. If the conveyance be an absolute sale, then those articles only should be valued which would be fixtures as between heir and executor; if there be a demise only, or the assignment of a lease, the valuation should extend to all that would be considered tenant's fixtures as between landlord and tenant. If the description of the premises in the renewal of a lease contain the general terms, 'lands, buildings, erections,' &c., fixtures are considered to be included in the demise, and the tenant cannot afterwards remove them, whatever were his rights before the new lease was granted.

It is now settled that contracts exclusively for the sale of fixtures are valid without the formalities prescribed by the 4th section of the Statute of Frauds (29 Car. II. c. 3); though if the slightest interest in the realty be intended to pass, the statute will apply. It would seem, too, that a contract for the sale of fixtures is not within the 17th section of the statute as a contract for the sale of goods and chattels.

(See the Treatise of Messrs. Amos and Ferard on the law of Fixtures.)

FLABELLA'RIA, a generic title for some fossil plants, as F. borassifolia, from the coal formation. (Sternberg.)

FLACOURTIA'CEÆ, or **FLACOURTIA'NEÆ**, a natural order of plants belonging to Lindley's parietose group of polypetalous Exogens. It has from 4-7 definite sepals cohering slightly at the base, the petals equal in number with the sepals, and alternate with them, sometimes wanting; the stamens hypogynous, equalling the petals, or twice as many or some multiple of them, and sometimes appearing as scales forming a nectary; the ovary roundish, distinct, sessile or slightly stalked; the style absent or filiform; the stigmas equal in number to the valves of the ovary, more or less distinct from each other; the fruit 1-celled, sometimes indehiscent and fleshy, sometimes capsular, 4-5-valved filled with a fine pulp inside; the seeds few, thick, usually enveloped in a pellicle formed by the withered pulp, the albumen fleshy, somewhat oily, the embryo straight in the axis, with the radicle turned to the hilum, and therefore usually superior; the cotyledons flat, foliaceous. This order consists of shrubs and small trees, with alternate simple coriaceous leaves on short stalks, and axillary many-flowered peduncles.

The affinities of this order are strongest with Capparidaceæ, with which they agree in a number of particulars. De Candolle says they approach Passifloraceæ by means of their parietal placentation and the presence of a series of barren stamina analogous to the corona of that order. Lindley indicates also a relation to Samydaceæ. They may however be distinguished from all other plants by their unilocular fruit having their inside wholly covered with the placentæ. About 13 small genera are referred to this order. Of these, three constitute Blume's order Pangiaceæ; but the plants composing it are little known at present.

These plants are natives of the hottest parts of the East and West Indies and Africa. Three of the genera, Flacourtia, Hydnocarpus, and Chaulmoogra, yield plants used by man; few, if any, are cultivated for ornament.

Flacourtia, the type of the order, was named in honour of Etienne de Flacourt, a director of the French East India Company, and the commander of an expedition to Madagascar in 1648, of which he gave an account. This genus is diœcious; the staminiferous flowers have their stamens densely crowded, an hemispherical receptacle, and are glandless at the base; the pistilliferous flowers have the calyx 4-5-cleft, deciduous; the stigmas 4-9, each furnished with a longitudinal furrow above; the seeds long. The species are thorny shrubs, with whitish sepals and yellow stamens.

F. Ramontchi, has roundish ovate, acute crenated leaves. This shrub attains a height of eight feet, and is a native of the island of Madagascar, where it is called *Ramontchi*. The fruit, which is edible, is about the size of a small plum, is red when ripe, at length becoming violet-coloured. It has a sweet and acid taste. There is a small island off the coast of Madagascar which is covered with these trees. This island is called by English sailors Plum-tree Island; by the French, Isle aux Prunes.

F. sapida has elliptical leaves, serrated, bluntish at both extremities. It is a native of the mountainous districts of the East Indies. The fruit is about the size of a common currant, and of a red colour. The fruit is eaten by the natives, and the tree is called by the Telingese *Pedda Caurew*.

F. inermis has elliptical crenato-serrated leaves, with short axillary racemes of hermaphrodite flowers. It is an unarmed tree, attaining a height of 30 feet. It has reddish-purple berries of a pleasant acid taste. It is a native of the Moluccas, where it is also extensively cultivated for the sake of its fruit. There are several other species of Flacourtia, all of them yielding edible fruits.

Hydnocarpus (from ὕδνον, a tuber, and κάρπος, a fruit) has diœcious flowers, the staminiferous ones with 5 stamens, 5 sepals, the two outer ones being ovate, 5 petals with villous margins furnished with a scale on the inside; the berry is spherical, terminated by four reflexed tubercles. There is only one species of this genus, which is a tree about thirty feet in height, the *H. venenata* of Gærtner, and *H. inebrians* of Vahl. It is a native of Ceylon. The fruit when eaten produces sickness, giddiness, and a dangerous form of intoxication. It is greedily devoured by fishes, which become stupified, but when taken in this way they produce poisonous effects as food.

Chaulmoogra is a diœcious genus; the staminiferous flowers with a 4-5-lobed calyx, 5 petals with a scale at the base of each; the pistilliferous the same, except the stamens, the ovary superior, 1-celled, with numerous ovules, and 5 parietal placentæ, 5 styles; the fruit succulent, dry, 1-celled, many-seeded.

C. odorata has short-stalked, alternate, bifarious, drooping, lanceolate, entire, acuminate, smooth, exstipulate leaves, 6 to 10 inches long, 1½ to 2½ inches broad. It is a native of Silhet. The seeds are employed extensively by the natives of India as a remedy for cutaneous diseases. In those cases they are applied externally; the testa being removed from the seed, the perisperm is beaten up with clarified butter into a soft mass, and applied to the part affected three times a day. The Indian names of this plant are *Chaulmoogra* and *Petarkura*.

The other genera belonging to this order are *Ryanaea*, named by Vahl after John Ryan, who collected plants in Guyana; *Patrisia*, named after M. Patris, who collected plants in Guyana; *Roumea*, after Philippe Rose Roume de St. Laurent, an agent of the French government at St. Domingo, who was of great service to Poiteau, who travelled there; *Kiggelaria*, after Francis Kiggelar, a Dutch botanist of the seventeenth century; *Stigmarota*, *Melicytus*, *Erythrospermum*, *Pangium*, and *Vareca*.

(Don, *Gardener's Dictionary*; Lindley, *Natural System*; Lindley, *Flora Medica*; Burnett, *Outlines of Botany*.)

FLAGSTONE. A variety of sandstone, in which the laminated structure prevails, is thus termed. Other laminated or thin-bodied rocks, as certain limestones and some argillaceous beds of the Silurian series, receive the same title. The laminations of flagstone arise from peculiarity of *deposition*; the laminations of slate (properly so called) arise from a new structure superadded to that of deposition, and possessing a certain symmetry and relations to lines and axes, which are at least analogous to crystalline arrangements.

FLEET PRISON, the name of a metropolitan prison now abolished, so called from its being situated by the side of the river Fleet, now covered over. It was the prison to which persons were committed by the ecclesiastical courts, courts of equity, Exchequer, and Common Pleas. It was governed by an officer called the warden, who was responsible for the custody of his prisoners, and summarily answerable to the courts whose prisoners were sent there for any abuse of authority, extortion, or other misconduct.

The Fleet Prison was abolished by the 5 & 6 Vict. c. 22, which established the Queen's Prison (formerly the Queen's Bench Prison) as the only prison for debtors, bankrupts, and other persons who might formerly have been imprisoned in the Queen's Bench Prison, the Fleet Prison, or the Marshalsea Prison. The prison was pulled down in 1845.

FLEXIBILITY is a property of bodies by which they yield transversely, on the application of some power: this property is distinct from elasticity, as it does not necessarily follow that the bodies acted on recover their original figures when the power is removed.

Fibres of wool, silk, hair, and the like, possess this property in a high degree; rods of wood, metal, and stone are flexible. and those of the two last materials are more particularly so when heated. The property is so much the more sensible as the fibres or rods are longer.

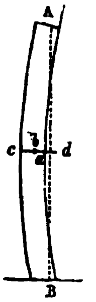
The deflexions of beams or bars in vertical and in horizontal positions, when strained by weights, have been noticed in Materials, Strength of, P. C.; and the employment of the fibres of hemp and of iron or copper wire in the formation of ropes is explained under Ropes, P. C. Ropes made of metal are said to be even more flexible than those made of hemp, the capabilities of suspending weights being equal, and the former being, of course, less in circumference than the latter.

The mathematical theory for the vibrations which may take place in a thread which is perfectly flexible, when small forces are applied to all its points; and the investigation of formulæ for determining the position and velocities of the points at the end of a given time, may be seen in Poisson's *Traité de Mécanique*, No. 482, &c., edit. 1833.

FLEXURE OF COLUMNS. If the particles of which a column is composed were equal spheres in contact with each other and arranged in lines parallel to the axis of the column, a weight diffused uniformly over the top of the column, when the latter is in a vertical position, would probably produce no flexure: but if the particles be supposed to have any tendency to slide laterally, particularly if they are irregularly distributed so that they are over the intervals between others below them, it must follow, from the action of the weight at the top of the column, either that the particles thrust one another laterally outwards all round the axis, producing in the column a swell which is greatest in the middle of its length, or that, the compression of the particles being greater on one side than on another, the column is diminished in length, on the compressed side; the weight being thus made to act obliquely upon it, a general bend of the whole column in one direction is produced.

This effect takes place in pillars of iron, stone, and wood; and when the bend, which in a pillar of uniform dimensions is generally greatest in the middle, becomes considerable, a rupture takes place: sometimes the fracture across the column is a plane inclined to the axis; but often a swelling appears near the middle, on the concave side, and, at the instant of rupture, a fragment in the form of a wedge is detached. The fibres of wooden pillars are generally of serpentine forms, and they adhere together laterally with, comparatively, a small force: hence, when such a pillar is compressed longitudinally by a weight, the latter acts obliquely on the fibres; and thus a pillar of wood becomes bent sooner than one formed of the other materials.

When a column is bent by a weight applied at the upper end, it is evident that, on the side which is concave outwards, the particles extending to some distance within the column must be in a state of compression, while those beyond that distance, towards the side which is convex outwards, must be in a state of tension; and, in any transverse section of the column, the line on opposite sides of which the particles are in opposite states is called the neutral line. The situation of this line in any section can only, at present, be determined by experiment.



Let AB be a vertical line passing through A in the centre of the upper extremity of a column bent by a weight, and imagine *cd*, in any transverse section (suppose in the middle of the column) to be a line cutting the concave face in *a*; it is evident that, if the column were incompressible, each of the particles immediately above *ca*, which, by the weight at A acting at *d*, the extremity of the lever *ad*, is separated from a particle in *ca*, resists the force of separation by its cohesive power acting at the end of a lever whose length is the distance of the particle from *a*, and the whole resistance depends on the momenta of cohesion in all the particles between *a* and *c*; whereas, the column being compressible, and the neutral point being somewhere, as at *b*, between *a* and *c*, it is evident that the resistance of each particle to the action of the weight will depend on a lever whose length is the distance of the particle from *b*, and the whole resistance, on the momenta of cohesion in the particles between *c* and *b*. Hence it is evident that the compressibility of a column must increase the tendency of the column to be broken in consequence of the flexure produced by a weight placed upon it.

In Materials, Strength of, P. C., it is stated, agreeably to the mathematical theory of elastic bodies compressed in the direction of their lengths, that the weights which solid columns will bear at the instant of beginning to bend varies with $\frac{ad^2}{l^2}$, in which a is the area of a transverse section, d its depth and l its length; and, when the pillar is a solid cylinder, this expression may be transformed into $\frac{d^4}{l^2}$ (d representing the diameter). Also in Poisson's 'Traité de Mécanique,' No. 315 (ed. 1833) it is shown that the force by which an elastic hollow cylinder resists the tendency to flexure by a weight acting in the direction of its length is expressed by a formula which denotes that the force, or weight, varies with $\frac{d^4-d'^4}{l^2}$, in which d and d' are, respectively, the exterior and interior diameters of the cylinder, and l its length. These formulæ must be understood however as holding good only for columns which are incompressible; and, till lately, good experiments for the determination of the actual strength of columns were entirely wanting.

This desideratum is now supplied by the valuable series of experiments carried on by Mr. Hodgkinson, and of which a full account is given in the 'Philosophical Transactions' for 1840 (Part II.). The columns, which were placed in vertical positions, were of various length, from a few inches to seven feet six inches, and all were subject to pressures acting vertically; some were cylindrical and others were rectangular prisms, and the former were either solid or hollow: in some cases the ends of the columns were planes perpendicular to the lengths, in order that the pressure might be diffused uniformly over those ends; and, in the others, the ends were hemispherical, in order that the pressure might be transmitted almost wholly in the direction of the axis. Of the experiments alluded to, a few only can be stated here; but these, which are contained in the following table, may serve to give an indication of the relative strength of different columns when supporting weights, and of the inflexions which the columns experience.

No.	Nature of Column.	Material.	Forms of Ends.	Length in Inches.	Diameter, or Side, in Inches.	Weight in lbs. producing flexure.	Deflexion in middle, in dec. of in.	Breaking weights in pounds.
1	Solid Cylind.	Cast Iron	Hemispherical	60·5	0·5	113	·49	136
2	do.	do.	do.	60·5	0·5	136	·23	150
3	do.	do.	do.	60·5	1·53	10525	·14	10861
4	do.	do.	do.	60·5	1·96	24857	·6	25403
5	do.	do.	do.	30·25	0·99	4985	·13	6105
6	do.	do.	do.	15·125	0·5	1997	·31	1997
7	do.	do.	Plane	30·25	1·	21629	·27	21853
8	Solid Prism	do.	do.	60·5	1·03×1·02	4052	·43	4164
9	Hollow Cyl.	do.	Hemispherical	90·75	Ext. di. 1·78 Int. di. 1·21	3317 5333	·11 ·49	5585
10	do.	do.	Plane	do.	Ext. di. 1·78 Int. di. 1·21	8861 16705 17489	·11 ·5 ·66	17840
11	Solid Prism	Danzig Oak	Rounded	60·5	1·75×1·75	2141	·13	2749
12	do.	do.	Plane	do.	do.	9949	·14	10171

From his experiments Mr. Hodgkinson has obtained the following conclusions;—

All the pillars whose lengths exceeded four times their diameters became bent before they broke; and when the pillars were of uniform dimensions, both ends being plane or both hemispherical, the greatest flexure was near the middle of the length and the fracture was at that place; but when one end was plane and the other hemispherical, the fracture was at a distance from the rounded end equal to about one-third of the whole length.

Pillars of cast iron with plane ends, and having their lengths about thirty times their diameters, were broken by weights equal to one-third or one-fourth of those which would crush them if they had been made short enough to be crushed without bending: and when the lengths of pillars, whether made of cast-iron, wrought-iron, steel, or timber, were from 30 to 121 times their diameters, the ratio between the weights supported on those with flat and those with rounded ends was nearly as 3 to 1; the weight, in the latter case, falling almost entirely on the axis. The strength of iron columns with flat ends appeared, however, to suffer a diminution of relative strength as they became shorter; and this was found to be owing to the tendency of those columns to be crushed by the greater weight which, in order to produce flexure, it became necessary to place on them. The ratio between the strengths of pillars having both ends flat and both rounded, within the lengths above mentioned, was nearly constant; and when one end of a column was rounded and another flat, the strength was found to be nearly an arithmetical mean between those of the other pillars.

In some of the experiments the cast-iron columns were formed with disks at their ends, the diameters of the disks being about twice as great as those of the columns; and it was found that these sustained a greater pressure before breaking than the simple columns: the strengths of such columns were about equal to those of columns of equal diameters and half their lengths, the ends of the latter being hemispherical. When columns were thicker in the middle than at either end, their strength was thereby increased, if compared with cylindrical columns, by one-ninth or one-seventh.

Mr. Hodgkinson succeeded, in many of his experiments, in determining the position of the neutral point; and, among the experiments stated in the above table, the fifth and sixth are those in which the situation of the point appears to have been correctly ascertained. In the former it was at a distance from the compressed side of the column equal to 0·23 inch; and, in the latter, at a distance from the like side equal to 0·11, being measured, in both cases, at the place of fracture, in the direction of a diameter. In the prismatic pillars, the flexure always took place in the direction of a diagonal. The hollow columns used in the experiments were often thicker on one side than on the opposite, yet the strength of such columns differed little from those of columns of uniform thickness: the reason for this seems to be that the thin side was almost always that which was compressed; and as iron resists compression with about six times the force with which it resists tension, it must follow that such a column would seldom give way on the compressed side.

In solid cast-iron pillars whose lengths were from 30 to 121 times their diameters, the ends being hemispherical, the breaking weight, with flexure, varied nearly as a power of the diameter whose exponent was 3·76: when the ends were plane, that exponent was 3·55. When the diameter was so small that very little compression took place before the pillars broke, the exponent was nearly equal to 4, agreeably to the mathematical formula above stated. In the like pillars, whether the ends were rounded or flat, the breaking weights varied inversely as a power of the length whose exponent was 1·7. The experiments on hollow cast-iron cylinders whose lengths were not less than 30 times their external diameters, showed that the above exponents of the powers of the external and internal diameters, and also of the lengths, hold good for the breaking weights. Computing therefore the coefficients, on the supposition that the diameters were expressed in inches and the lengths in feet; the expressions for the breaking weights (W) in pounds were:—for hollow cylindrical columns with hemispherical ends,

$$W = 33379 \frac{d^{3.76} - d'^{3.76}}{l^{1.7}};$$

and for such columns with flat ends,

$$W = 98922 \frac{d^{3.55} - d'^{3.55}}{l^{1.7}}:$$

the same formula serving for solid cylinders by making, in both, $d' = 0$.

FLINDERSIA. [CEDRELACEÆ, P. C. S.]

FLINK, GOVERT, a very able Dutch painter, born at Cleves in 1616. His parents were wealthy, and designed Govert for a merchant, an occupation to which he showed every disinclination; but his parents steadfastly opposed his own inclination to become a painter, until they happened to hear a sermon by Lambert Jakobzen, a Minorite of Leeuwarden, who was himself a painter. They in consequence changed their notions as to the eligibility of Govert's choice, and placed him with Jakobzen to learn to paint. He studied afterwards a year under Rembrandt at Amsterdam, and completely mastered his style of execution and colour, and adhered to it for some years until after the death of Rembrandt, when the Italian taste prevailed, and he had seen the works of Rubens and Vandyck. Flink then took as much pains to get out of Rembrandt's manner as he had before taken to acquire it. He was however as successful in the one as in the other, and produced several historical pictures and many portraits, all of which rank among the best productions of the Dutch school. He died in 1660, aged only forty-four. If he had not died at so early an age, he would probably have produced many noble works, as his last picture is his best, his Solomon praying for Wisdom, in the Council Hall at Amsterdam. He has also painted many admirable portraits: he has had few superiors as a portrait-painter.

Flink formed a good collection of prints and Italian drawings, which was sold after his death for 12,000 florins.

(Houbraken, *Groote Schouburg*, &c.)

FLINT. The true origin of this mineral substance—as it occurs in the chalk of Europe especially—has been, and still is, the subject of much discussion among microscopists and geologists. Mr. Bowerbank believes generally in the origin of flints (and some allied minerals) from sponges. In confirmation of this view spicula, such as characterize the silicious sponges (Halispongia), are found in flint, and on the surfaces of flints peculiar marks of organization referable to spongeous texture. Ehrenberg, finding in some flints abundance of infusorial animalcula, suggests the origin of flint from aggregations of these silicious-shielded microzoaria. Mr. Charlesworth has recently found flint occupying the closed pulp cavity of a tooth of mososaurus, and regards this fact as opposed to both speculations.

It appears desirable to prosecute still further the microscopic researches on this subject, and to extend the inquiry to other silicious minerals, especially the cherts which lie in the oolite of Yorkshire, the lias of Mendip and Glamorgan, and the mountain-limestone of Britain generally.

FLOOR. [House, P. C. S.]

FLOOR-CLOTH. The use of a covering for floors, though partly dependent on other circumstances, is mainly determined by the kind of material of which the floor is made; since, so far as decoration is concerned, certain kinds of flooring are in themselves more elegant than any covering that could be applied to them.

Checquers of black and white, or various-coloured marble, form a kind of flooring well adapted for large buildings; because there is space at command for producing a pattern both large in size and complex in details. The pavement beneath the dome of St. Paul's well illustrates the facilities afforded by this kind of flooring for the development of a large design: it is quiet to the eye, and is not frittered down into insignificance by the smallness of the different patterns. The *mosaic* pavements, so much adopted by the Romans, appear to have been more frequently used for floors of moderate size than for those of great magnitude. The halls of private houses and many of the principal apartments seem to have been often floored in this way: the flooring, in such cases, consisted usually either of a series of ornamental borders enclosing one or more compartments containing a device or group, or of a uniform pattern in two or three colours. [Mosaic, P. C.] Another kind of flooring, technically named by the French *parquetry*, owes its beauty to the arrangement of small pieces of wood in an ornamental form: it is, in fact, a species of mosaic in wood. About two centuries ago this sort of workmanship was in high favour, especially in France, where a workman named Boule carried the inlaying process to a high degree of delicacy. In some examples the pieces of wood employed were so small and the colours so selected, as to admit of the formation of pictures, or of small articles for furniture or ornament: in such case the term *marquetry* was applied to the result produced, *parquetry* being the name employed when floors were the object of the workmanship. Since the use of sawing and planing machines the production of parquet flooring has been rendered more easy than formerly. The simpler kinds are said to have had their origin in a desire to avoid the warping of long narrow boards, by employing boards only three or four feet long by as many inches in width, and arranging them in various patterns. In a recent periodical work ('Art-Union,' 1845) it is stated that a foreigner, Mr. Steinitz, has lately extended the use of such flooring as this in England; he has floored two small rooms in Windsor Castle, and a portion of one of the staircases in the new Royal Exchange. He is said to proceed thus:—The thin layers, or veneers, of ornamental wood are fitted on stout oak frames formed into compartments, comprising squares, diamonds, polygons, or any other desired shape; the oak frames are rather more than an inch in thickness, and the rich or coloured wood laid on them is from a quarter to three-eighths of an inch in thickness. All beautifully grained wood, capable of being cut up into veneers, such as maple, cedar, mahogany, satinwood, rosewood, and ebony, are available for this purpose.

Floors possessing an ornamental character are, however, decidedly an exception to the general rule; and it has become customary, in this country at least, to lay down some sort of covering on the wooden boards of which the flooring is formed, in most rooms a little removed from the humbler class. Two extensive branches of manufacture have become by degrees established for this purpose—that of *Carpets* (for which see Carpet, P. C.), and that of *Floor-cloth* or *Oil-cloth*, more modern and less important than the other. As both of these kinds of covering are formed of cloth, and as *Drugget* is a sort of medium between the two, it is not difficult to see how motives of economy may have led from the use of a carpet to a plain drugget, and from this to a painted drugget or cloth, more or less diversified in the arrangement of the colours.

Floor-cloth is made partly of hemp and partly of flax, the former being the cheaper of the two, but the latter better fitted to retain the oil and paint on the surface. As a means of avoiding the necessity for seams or joinings in the cloth, looms are constructed expressly for the weaving of the canvas, of the greatest width likely to be required. As brought to the floor-cloth factories, the pieces of canvas have generally one of these scales of dimensions:—a hundred yards long by six wide, a hundred and eight yards by seven, a hundred and thirteen yards by eight. The flax and hemp are spun, and the canvas woven, almost entirely in Scotland, chiefly at Dundee; and the degree of fineness is generally such as to present about sixteen or eighteen threads to the linear inch.

The canvas, throughout the subsequent operations, retains the same width as was given to it in the loom; but it is cut into pieces varying from sixty to a hundred feet long: each of these pieces has to be stretched over a frame in a vertical position; and in most of the factories there is a large number of such frames, some a hundred feet long by eighteen or twenty high, others sixty feet long by twenty-four high. As a means of transferring the canvas to these frames, it is, when the bales are opened, cut to the proper length, laid down on the floor of a large room, and coiled round a long wooden roller about five inches in diameter; this roller is then lifted up vertically and removed close to the frame; one edge of the canvas is nailed or hooked to one edge of the frame, and the roller is made to travel onwards and to revolve in such a manner as to give off the canvas as fast as the latter can be hooked to the upper horizontal bar of the frame; when all is uncoiled and the canvas hooked on all four of its edges, the sides of the frame are so drawn by winches and levers as to stretch the canvas to a degree of tightness nearly equal to that of a drum, notwithstanding the extent of the surface (from fifteen to eighteen hundred square feet). Here the canvas remains many weeks, during most of the processes.

Before the imprinting of the pattern which forms the most conspicuous feature in floor-cloth, the surface of the canvas requires a great deal of preparation, to render it smooth and durable. The pattern is applied on one surface only; but both surfaces are painted and prepared, the back before the front. A wash of melted size is applied by means of a brush to each surface; and, while this is yet wet, the surface is well rubbed with a flat piece of pumice-stone, whereby the little irregularities of the canvas are worn down, and a foundation is laid for the oil and colour afterwards to be applied. To work over so large an extent of surface, the workmen are provided with narrow scaffoldings, built up in front of, but not in contact with, the surface of the canvas: one scaffold being in front and another behind the canvas.

When the size-preparation is dried, the painting begins. The paint employed consists of the same mineral colours as those used in house-painting, and, like them, mixed with linseed oil; but it is much thicker or stiffer in consistence, and has very little turpentine added to it. The first layer of paint is applied with a trowel; or rather, the paint is dabbed on in large masses here and there, by means of a brush, and then levelled and spread by means of a kind of trowel twelve or fourteen inches in length. Ten or twelve days are required for this thick coating to dry; and at the expiration of this time a second coating is laid on, thinner than the former, and applied with a brush instead of a trowel. These two layers of paint are all which the back or hinder surface of the canvas receives; but the front or face receives a greater thickness and a greater number of processes. For instance, after the sizing, the surface is rubbed down with pumice-stone; then comes the 'trowel-colour,' followed by a second rubbing with pumice; and then two, three, or more layers of colour, applied with a brush, each coating being followed by a rubbing with pumice before the next one is applied. The surface has by this time acquired a great degree of smoothness, and the general substance a suppleness and pliability.

The prepared canvas is next removed from its vertical position in the frame, and wrapped round a roller, which is so placed as to allow the canvas to be uncoiled and spread out on a table to be printed. The printing of floor-cloth is conducted much on the same principle as that of paper-hangings for rooms [Paper-hangings, P. C.], and that of 'colour-printing,' viz. the successive application of two or more blocks or engraved surfaces, each one giving a different part of the device from the others, and being supplied with paint of a different colour. In the infancy of this art the pattern was given by means of 'stencil-plates;' that is, thin plates of metal or of pasteboard were pierced with holes at the parts intended to form the pattern, and the paint was so applied as to fall through these holes upon the surface of the canvas spread out beneath. It was rather less than a century ago that the use of wood-blocks superseded that of stencil-plates for this purpose. The first block so employed was about fifteen inches square, and had a simple device of zig-zag lines cut upon its surface; when this was pressed face downwards on a cushion coated with wet paint, it took up a layer on all the raised parts of the device, and was then in a fit state to impart its impress to the canvas. The increased complexity arising from the employment of several colours was a feature of later introduction.

As at present conducted, the printing of floor-cloth with several colours requires much care on the part of the designer before the painter enters on his department. In the first place, the device is carefully drawn on the full scale on a stiff sheet of paper, and is coloured fully in every part according to the exact appearance which it is intended to present on the canvas. A second piece of paper is placed under this, and with a pin or pricker a series of holes is made through both papers, following the outlines of the pattern so far as regards one colour, which we may suppose to be green; another blank paper is placed under the pattern in lieu of the former, and the outlines of another coloured portion of the device are marked through both papers with the pricker; and so on as many times as there are colours, the outline of each colour being transferred to a paper distinct from the others. An equal number of blocks of wood are then prepared; these consist of two thicknesses of white deal and one of pear-tree wood, ranged at right angles with respect to the grain, to prevent warping; they are about fifteen inches square, by two and a half in thickness, and the pear-tree surface is the one on which the engraving is to be executed. One of the pricked papers is laid down on a prepared block, and a little bag containing pounce or pounded charcoal is daubed all over it; the powder enters the pin-holes, and leaves upon the surface of the wood a series of dots sufficient to guide the carver in working out the design, which he does by cutting away all the surface except where the lines of device are marked. All the other blocks are treated in the same way; and it is easy to see that each one is left uncut at those parts which are cut away in all the others, so as to avoid confusion of colours.

The blocks (which we will suppose to be four for one pattern, red, yellow, blue, and green) being ready, and the prepared canvas spread out on a flat table, the printing commences. The paint (say red) is applied with a brush to the surface of a pad or cushion formed of flannel covered with floor-cloth; the block, held by a handle at the back, is placed face downwards on this cushion, and the layer of paint thus obtained is transferred to the surface of the canvas by pressing the block smartly down on the latter. A second impression is made in a similar way by the side of, and close to, the first; and so on throughout the length and breadth of the canvas; each impression being about fifteen inches square. The proper junction, or 'register,' of the successive impressions is aided by pins at the corners of the blocks. When the whole surface is thus printed with one colour, all the other three are similarly applied in succession. Such would likewise be the case if the number of colours was more than four: but the greater the number the greater would be the care necessary in adjusting the numerous partial impressions so as to ensure a proper arrangement of the whole.

In printing floor-cloth for passages and stairs, where the width seldom exceeds a yard, the canvas is prepared in the frames as in other cases; but it is cut up into strips before being printed, and has usually a border given to its pattern by means of blocks much narrower than those employed in other cases. Where there are large patches of one colour in the pattern of floor-cloth, they are not given by smooth surfaces on the block, but by means of little projecting squares technically called 'teeth;' the reason for this is, that if a surface two or more inches square were laid on wet paint, it would not take up the paint equally, but would exhibit it in an unequal splat; whereas, if the surface were broken up into a number of smaller surfaces by means of lines cut in various directions, these lines would act as air-vents, and the paint would be taken up pretty equally by the little squares or teeth.

One among the features which distinguish 'cheap' oil-cloth (so called) from good, is the hastiness with which the processes are conducted; the paint has often insufficient time for drying, and is sold for use before it is fitted to bear the friction of the feet. It has been suggested, with some probability, that floor-cloth may tend to rot the boards of a flooring in a damp room, by preventing the free escape of vapour.

Mr. Loudon ('Encyclop. of Cottage and Villa Architecture,' p. 345) notices a suggestion for the use of paper instead of floor-cloth or carpet. The carpet, according to this suggestion, is formed in the first instance of any fragmentary pieces of linen, cotton, canvas, or other material, sewn up to the required size. This cloth is stretched on the floor of a large room, and kept down in its place by being pasted round the edges. On this foundation stout paper is pasted; two thicknesses being applied in every part, with the joints so arranged as to be but little perceptible. On this a surface of wall paper is pasted, and here an opportunity for the exercise of taste is afforded, since a variety of pleasing patterns may be obtained by the judicious combination of fragments which are in themselves of very little account. When the pattern is thus far produced, it is coated twice with warm melted size, applied so as to soak into every part of the paper, and prepare it for the reception of the varnish. One or more coatings of boiled oil are applied after the size, and to the oil succeeds copal varnish. Of the floor-covering so produced it is said, 'these carpets are portable, and will roll up with about the same ease as oil-cloth; they are very durable, are easily cleaned, and if made of well-chosen patterns have a very handsome appearance. Where labour is cheap the cost will be very trifling; the materials being of little value, and the expense consisting chiefly in the time requisite to put them together. Where cloth cannot be easily procured, the carpet may be made by pasting paper to painted boards; when by repeated coats of paper it has become strong and firm, it will separate from the paint and will be as durable as if mounted on any kind of cloth. For earth, brick, or stone floors, in order to render them impervious to damp, these carpets may be made with two faces, by pasting paper on both sides of the cloth which forms their basis, and well oiling or varnishing them on the under as well as the upper surface; they may also be bound with leather or any strong substance, to prevent moisture from penetrating to the paste.' (p. 346.)

It has also been more than once suggested, that 'Geographical carpets' might advantageously be constructed for school-rooms and similar apartments. By this term is meant the employment of a carpet or covering in which the lines of a map are substituted for a regular pattern. There would, as Mr. Loudon has stated, be a good deal of difficulty in working out the idea, since it would have to be decided whether the map should be *printed* before being laid down as a carpet, or filled in by hand afterwards. The choice of material too, whether linen, holland, or paper, would be attended with some difficulty; but such a map, especially if the northern portion of it were directed to the northern side of the room, would not be without its value in rendering the position of a country or district familiar to the inmates of the room.

FLORENTINUS, a Roman jurist, whose praenomen is unknown. His period also is uncertain, but he lived after the Emperor Antoninus Pius, for he cites one of his Constitutions, and names him Divus (*Dig.* 41, tit. 1, s. 16). He is not mentioned by any of the jurists who are cited in the Digest, a circumstance which seems to argue that he belonged to a later age than any of them, or was at least as late as any of them. He wrote eleven books of Institutiones, from which there are a few excerpts in the Digest.

FLORIS, FRANS, or FRANS DE VRIEND, was a celebrated Flemish painter; Vasari terms him the Flemish Raphael. He was born of a good family at Antwerp, in 1520; his father, Cornelis de Vriend, was a sculptor, and Frans was himself a sculptor in his earlier years. He learnt painting under Lambert Lombardus at Liège, and studied afterwards the works of Raphael, Michel Angelo, and the antique, for some years at Rome. He returned with a great reputation to Antwerp, and formed a numerous school there. He was the most distinguished painter in the Netherlands in the time of Charles V. and Philip II., and would probably have been much employed by these princes had he not been notorious for a love of wine, which he habitually took to excess, and he had the reputation of being as great a drunkard as painter. He died at Antwerp in 1570.

Van Mander and Descamps mention several works by Floris which are now lost; but there are still some excellent works by him in the Netherlands, and there are others in the galleries of Vienna, Dresden, and Berlin.

One of his best works is a Nativity, in the Cathedral at Antwerp, which in Sir Joshua Reynolds's opinion is well composed, well drawn, and well coloured; Sir Joshua admired also his Crucifixion, at the Recollets. Floris etched a few plates, and some of his designs were engraved and published by Jerome Cock.

(Van Mander, *Leven der Schilders*; Descamps, *Vie des Peintres Flamands*, &c.)

FLOWERS, ARTIFICIAL. The Italians, according to Dr. Ure (*Dictionary of Arts, &c.*, art. 'Flowers, Artificial'), appear to have been the first people in Europe who excelled in the art of making these elegant ornaments, though of late years the French have displayed most ingenuity and taste in the manufacture. Ribbons of various colours, folded into the required forms, were, according to the above writer, originally employed for imitating flowers, by being attached to wire stems. This imitation, he says, soon gave way to that by feathers, which are more delicate in texture, and more capable of assuming a variety of flower-like figures; but it was found difficult to dye them with colours of the requisite vivacity. 'The savages of South America,' he adds, without quoting any authority, 'manufacture perfect feather-flowers, derived from the brilliant plumage of their birds, which closely resemble the products of vegetation. The blossoms and leaves are admirable, while the colours never fade.'

The cocoons of the silk-worm, which take a brilliant dye, preserve their colour, and have a transparent velvety appearance suitable for the imitation of petals, are sometimes used by the Italian flower-makers. The French, of late years, have used the finest cambric for petals, and the taffeta of Florence for the leaves; and M. de Bernardiere has introduced artificial flowers made of exceedingly thin leaves or laminæ of whalebone, which may be bleached and dyed of various hues. Sometimes petals and leaves are made of velvet, coloured by the application of a finger dipped in the dye. Dr. Ure adds directions for dyeing various colours required in the manufacture of artificial flowers.

The stems of artificial flowers are mostly formed of wires, (the largest being of two or more wires twisted together), wrapped round with paper, silk, or some other material of the required colour; and wires are also sometimes applied to the leaves and other parts which need support. The leaves and petals are mostly cut, and, if needful, embossed, by stamping with dies with sharp cutting edges, and are united together by means of wires and paste or cement. The modes of colouring are of course exceedingly various, it being in many cases necessary to apply colour only to one part of a petal, or to apply two or more colours to one petal. Seeds and similar objects, and small fruits, such as currants, are beautifully imitated by wax, glass, or other compositions; and by the judicious intermixture of a variety of other materials, almost any object in the vegetable kingdom may be imitated with surprising accuracy and beauty. To such perfection is the manufacture carried, that artificial flowers are not only employed as decorations in ladies' head-dresses, but are also much used as elegant table or mantel-piece ornaments. When thus employed, as they are not liable to the same shaking and rubbing as those used in dress, more fragile and easily injured materials may be employed. Wax flowers are made of extreme delicacy for such purposes, and we have lately seen cheap but beautiful imitations of them in paper coated with wax. Rice-paper is also occasionally used for the purpose. Artificial flowers formed of shells, which, by a judicious choice of forms and colours, may be made of far more natural appearance than would be supposed, are also used for such purposes, although, unless very small, they are too heavy for head-dresses.

The manufacture of artificial flowers is conducted almost entirely by girls and women; and as it depends mainly upon taste and manual dexterity, it forms a very suitable as well as important branch of female employment.

FLUIDS, ELASTIC. This name may be applied to all the fluids in nature, since all are in certain degrees elastic; but it belongs particularly to such as are aeriform, liquid substances possessing the property of elasticity in a very low degree. Among the aeriform fluids, however, those which are usually considered as permanently elastic are called gases; and the term elastic fluid is frequently confined to atmospherical air and the vapours which are produced from solids or liquids by the action of heat; these last are therefore such as may be rendered solid or liquid by reducing their temperature, or by increasing the pressure under which they exist. But the difference between these and the fluids which are called permanently elastic is perhaps nominal, since many of the latter, by the discoveries of Dr. Faraday, are found capable of being exhibited in a liquid form. [GAS, P. C.] This philosopher, for example, obtained carbonic acid in a liquid state from carbonate of ammonia, by subjecting it to great compression in a sealed tube, one end of which was placed in a freezing mixture. The liquor was colourless. Many of the gases, moreover, on being combined with one another and with other substances, form solids or liquids: thus, oxygen gas unites with metals and becomes solid; ammoniacal gas and muriatic gas unite and form the solid called muriate of ammonia; while oxygen and hydrogen gas unite to form water.

Almost all gases are invisible; but several which are so when they exist alone, become visible on being mixed with one another. Thus, deutoxide of azote being mixed with atmospherical air or with nitrous acid, the combination becomes visible and of a red colour. Several gases also become visible when mixed with aqueous vapour. An augmentation of the temperature of vapour may, by producing an increased rarefaction, render it invisible; and, on the other hand, a diminution of temperature will cause such a condensation as may render visible a vapour which before was imperceptible. These effects of heat and cold upon vapour have been proposed as explanations of the apparent diminution of the mass of a comet when near the sun, and of its apparent enlargement in receding from that luminary. All elastic fluids are transparent, but different quantities of light are absorbed in passing through those of different kinds, and when the thickness of a stratum of fluid is considerable, the absorption is so great as to render an object beyond it invisible.

The elastic forces of a dry gas at a given temperature are inversely proportional to the volumes they occupy; and this law holds good also both for mixtures of elastic vapours with each other, and of vapours with gases, provided no chemical action takes place between them. Thus, different fluids of equal temperatures and equal elastic forces being introduced together in a close vessel whose capacity is equal to the sum of the volumes of the fluids separately, the fluids for a time remain separately in equilibrio; but experience shows, that gradually the fluids intermingle with one another, producing a homogeneous fluid preserving the same temperature and elastic force. It has been found also that if different fluids having equal temperatures with different elastic forces, and occupying separately equal volumes V, be mixed together in a close vessel whose capacity is V, the elastic force of the mixed fluid will be equal to the sum of the elastic forces of the separate fluids, and the temperature will remain constant. When a vapour at a given temperature is compressed by being confined within a smaller space than that which it previously occupied, part of the vapour becomes condensed, and the remainder continues to possess the elastic force due to the temperature. And again, if the volume of a quantity of vapour be increased, the vapour will expand, and, if not in contact with the liquid from which it was produced, its elastic force will be diminished; if in contact with the liquid, new vapour will rise to supply the void created by the dilatation, and the elastic force will remain constant.

The temperatures at which liquids become elastic fluids by the action of caloric are very various: muriatic and nitric æthers boil, under the usual pressure of the atmosphere, at about 70° (Fahr.); sulphuric æther boils at 98°, and acetic æther at 160°: water boils at 212°, while mercury can be made to boil only at a temperature of 670 degrees.

The quantity of vapour produced by heat from a liquid increases with an increase of temperature, and while in contact with the liquid its elasticity varies with its specific gravity. The elastic force of vapour is increased when the vapour is mixed with air; for if the interior of a barometer tube be moistened at the upper end with water, and air be introduced in it above the column of mercury, the tube being inserted as usual in a cistern of the latter fluid, the depression of the mercurial column in the tube by the expansion of the vapour and air, in consequence of an application of heat on the exterior, is greater than that which results from the expansion of air when dry.

The atmosphere which surrounds the earth is endowed with an elastic power; and partaking, moreover, of the earth's diurnal rotation, its particles should, by their elasticity and centrifugal force combined, recede from the earth till the whole is dissipated in space. Such is not the fact; and hence it is inferred, either that at a certain elevation above the surface of the earth, the elasticity of the atmosphere is totally destroyed by the absence of caloric; or that beyond the stratum in which the centrifugal force of the particles is equal to their gravitation, there may exist, in a state of rest, an ætherial fluid occupying the whole extent of space, and preventing the atmosphere from being further expanded by its own elasticity.

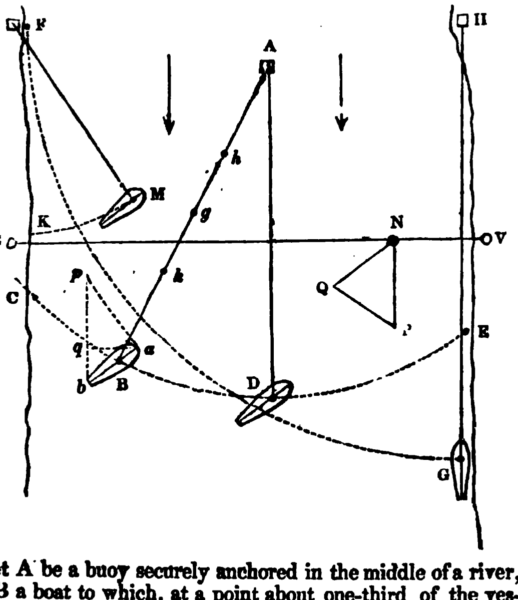
Now, by Mechanics, it may be found, that the distance from the surface of the earth to the stratum of the atmosphere in which the centrifugal force of the particles is equal to their gravity is about five semidiameters of the earth, at which height the density must be inconceivably small; and since it is not necessary to suppose that the ætherial fluid beyond the atmosphere of the earth is more dense or more elastic than the atmosphere at that height, it may readily be admitted, that whatever may be the effect of such a fluid in resisting the motion of a comet, it can produce no sensible retardation of the movements of the planets.

The crepuscular light which has been observed at the cusps of Venus, and the changes which take place on the apparent disks of Mars and Jupiter, afford indications that those planets have atmospheres, though, with our instruments, such atmospheres may not be rendered sensible by their action on transmitted light. If, about a planet, an atmosphere were formed in consequence of the attraction exercised by the planet on the ætherial fluid supposed to fill all space, since that fluid may have no greater density and elastic power than the atmosphere of the earth at the height of five semidiameters of the latter above its surface, the attraction of the planet may be incapable of rendering it sufficiently dense to produce any sensible effect in refracting light to the earth. Again, the height and the law of the variations in the density of the strata in an atmosphere which may be formed about a planet by the vapours arising from waters existing on its surface, would depend on the temperature; and this we have no means of knowing: but assuming it to be equal to the mean temperature at the surface of the earth, the height of such atmosphere would be very small compared with that of the existing atmosphere about the earth. An atmosphere of either of the kinds here indicated would serve to account for the rare occurrence of remarkable refractions in the phenomena of the immersions and emersions of Jupiter's satellites, or the occultation of stars by the moon.

For the properties of elastic fluids, see also ELASTICITY, P. C.; GAS, P. C.; VAPOUR, P. C.; and EVAPORATION, P. C. S.

FLY, FLY-WHEEL. [WHEELS, P. C., p. 316.]

FLYING BRIDGE. This consists usually of a boat or other vessel which, being attached by a rope to a buoy moored in the middle of a river, is made, by the action of the current, to move across on an arc of a circle of which the buoy is the centre. On large rivers, at places where the communications across them are very frequent, such bridges will probably, in future, be superseded by steam-vessels; but, for temporary purposes, and particularly to facilitate military operations in countries where steam navigation is not in use, they may be of the highest importance.



Let A be a buoy securely anchored in the middle of a river, and B a boat to which, at a point about one-third of the vessel's length from the head, is attached one end of the cable or chain B A: then *p b* indicating the direction of the current, if the keel *a b* of the boat be inclined to that direction in any angle as *p b a*, the pressure of the water against one side of the boat being resolved in a direction *q a* perpendicular to *p b*, or across the river, will cause the boat to describe the arc C D E, whose centre is A. As far as the point D, in the middle of the river, the boat descends the latter; and, afterwards, it ascends obliquely against the current; but, while its keel is kept by the rudder in a position nearly parallel to *b a*, the force parallel to *q a* continues to act and impel the boat towards E. If f represent the direct force of the current, and θ the angle *p b a*, the force perpendicular to *p b* will be expressed by $f \sin^2\theta \cos\theta$; and this will be a maximum when $\theta = 54° 44'$.

It is evident that by increasing the length of the rope A B, the length of the arc between C and E will be diminished; the retardation arising from the action of the current, in ascending from the middle of the river to E, will also be less: the length of the rope or chain should, in fact, be such that the arc C D E may not exceed a quarter of the circumference of the circle; and when, for this purpose, the length is very great, it must be supported as at *g*, *h*, and *k*, on moveable buoys or small boats.

A flying bridge sometimes consists of a simple flat-bottomed vessel, having a mast fixed to one of its sides in the middle of its length. The cable passes through a block at the mast head, and is attached at one end to the opposite side of the vessel, the other end being made fast to the buoy. Two ropes connected with the cable lead one to the head and the other to the stern of the vessel; and, by pulling on one of these, the other being let go, the vessel is placed in a position oblique to the current: this position is retained by means of a steering oar aided by a current-board which may be let down into the water at the head or stern as the case may require.

In a rapid current it may be impossible to make the boat B move up the ascending arc D E; in which case a boat at F, by means of a cable made fast at H on the opposite bank, may be allowed to describe the descending arc F G. On setting out from F, the boat takes with her a coil of rope, of which one end is attached to a fixed object near that place; then, on arriving at G, the boat is drawn up along the bank to H; and by the rope is hauled across the river to F, from whence it set out. Again, a rope being made fast to an object near F, a boat may be steered obliquely from some point as K, till she comes to a part, as M, of the river at which the current acts strongly upon her; then letting go the rope and, by the rudder or steering oar, keeping the boat's keel at a proper inclination to the direction of the current, the resolved force of the water will impel the boat to some point, as G, on the opposite bank.

When the river is too wide for a boat to swing over in a single arc, two buoys may be moored in a direction across the river, at equal distances from the banks and from each other, and two boats connected with them by ropes may be impelled in circular arcs, one extending over the first half of the breadth of the river, and the other over the second: a raft being moored in the middle facilitates the transference of the passengers, &c. from one boat to the other; or, without the raft, one boat, on arriving in the middle of the river, may transfer its passengers immediately to that which is to describe the other half of the breadth.

A triangular raft N P Q having its front, as N P, parallel to the direction of the current, and being connected by a ring at N, with a rope S V stretched tightly across the river, may, by a resolved force of the current on N Q, be impelled directly to the opposite bank; and, on reversing its position so that P may be connected by a ring with the rope S V, the raft may be impelled across in a contrary direction. A boat running by a ring at one end, on S V, may, by being kept in a position corresponding to that of the line N Q, in like manner be *sheered* across the river.

On broad rivers, and when objects of great bulk and weight, as horses, carriages, or artillery, are to be conveyed across, two boats or barges placed in parallel positions, and carrying a platform extending between their exterior gunwales, are employed: the bay or interval between the vessels is as wide as is consistent with the strength of the platform, in order that as much as possible of the current may act against a side of the lower vessel. The vessels are made narrow and deep, and each is provided with a mast, which may be from twenty to thirty feet in height; these are connected together at ten or fifteen feet from the platform by two horizontal beams, one above the other, and between them is a block of wood which is capable of sliding from one mast to the other. The cable or chain is made to pass through a perforation in the sliding piece, and the latter is placed contiguously to either mast, according to the direction in which the vessels are to move. A drawbridge is constructed on each side of the platform, and one of them is let down to form a passage when the vessels arrive at the landing-place on either side of the river. Each vessel has a rudder, and the tillers are connected by a bar, in order that one man may be able to turn both.

For ample details concerning the subject of this article see 'An Essay on the Construction of Military Bridges,' &c., by Major-General Sir Howard Douglas.

FOG. [MIST, P. C.]

FOHR, CARL PHILIPP, a young landscape painter of very great ability, was born at Heidelberg in 1795. In 1816 he visited Rome, and made the acquaintance of Cornelius, Veit, Overbeck, and Koch the landscape painter, and he shortly painted two large pictures there, which ranked him among the first painters of his class, and procured him the notice, patronage, and friendship of Ludwig I., the present king of Bavaria, then crown-prince. This great patron of the arts, compared with whom Lorenzo de' Medici was but a shadow in magnificence, was strongly impressed with Fohr's ability; on taking leave of him at Rome, he pressed his hand, saying 'Wir sehen uns wieder; wir gehören uns näher an' (We shall see each other again, we belong nearer to each other). It was not so, however; Fohr was drowned in the Tiber while bathing, on June the 29th, 1818, in the sight of three friends, who could afford him no assistance. Several of his early landscapes are in the museum at Darmstadt; a Life of him was published at that place in 1823: his portrait has been engraved by Amsler, one of the friends who witnessed his death.

(Nagler, *Neues Allgemeines Künstler Lexicon.*)

FONTA'NA, PROSPERO, a celebrated painter of Bologna, where he was born in 1512. He was the pupil of Innocenzio da Imola, the assistant of del Vaga and Vasari, and the master of the Caracci; and was of great authority in Bologna until the establishment of the school of his pupils. As a fresco painter Fontana was a mere machinist, but in portrait he was one of the first painters of his time. There are frescoes by him at Bologna, at Rome, and at Città di Castello, where in a few weeks he painted a great hall in the Palazzo Vitelli illustrating the deeds of that family. He was presented by Michelangelo as a good portrait painter to Giulio III., who took him into his service, as did also his three successors. Fontana died at Rome in 1597. Lavinia Fontana, called also Zappi, the name of her husband, was the daughter of Prospero, and likewise distinguished herself for her ability in painting, especially in portrait; but she executed works in various departments of painting, all finished with care and delicacy. Some of her portraits have passed for the works of Guido. She was a great favourite with the noble ladies of Rome from the time of Gregory XIII. to Paul V.; she painted Gregory's portrait. She died at Rome in 1614, aged sixty-two.

(Malvasia, *Felsina Pittrice*; Lanzi, *Storia Pittorica*, &c.)

FONTEVRAULT. [MAINE ET LOIRE, P. C.]

FOOT. [SKELETON, P. C.]

FOOT-PRINTS, impressions of the feet of reptiles (as of Cheirotherium) and birds (Ornithichnites), are now become recognised evidence of the existence of particular races of organic beings, in certain geological periods, though no other traces of them remain. By this evidence, the air-breathing vertebrata appear to be of higher antiquity than was formerly supposed, and to date from the upper parts of the carboniferous system.

FORAMINI'FERA, FOSSIL. The expectations of naturalists and microscopists, from Lamarck to Ehrenberg, that in the composition of the stratified crust of the globe minute organized bodies have had a more important share than the bones of Vertebrata and the shells of Mollusca, appear to be fully justified by recent discoveries in the Cainozoic and some of the Mesozoic strata. In most countries the superficial marls and silts which are associated with peat, are found to be full of the siliceous shields of Infusoria; some of the tertiary sands are loaded with the calcareous shells of Foraminifera, and this group has been distinctly traced downwards into the chalk, the oolite, and mountain limestone, and probably even into the Silurian rocks. These Foraminifera diminish in number as we pass below the chalk: perhaps also they recede more from the forms of existing minute Polythalamacea, but this is a point requiring much further investigation. The most abundant forms in the chalk belong to a few groups entitled Rotalia, Spirolina, and Textilaria. In the oolites and mountain limestone the forms generally resemble those of Textilaria:—

The following table exhibits a summary of the distribution of the genera.

In Cainozoic strata of Britain, according to Morris's Catalogue.	Anomalina.
	* Biloculina.
	Cristellaria.
	Dentalina.
	Glandulina.
	Globigerina.
	Marginulina.
	Nodosaria.
	Nonionina.
	Operculina.
	Planorbulina.
	* Polymorphina.
	Polystomella.
	Quinqueloculina.
	Rotulina.
	Rosalina.
	Rotalia.
	Spiroloculina.
	* Textilaria.
	Triloculina.
	Truncatulina.

In the Cainozoic strata, taken generally, Bronn enumerates 46 genera, and Ehrenberg has augmented the number.

In Mesozoic strata. Chalk of Maestricht, Meudon, Wilts, &c. (Morris's Catalogue.)	* Bulimilina.
	Cristellaria.
	Dentalina.
	Gaudryina.
	Globigerina.
	Lituola.
	Marginulina.
	Nummulina.
	Rosalina.
	Rotalia (7 species British).
	Siderolina.
	* Spirolina.
	* Textilaria.
	Truncatulina.
	Turbinulina.
In Mesozoic strata. Oolite of Caen. (Bronn.)	Cristellaria. Planularia.
Oolite of Stonesfield.	Textilaria ? Rotalia ?
Oolite of Yorkshire.	Rotalia ? Textilaria ? frequent.
In Palæozoic strata. Mountain Limestone of Bristol.	Textilaria ?
Limestone of South Devon.	Genus ?

Concerning these numerous minute fossils, Ehrenberg has recently added to our knowledge on two material points, viz. —the organization of the analogous living races, and the degree of affinity between fossil and recent forms. From a fortunate capture at Cuxhaven in September, 1839, Ehrenberg was enabled to exhibit alive at Berlin two species of D'Orbigny's genus Polystomella (classed by Ehrenberg as Geoponus and Nonionina), and to study their organization.

The animal is soft, internal, covered by the discoidally spiral concamerated shell, and without prehensile apparatus or tentacles at the mouth. Through perforations in all parts of the shell minute extensile filamentous tentacula pass, and larger bundles of these appear about the umbilicus of the shell.

The last, sometimes the 2-4 following ones, contain transparent parts only. The others are filled with two differently coloured larger organs. One of these is the spiral alimentary canal expanded in each chamber, contracted at each articulation (to an aperture in the septum); the other is granular, and is perhaps an ovarian mass.

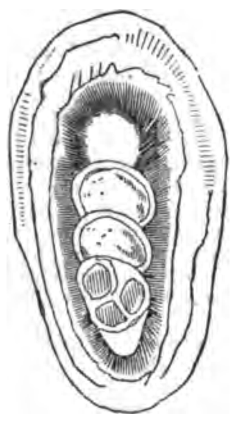
By dissolving the shell in weak acid the shields of Infusoria swallowed as food became visible in all parts of the alimentary canal. There are no pulsating vessels. Ehrenberg appears to regard one of these animals as a compound coral animal, the other as a single coral animal—the former communicating from chamber to chamber by many small apertures in the septa, the other by one.

In a fossil state the shells of Rotalia show the minute perforations through which the pseudopodous tentacula passed, and by a careful examination of the remains of those bodies embalmed in flint Dr. Mantell (*Medals of Geology*, vol. i. p. 232) has shown the general internal arrangement of the shell, and general form, if not the minute organization, of the animal inhabitant. In a recent communication to the Geological Society of London, this author has more distinctly expressed his opinion that the soft body of Rotalia is actually silicified, and distinguishable by colour from the clearer flint which has replaced the shell.

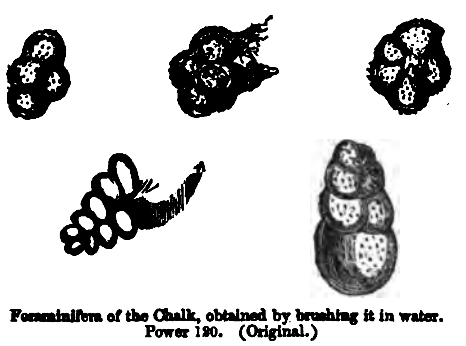
The relation of the fossil Foraminifera to the recent types is perhaps closer than that of most other tribes. It appears not only that several tertiary forms are identical with living species, but further, according to Ehrenberg, that no less than nine or ten Foraminifera of the chalk are undistinguishable from existing species. The following is the list of those species, and the localities where they occur in real chalk :—

1.	Globigerina bulloides	Denmark.
2.	Globigerina helicina	Cattolica.
3.	Rosalina globularis	Gravesend.
4.	Rotalia ocellata	Cattolica.
5.	Rotalia globulosa	Rügen.
6.	Rotalia perforata	Cattolica.
7.	Rotalia turgida	Gravesend.
8.	Textilaria aciculata	Brighton.
9.	Textilaria globulosa	Rügen.
10.	Spirolina cylindracea	Paris.

Even if some doubt must remain as to the exact identity of the specific forms thus declared to occur, both recent and in cretaceous beds, the analogies are too close and too numerous to allow of hesitation in admitting that the Foraminiferous races of the Mesozoic and Cainozoic periods have more decided affinity than appears in any other group of organic life. As some of the Polypiaria of the Silurian series pass upwards into the Devonian era, some of the Foraminifera of the chalk, with Terebratula vitrea and T. Caput Serpentis, appear to reach our own day; and thus by feeble, but not to be neglected links, the systems of antient and modern life are united into one only partially discontinuous series, the seeming interruptions being in the higher grades of life, the less striking connexions being formed by the simpler marine organic structures which might better survive great physical catastrophes and better endure successive variations in the condition of the sea.



Foraminifer of the Mountain Limestone, forming the centre of an oolitic grain. Power 120. (Original.)



Foraminifera of the Chalk, obtained by brushing it in water. Power 120. (Original.)

FORBES, PATRICK, Bishop of Aberdeen, was born soon after the middle of the sixteenth century. He was the eldest son of the proprietor of Corse, in the county of Aberdeen, where his descendants still possess estates. He studied at Stirling and Glasgow. His first clerical appointment was at Keith, in Morayshire. He became bishop of Aberdeen in 1618, and died in 1635 He was the author of several polemical works, which were collectively published in Latin at Amsterdam, in 1646. A curious collection of funeral sermons on his memory, by many eminent survivors, was published soon after his death.

(Irving, *Lives of Scottish Writers*, ii., 43-47; *Funerals of Bishop Forbes*; reprinted for the Spottiswoode Society.)

FORBES, WILLIAM, Bishop of Edinburgh, was born at Aberdeen in 1580. He studied at Marischal College in Aberdeen, which he entered when he was twelve years old. He held for some time a chair of logic in Aberdeen; and afterwards travelled in Germany and Poland, studying at Helmstädt and Heidelberg. On his return to Britain he was offered a professorship of Hebrew in Oxford, but the state of his health induced him to return to his native country. In 1618 he was made principal of Marischal College. We find him in 1621 ceasing to hold this office, and soon afterwards becoming one of the ministers of Edinburgh. In that capacity he preached before Charles I. on his visit to Scotland in 1633, and the eloquence he then exhibited is said to have induced the king to resolve that he should be the first bishop of Edinburgh. That short-lived see was erected in the ensuing year, and Forbes was appointed bishop on 26th January, 1634. He died on the 11th of April of the same year. His fame is chiefly traditional. His only published work is posthumous: 'Considerationes modestæ et pacificæ Controversiarum de Justificatione, Purgatorio, Invocatione Sanctorum et Christo Mediatore, Eucharistia,' published in 1658. It embodied a proposal for an accommodation between the Protestant Episcopal churches and the Church of Rome likely to have made episcopacy more unpopular in Scotland than it was. Some other polemical works which had raised high expectations were lost. Burnett, characterizing his eloquence, says that 'he preached with a zeal and vehemence that made him forget all the measures of time—two or three hours was no extraordinary thing for him.'

(Irving, *Lives of Scottish Writers*, ii., 1-9.)

FORBES, JOHN, a divine and polemical writer, second son of Patrick Forbes, Bishop of Aberdeen, was born on the 2nd of May, 1593. He studied at Heidelberg and Sedan, and returned to Scotland in 1619. In that year he was appointed professor of divinity in King's College, Aberdeen. 'In this important vocation,' says Dr. Irving, 'he laboured with great diligence, and speedily acquired the character of a most able and useful teacher. He was profoundly skilled in ecclesiastical antiquity; and not contented with delivering what is called a system of divinity, he exhibited a very elaborate deduction of the progress of Christian doctrine in various ages of the church.' He lived during the period of the hottest struggles for supremacy between Episcopacy and Presbyterianism; and possessed with the views of toleration and ecclesiastical peace that appear to have distinguished his family, he published in 1629, at Aberdeen, 'Irenicum Amatoribus Veritatis et Pacis in Ecclesia Scotiana.' Afterwards, in 1638, when the breach between the two parties, which was the commencement of the civil wars, had begun, he published 'A peaceable Warning to the subjects in Scotland.' He was afterwards a leader in a polemical dispute as one of those generally styled 'the Aberdeen doctors,' who conducted, on the side of Episcopacy, a controversy with the Covenanters. Whichever party may have had the advantage in argument, the latter had the superiority in physical force; and after having seen his coadjutors deprived of their benefices, Forbes was subjected to the same fate in 1640. His case was one of peculiar hardship, for he had made over part of his own private property to be attached to the professorship which he held; he lost this property on being dismissed from his office. In 1644 he went to Holland, where he married a Dutch woman named Soete Roosboom, or Sweet Rosetree. He returned to Aberdeen in 1646, and died on the 29th of April, 1648. Besides the works already mentioned, he published others on kindred subjects, some of which passed through more than one separate edition; and the whole, along with some posthumous additions, were collectively published in his 'Opera Omnia,' at Amsterdam, 2 vols. folio, 1702-3.

(Irving *Lives of Scottish Writers*, ii. 46-54; *Funerals of Bishop Forbes*, reprinted for the Spottiswoode Society.)

FORCING-ENGINE. [FIRE-ENGINE, P. C.]

FOREST MARBLE, one of the upper beds of the Bath oolite series.

FORLI, MELOZZO DA, a celebrated painter of Forli, where he was born about 1436. Melozzo was the first who ventured to foreshorten figures upon ceilings, to attempt the *sotto in su* as it is termed by the Italians, and in which Correggio has obtained so great a name; Melozzo however was scarcely inferior in this respect to that great painter. He excelled generally in perspective; in a work published in 1494, by Fra Luca Paccioli, entitled 'Summa d'Aritmetica e Geometria,' he is enumerated among the living painters who were *famosi e supremi* in perspective.

Scarcely anything is known of Melozzo, though his contemporaries termed him 'the incomparable painter, and the splendour of all Italy.' (Morelli, *Notizia d' Opere di Disegno*, &c., p. 109.) He is supposed by some to have been the fellow-pupil of Mantegna with Squarcione at Padua, and by others to have been the scholar of Piero della Francesca, one of the earliest masters of perspective. He was early in Rome: he is noticed by Vasari as the contemporary of Benozzo; he painted there, in 1472, for Cardinal Riario, the nephew of Sixtus IV., an Ascension of Christ, on the altar vault of a chapel of the church of the Apostles, Santi Apostoli, which was sawed out and removed in 1711, the principal part to the Quirinal Palace, and part to the Vatican, which is now in the sacristy of St. Peter's. The part in the Quirinal, the Ascension, has the following inscription—'Opus Melotii Foroliviensis, qui summos fornices pingendi artem vel primus invenit vel illustravit, ex abside veteris templi SS. XII. Apostolorum huc translatum anno Sal. MDCCXI.' All the fragments are engraved in D'Agincourt's 'Histoire de l'Art par les Monumens.' There is also a large fresco, now mounted on canvas, in the gallery of the Vatican, which was formerly on a wall of the old Vatican library; it represents Sixtus IV. installing (Bartolomeo Sacchi, or) Platina in 1475, as prefect of the said library. The fresco was removed from the wall and fixed to the canvas by Domenico Succi of Imola, by order of Leo XII. The expression of all the heads, mostly portraits of distinguished persons, is good and individual, and the general arrangement and colouring are of great merit, but in the severe style of Mantegna and other eminent *quattrocentisti*.

(Vasari, *Vite de' Pittori*, &c., in the life of Benozzo (Gozzoli); and the notes to Schorn's German translation; Lanzi, *Storia Pittorica*, &c.; *Galleria di Quadri al Vaticano*, Roma, 1836.)

FORMATION, a geological term subordinate to 'system,' and including special 'groups,' or assemblages of strata; in a looser sense it applies also to pyrogenous rocks, and mineral veins.

FORTEBRACCI. [Braccio Fortebracci, P. C. S.]

FOSBROKE, REV. THOMAS DUDLEY, has given a sketch of part of his life in a notice prefixed to the original quarto edition of his 'Encyclopædia of Antiquities,' published in 1824; and he has entered into some details about his ancestry, both in that paper, in his 'Abstracts of Records respecting the County of Gloucester,' 1807 (vol. i. p. 407), in his work entitled 'Ariconensia,' 1821, p. 168, and in an account which he left in the hands of a friend, and which has been prefixed to the third and posthumous edition of his 'British Monachism,' 1843. There is also a full memoir of his life prefixed to the last-mentioned publication; being the same, or nearly the same, which had previously appeared in the 'Gentleman's Magazine' for February, 1842.

Thomas Fosbroke, the only child of Mr. William Fosbroke, whose progenitors for several generations had been clergymen, was born in London, 27th May, 1770. He was educated at St. Paul's school, whence he was elected in 1785 to a Teasdale scholarship at Pembroke College, Oxford. He took his degree of M.A. in 1792; and was the same year ordained deacon, and settled in the curacy of Horsley, in Gloucestershire, which (having been ordained priest in 1794) he held till 1810, when he became curate at Walford in Herefordshire. He was presented to the vicarage of Walford in 1830; and he died there on the 1st of January, 1842.

Mr. Fosbroke first made himself known as an author in 1796, by the publication of a poem entitled 'The Economy of Monastic Life, as it existed in England, with Philosophical and Archaeological Illustrations,' 4to. It is in the Spenserian stanza, but in the style, as well as in the title, it was intended, it seems, as an imitation of Darwin's 'Economy of Vegetation.' It is reprinted at the end of the third edition of his 'British Monachism.' That work, the full title of which is 'British Monachism, or Manners and Customs of the Monks and Nuns of England,' first appeared in 2 vols. 8vo. in 1802; a second edition, much enlarged, was published in one volume, 4to. in 1817; and since the author's death a third in one volume, 8vo. has been brought out under the care of his son, the Rev. Tate Fosbroke, Vicar of St. Ives; London, 1843. In 1807 he published by subscription two volumes 4to. of 'Abstracts of Records and MSS. respecting the County of Gloucester,' forming a contribution of raw materials for a county history. In the 'Biographical Dictionary of Living Authors,' 8vo., London, 1815, we are told (at p. 119) that in 1809 Mr. Fosbroke published, in 8vo., a 'Letter to Mr. Canning on his uncandid Abuse of the Duke of York;' but afterwards, at p. 431, the letter is stated to have been a censure not upon Mr. Canning (who indeed never abused the Duke of York) but upon the opposition; and it is added, that 'of this pamphlet there were only fifty copies printed.' It is not mentioned in the memoir published by Fosbroke's family. That memoir (which is loosely drawn up) states that soon after his removal to Walford, in 1810, he illustrated the unpublished statues in Mr. Hope's collection; but what may be the precise meaning of that we do not know. About this time Mr. Fosbroke was much incommoded by the bankruptcy of Sir Richard Phillips, the publisher, for whom he had made considerable progress in compiling a work to be entitled an Archaeological Dictionary. In 1814 he published 'A Key to the New Testament, or Whitby's Commentary abridged;' in 1819, 'An Original History of the City of Gloucester,' 8vo.; in 1820, 'The Wye Tour, or Gilpin on the Wye,' 8vo., several times reprinted; in 1821, 'Ariconensia, or Archaeological Sketches of Ross and Archenfield,' 8vo.; and in 1821, 'Abstracts and Extracts of Smyth's (MS.) Lives of the Berkeleys.' He had also before this written a 'Grammar of Rhetoric,' which is stated to be the same with that published in the collection called Pinnock's Catechisms. His principal work, 'The Encyclopædia of Antiquities, and Elements of Archaeology,' came out by subscription, in 2 vols. 4to. in 1824; and a second edition, in 1 volume, 8vo., appeared in 1840. It was followed by a 'Picturesque and Topographical Account of Cheltenham and its vicinity,' 8vo. 1826; 'The Tourist's Grammar,' 12mo., the same year; and 'Foreign Topography, or an Encyclopædiac Account, alphabetically arranged, of the antient remains in Asia, Africa, and Europe, forming a sequel to the Encyclopædia of Antiquities,' 4to. 1828. His narrow circumstances were somewhat relieved by his being elected, in 1827, an honorary associate of the Royal Society of Literature, which brought him an allowance of 100*l*. a-year till the royal bounty was withdrawn from the Society in 1831. To the first volume of the Transactions of the Society of Literature he contributed a paper entitled 'Extracts from MSS. relative to English History;' and to the second volume, 'Illustrations of the Constitution of our antient Parliaments.' He was also a regular correspondent of the Gentleman's Magazine for several years previous to the termination of the original series of that work in 1834; and he is stated to have left prepared for the press 'A New and Original Synopsis of antient English Manners, Customs, and Opinions, derived from Old Chronicles, &c.,' which, however, has not yet appeared.

Mr. Fosbroke possessed a considerable knowledge of English antiquities, and also of general archaeology, in the study of which departments of inquiry he had spent his life; and his 'Encyclopædia of Antiquities' and 'British Monachism' are convenient books, though rather of reference than of authority. He had no accurate learning; and his judgment and acuteness were about on a level with his scholarship. All his books are rather popular compilations than any thing higher.

He married, in 1796, Miss Howel of Horsley, by whom he had four sons and six daughters. Seven of his ten children survived him.

FOSCARI'NI, MARCO, born in 1698, of an old patrician family of Venice, which has produced many distinguished men, studied at Bologna, after which he was employed in official situations in the service of his country. In 1733 he was sent Ambassador to the emperor Charles VI. He remained at Vienna for several years, and he had the arduous task of maintaining the neutrality of Venice during the war of 1733-35 between the French and the Austrians on the occasion of the Polish succession. He there wrote an interesting account of the court of Vienna, its politics, and its administration, especially of its Italian dominions, in which he pointed out the latent causes of the sudden reverses which the Austrians experienced in that campaign, and by which they lost the kingdoms of Naples and Sicily. This work has remained inedited until lately, when it was published by J. P. Vieusseux, at Florence, in 1843: 'Storia Arcana ed altri Scritti inediti di Marco Foscarini,' 1 vol. 8vo., forming part of a series of inedited or rare Italian historical works, entitled 'Archivio Storico Italiano,' which are being published under the superintendence of a society of learned men in Tuscany. One of the merits of Foscarini as an historian is his conscientiousness and love of truth.

After his return from Vienna, Foscarini was sent ambassador to Rome, and afterwards to Turin, where he supported the principle of neutrality adopted by the Venetian senate during the war of the Austrian succession. In his various embassies he compiled, according to the custom of the Venetian diplomatists, well digested 'relazioni,' or reports, not only of his personal transactions with foreign statesmen, but also of what he had observed and learnt concerning the political principles and views of the various courts of Europe. And whilst he adhered, according to his instructions, to the system of strict neutrality cherished by the Venetian senate, he warned his employers of the necessity of being prepared for all contingencies amidst the change that was taking place in the relative position of the great powers of Europe—a warning which, had it been attended to, might have saved Venice half a century later.

On his return from his Turin embassy he was appointed 'Riformatore dello Studio di Padova,' or superintendant of that university, in which he effected useful reforms and improvements. About this time he delivered in the Great Council of Venice an oration, in recommendation of the revival of an antient custom of sending from time to time extraordinary inspectors into the province of Dalmatia for the purpose of discovering and correcting the abuses that had crept into the administration of that important but long neglected country. And this motion was carried. His oration was published long after his death, at Venice, in 1831, with illustrations by Cicogna: 'Della Necessità di spedire Inquisitori di Stato in Dalmazia, Orazione inedita di Marco Foscarini.' In 1752 he published the first volume of his history of Venetian literature: 'Della Letteratura Veneziana libri otto, di Marco Foscarini, Cavaliere e Procuratore, volume primo,' fol. Padova, 1752. This work, which was considered to be a model of literary history, established the reputation of Foscarini as an author. The first four books treat of the Venetian writers on law, the old chroniclers, the historians of Venice, and the Venetian writers on the history of other countries, including travellers. The remaining four books were to treat of the writers on mathematics, geography, and hydrostatics, those on the art of war and navigation, and lastly the rhetoricians and orators. This second part of the work however has remained unfinished and unpublished. The style of the work is concise and dignified, and the authorities are carefully quoted and discussed in copious notes. Moschini has published a sort of continuation of the work in his 'Della Letteratura Veneziana del Secolo XVIII.'

In May, 1762, Foscarini was elected doge, but his tenure of that dignity was short, for he died in the following March, 1763, generally regretted. He was one of the last distinguished statesmen of Venice. He left a rich and very select library of books and MSS., which was sold after the fall of Venice in 1799. The Emperor of Austria purchased the collection of MSS. for 10,800 livres, and they are now in the imperial library at Vienna. A catalogue of the historical part of the collection, which consists of nearly 400 MSS., is given at the end of the Storia Arcana noticed above, together with two letters of Foscarini, 'on the manner of writing history.' The MSS. were among the materials by the aid of which Foscarini compiled his history of Venetian literature. Many of them are very valuable for the history of Venice. Ranke has made use of some of them in his history of the popes. Besides the works mentioned in the course of this article, several minor productions of Foscarini have been printed, such as an oration delivered in the Great Council in support of the institution of the Council of Ten; his report of his Turin embassy, which gives much valuable information concerning the Sardinian monarchy, and which was published in the first volume of the 'Mercurio Italico' in London, and was republished with comments by Cibrario in 1830; a 'Discorso sulla Necessità della Storia e della Facoltà del ben Dire per gli Uomini di Repubblica,' published at Venice in 1819; and another, 'Intorno ai metodi e alla forma della Veneta Repubblica.' A number of Foscarini's writings remain inedited in the library 'del Seminario' at Venice, in the library of St. Mark, in and his own collection now at Vienna. Ludovico Arnaldi and others wrote biographical notices of Foscarini at the time of his death; and Professor Sibiliato, of Padua, wrote an oration, 'Intorno all' Eloquenza del Foscarini.'

P. C. S., No. 75.

(Tipaldo, *Biografia degli Italiani Illustri del Secolo XVIII.*; Preface to the *Storia Arcana* of Foscarini.)

FOSCHI'NI, ANTONIO, was born June 16th, 1741, at Corfu. This able architect—who, we may observe, is omitted in Nagler's 'Künstler-Lexicon'—was the son of Ferrarese parents, and always called himself a native of Ferrara, because he had been brought up from his infancy in that city. His first professional studies were directed by his father chiefly towards engineering and hydraulics, but his own taste pointed out architecture as a more congenial pursuit, and to that he applied himself not only with diligence, but with the earnest desire of reforming the various abuses and correcting the bad taste which for nearly two centuries had corrupted the art in Italy. Appointed to the professorship of architecture when Clement XIV. endeavoured to restore the University of Ferrara to its former splendour, he laboured to impress upon the students the importance of attending to those fundamental principles which had been more or less disregarded or lost sight of, through aiming at superficial novelty without any freshness of invention for its basis. Yet greatly as his reputation increased, it did not shield him from the calumnies and intrigues of enemies, who succeeded in at length dispossessing him of his office. He was afterwards nominated, in 1804, to a similar professorship in the university of Pavia, not only without solicitation, but so contrary to his own wishes, that, flattering as the offer was, he rejected it. In like manner he refused the overtures made to him both from Vienna and Rome, although they opened an equally lucrative and distinguished career to him. His attachment to Ferrara, joined to his indifference for wealth, prevailed over all other considerations. Ferrara was the home of his affections, and he remained there till his death, December 14th, 1803.

The list of buildings executed by him, which claim notice as works of architecture, is by no means a long one: the greatest and most admired of them was the theatre at Ferrara, reputed one of the most spacious, well-arranged, and elegant structures of its kind in all Italy. It should be observed, however, that it is said to have been originally begun by the celebrated Cosimo Morelli [Morelli, P. C. S.], Foschini afterwards improving upon his designs. What would have added both to his own renown and that of Ferrara, was his design for completing the great tower of the Duomo, which, had it been realized, would have rendered it one of the loftiest in Europe, but the want of adequate funds caused the project to be laid aside. Unfortunately, too, neither that nor any other of the numerous designs and manuscript treatises on architecture which he left at his death, have ever been published—a circumstance by far too common with those of his profession to occasion any surprise, however much it may cause regret. The fame of the theatre at Ferrara brought him commissions for designs for others from Vienna, Verona, and Ancona; but, rather strange to say, he appears to have declined them: at any rate the only other theatre known to have been executed, if not by him, from his designs, is the one at Lendinara. The great Hospital at Commachio is another edifice by him; and shortly before his death he was engaged in preparing designs for a basilica or large church at Bandeno, in the territory of Ferrara.

FOSSA'TI, DOME'NICO, born at Venice in 1743, was the son of Giorgio Fossati, who, besides practising as an architect, was also a painter and engraver. The elder Fossati may also claim to be considered an author, having published in 1747 an Italian translation of Felibien's 'Lives of Architects,' a second edition of which appeared in 1755. Gifted with a fertile imagination, and delighting in the poetic effects which architecture is capable of producing, Domenico chose for himself a walk of art which, although generally looked upon as a secondary one, enabled him to *improvise* at will the most splendid conceptions, quite unchecked by either utilitarian or necessitarian considerations. Having finished his studies, he commenced scene-painter, and was abundantly employed not only as such, but in adorning various palaces and churches with architectural and other decorative painting. On the Teatro di San Benedetto in Venice being burnt down in 1775, he made a model for a new edifice; yet greatly as it was admired, it was not adopted, on account of being found too expensive. He however painted a great deal of the scenery for the new theatre, as he afterwards did for those of San Samuele and San Luca in that city. When Venice was visited by Pius VI., and by the Grand Duke and Duchess of Russia in 1782, Domenico and his father had the charge of getting up the splendid preparations made in honour of those high personages. Nor wa Venice the only field of his talents: he resided some time a

Odine, where, besides painting for the theatre, he was employed in decorating several palaces; after which he was engaged successively at Padua, Vicenza, and Verona, one of his most important performances being the ceiling of the church of Martellago. Those labours terminated, he went to Milan, and assisted Piermarini [Piermarini, P. C. S.] in the internal decorations of the theatre of La Scala, then just erected; after which he painted for the theatre at Monza, and that at Gratz, and while at the latter place received invitations from both Rome and St. Petersburg. He was however induced by his friends to decline them, and to return to Venice, but there a disaster awaited him which neither they nor he could foresee. He had just finished painting a ceiling in the Palazzo Contarini, and was standing upon the scaffold with some of his assistants, when a workman incautiously removed one of the props, and all were precipitated to the ground. The only one who received any serious injury was Fossati, who broke his leg, and died in consequence, within less than a month afterwards, August 15, 1784. He left a great number of drawings, consisting of original designs, studies and sketches, which came into the possession of his nephew Pierangelo, son of his brother Giuseppe, which brother was an architect and engineer in the service of the King of Naples.

FOSSOMBRO'NI, VITTO'RIO, born in 1754, at Arezzo in Tuscany, of a noble family, studied at Pisa, and applied himself especially to the mathematical sciences, for which he showed a particular aptitude. In 1782 he was appointed, by the Grand-Duke Leopold I., inspector of the property of the military order of S. Stefano, and in 1785 he was made commendatary of that order. In 1792 he was consulted by the Grand-Duke Ferdinand III. on the subject of the corn-trade and corn-laws, upon which he wrote a treatise, which has not been published. In 1794 he was appointed hydraulic superintendent of the Val di Chiana. Fossombroni had previously studied the ground attentively, and had written a learned treatise on the causes which had led to the encroachment of the waters over that low but fertile district, and had pointed out the means of draining the country: 'Memorie Idraulico-storiche sopra la Val di Chiana,' 1789. He promoted the works for that object, which having been continued through a succession of years, have at last restored the valley of the Chiana to fertility and salubriousness. In 1796 Fossombroni was appointed Minister for Foreign Affairs of the Grand-Duke of Tuscany. When the French took violent possession of the country in 1799, Fossombroni accompanied his master to Vienna, where the grand-duke gave him leave to return home to attend to his own affairs. After Tuscany was transformed into a kingdom, the new queen of Etruria appointed Fossombroni in 1804 member of the Commission of Finance. In April, 1805, he was sent, jointly with the Prince Corsini, to Milan, to compliment Napoleon on his assumption of the crown of Italy. When Tuscany was annexed to the French empire, Napoleon made Fossombroni a member of the Legion of Honour, and appointed him president of the commission for the improvement of the Campagna of Rome and the drainage of the Pomptine Marshes, on which he wrote a report for the emperor. On the restoration of the Grand-Duke Ferdinand to his paternal dominions, Fossombroni was one of the first persons employed in the new ministry. He was made president of the legislative commission, councillor of state, minister for foreign affairs, with the presidency of the other departments of the government. These offices he retained till his death, which took place in 1844, when he was ninety years of age, having retained all his mental faculties to the last. In 1832, when he was seventy-eight years of age, he married a lady of a noble family of his native town, Arezzo.

Besides the works already mentioned, Fossombroni published the following works on hydraulics: 1. 'Memoria sopra la Distribuzione delle Alluvioni;' 2, Memoria sulla Resistenza ed Urto dei Fluidi;' 3, 'Illustrazione di un Antico Documento relativo all' originario Rapporto trà le Acque dell'Arno e della Chiana,' 1826; 4, Memoria sulla Relazione trà le Acque dell' Arno e quelle della Chiana,' 1839. In these last two papers he explained the remarkable change that has taken place in the course of ages in the declivity of the bed of the Chiana, which in antient times afforded a water communication between the Arno and the Tiber. [Arno, P. C.] He also adverted to the danger to which the city of Florence and the surrounding country were exposed, in consequence of the alluvial deposits which are carried by the Chiana and numerous other streams into the Arno, and which tend to raise the bed of the Arno; 5, Saggio sulla Bonificazione delle Paludi Pontine;' 6, 'Memoria sul Lago di Fucecchio,' another marshy district of Tuscany, in the valley of the Lower Arno; 7, 'Relazione sopra l'Incanalamento di un Tronco del Fiume Arno;' 8, 'Memoria sulle Maremme Toscane;' 9, 'Memoria sopra la Inclinazione Artificiale.' Fossombroni wrote numerous other memoirs on hydraulic subjects, which are inedited; among the rest, a memoir on the lagoons of Venice, for the Emperor of Austria, which has been used for the works which are now in progress in that quarter, and another memoir for Mehemet Ali, Pasha of Egypt, concerning the construction of a basin at Alexandria. Fossombroni also wrote several treatises on mathematics and mechanics, among others a 'Saggio sopra il Moto degli Animali e sopra i Trasporti;' a treatise 'Sopra la Misura delle Forze Muscolari;' another, 'Sopra la Valutazione della Forza e degli Attriti;' and a 'Memoria sopra il Principio delle Velocità Virtuali,' published in 1796, and which was highly praised by Lagrange, Lacroix, Laplace, and other eminent mathematicians.

As a statesman, Fossombroni was enlightened and unprejudiced. Jealous of the independence of his native country, he asserted its rights upon every occasion during the long and occasionally critical period of his administration; he maintained the freedom of commerce, which has greatly contributed to the prosperity of the country; he advocated toleration of opinions, and he strove to render Tuscany a model of a paternal but enlightened government. His system appears to have been to govern without bustle and noise, to let society move on with as little apparent interference as possible on the part of the governing powers, a task in which he was assisted by the disposition of the people, the smallness of the state, and by his own temperament. He may have been censured by some for being too tolerant, and by others for not being bold or active enough; but in these matters our judgment ought to take into consideration the condition of the times and the circumstances of the country. One thing generally admitted is, that under Fossombroni's administration Tuscany has been the happiest country in Italy.

(*Rivista Ligure*, and other Italian journals for 1844; *Communications from Italy*, and the works of Fossombroni quoted above.)

FOSTER, REV. JOHN, was born in the year 1770, in Yorkshire. At an early age he attracted the notice of the late Dr. Fawcett, baptist minister, of Hebden Bridge, near Halifax, in Yorkshire, by whose interest he was entered a student of the Baptist college, Bristol, where he studied first under Dr. Evans and afterwards under Dr. Ryland. After he had completed his studies he became a preacher, and during a course of several years was successively settled as such at various places, the last of which was Downend, near Bristol. He then relinquished the active duties of a minister, and for the last eighteen or twenty years of his life resided at Stapleton, near Bristol, chiefly occupied in literary occupations, and preaching only occasionally. He was for many years a frequent contributor to the 'Eclectic Review,' in which his first article appeared in November, 1806, and his last in October, 1839. He died at Stapleton, Oct. 15, 1843.

Foster's reputation as an author is chiefly founded on his 'Essays,' which were first published in 1805, in the form of a series of letters, which, though intended for publication, were really addressed to the lady who soon afterwards became his wife. The 'Essays' are on the following subjects:—1, 'On a Man's writing Memoirs of himself;' 2, 'On Decision of Character;' 3, 'On the application of the epithet Romantic;' 4, 'On some of the Causes by which Evangelical Religion has been rendered unacceptable to Persons of cultivated Taste.' The only other work which he published in a separate form, was 'An Essay on the Evils of Popular Ignorance,' which grew out of the topics of a discourse delivered at a public anniversary meeting in aid of the British and Foreign School Society, and which he afterwards expanded into a volume of moderate size. To the 'Eclectic Review' he contributed altogether 185 articles, of which 50 were selected and published in a separate form in 1844. A volume of lectures, edited from Foster's notes by his friend Mr. Jonathan Ryland, is said to be in the course of preparation.

John Foster's writings occupy only a small space, but they are of great merit. The 'Essays' have now (1845) gone through eighteen editions, and their popularity seems to be rather increasing than diminishing. Foster's intellect is of a high order, clear, comprehensive, and of strong grasp. He displays an intimate knowledge of the various forms of human character, draws his remarks from a wide extent of personal observation as well as a large acquaintance with books, and is entirely free from party views or sectarian feelings. His thoughts are unborrowed, his morality high and pure, and his views, whether relating to public government or private conduct, are independent, lofty, and liberal. His composition is very elaborate, yet natural and graceful; it has no appearance of having been modelled on the style of any other writer, but always seems to flow with the unrestrained current of his thoughts, generally with a tendency towards expansion, yet often concise, nervous, and impressive.

The 'Essay on the Evils of Popular Ignorance' consists of a series of arguments on the necessity of a comprehensive scheme of popular education. It is very powerfully written. To some of the editions is annexed his sermon in defence of Christian missions, which is much admired.

Foster was eminently qualified for a reviewer, as well as an essayist. His strong good sense, his wide range of knowledge from books and observation, his perfect independence of mind, power of sarcasm as well as of eulogy, pure taste, and attractive style, all contributed to fit him for sitting in judgment on works of general literature.

In person Foster was rather above the middle size. His countenance was handsome and striking. His social character is described as having been very attractive. His range of topics in conversation was extensive, embracing not only such subjects as those treated of in his writings, but including the fine arts, of which he was an enthusiastic admirer, and almost every department of antient and modern literature.

(*Gentleman's Magazine*, Jan. 1844; *Eclectic Review*, Feb. and May, 1844.)

FOULSTON, JOHN. The name of this architect, who died at Plymouth, January 13th, 1842, aged sixty-nine, is especially connected with the history of that town and its neighbourhood, where, during the last thirty years of his life, he enjoyed a very extensive practice, and executed nearly all the public buildings then erected at Plymouth and Devonport (formerly Plymouth Dock), besides various general improvements, such as streets, and lines of uniformly built houses, distinguished by the name of 'Terraces.' Hence he came to be regarded as *the* architect *par excellence*, and has been complimented by the title of the 'Wren of Plymouth,' though that of its 'Wood' [Wood, P. C.] would have been compliment sufficient. That he did much for the general appearance of Plymouth and the places in its vicinity, is not to be disputed: he introduced an improved style of building; but those of his buildings which challenge notice as distinct works of architecture exhibit little more than a smattering of style—those superficial and obvious rudiments of it which at once distinguish one style from another. In the critical meaning of the term, he himself possessed no style, for, applied to the works of an artist, *style* presumes both individuality and generality of expression in that particular language of his art which is employed by him; whereas Foulston's Greek was little more than the neutralization of Greek, followed in literal transcripts from it with respect to columniation, columns, and a few details, but essentially un-Greek, or pseudo-Greek, in regard to general character. His works in that style are however characteristic of their time, and serve to show what was admired in this country as genuine and 'pure' classical architecture during the early part of the present century, when *four-columned* Parthenons *without* sculpture and *with* sash-windows were hailed as marvels worthy of Athens itself. When compared with many things of the same date, even in the metropolis, Foulston's Greek ought to satisfy us as being very good; indeed, the criticism which extols the Post-Office in London as a classical and chaste piece of architecture, may without scruple profess quite as much admiration for the façade of the Royal Hotel at Plymouth, more especially as the latter has an octostyle portico, while the other is only hexastyle. The general resemblance of the two buildings is remarkable, for not only might they pass for being the work of the same architect, but for slightly marked variations of the same design. The coincidence however is no more than a very natural one, the same very limited system of composition being adopted for both—that wherein *columniation* is made the centre of what, being astylar [Astylar, P. C. S.], is characterized solely by *fenestration*. At all events, no suspicion of plagiarism can attach to Foulston, as his building was erected before the other.

With the exception of Soane and Laing, Foulston was the only one among his contemporaries who published designs of the buildings executed by him. The collection was at first announced as intended to consist of 200 plates, in 4 volumes, 4to.; but it appeared, in 1838, in a single volume, with 116 plates in lithographic outline, executed in a far more hard and formal than tasteful manner. As architectural illustration, the work is remarkably full and precise, even superabundantly so, many of the drawings consisting only of details of Doric and Ionic orders of the plainest description, as if lessons of that kind were needed, or not to be found in a hundred elementary works. Yet, though no fewer than forty-seven plates are devoted to a single edifice, comprising the Royal Hotel and Theatre, there is neither section nor view to give any idea of the theatre itself, but only drawings explanatory of the carpentry and construction of the stage. However, that publication enables us to do what, highly desirable as it is, is generally most difficult of accomplishment in architectural biography, to give a tolerably full and accurate list of Foulston's buildings. At Plymouth:—Royal Hotel and Theatre, begun 1811, Grecian Ionic; Exchange, 1813; Athenæum, 1818-19, Grecian Doric; St. Andrew's Chapel, 1823; Public Library. Devonport:—Town Hall, 1821-2, Grecian Doric; Civil and Military Library, 1823, Egyptian; Mount Zion Chapel, 1823-4, Hindoo; Column, 1824, Grecian Doric. Tavistock, Old Abbey Buildings restored, 1829. Torquay, Public Ball-room, 1839. Bodmin, Cornwall County Lunatic Asylum, 1818. Besides the above, which constitute his edited designs, Foulston executed several other buildings, public as well as private, including St. Paul's Chapel, Gothic, and Edgecumbe Place, at Stonehouse; St. Michael's Terrace, Stoke Damerell; Belmont House; and various villas and cottages in the neighbourhood of Stoke, and in other parts of the county. Greatly as he seems to have prided himself upon the correctness and purity of his taste in classical architecture, Foulston was by no means disposed to confine himself to the Grecian style, for he attempted every style in its turn, Egyptian and Hindoo not excepted, and even that of Soane included, St. Andrew's Chapel being so truthful a sample of Soane's style, that it might very well pass for the production of Sir John Soane himself in the very extreme of his peculiar manner. The fact is, Foulston seems to have discovered that he had exhausted all his stock of ideas for Grecian designs after employing that style for some of his principal works. It would not do to repeat Grecian Doric and Ionic porticoes, and those mere monoprostyle ones, perpetually, especially in contiguous buildings, and this, no doubt, determined him not only to have recourse to other and widely different styles, but occasionally to bring them together in direct contrast with each other, as at Devonport, where in the Town-Hall, Column, Library, and Chapel, he clustered together into one group Grecian, Egyptian, and Hindoo, the two last of a very spurious kind, one of them being evidently borrowed from the building in Piccadilly, while for the Hindoo there seems to be no better authority than the architect's so naming it. The two first-mentioned structures are, on the contrary, highly creditable to Foulston's taste: the Town-Hall presents a Doric tetrastyle (forming the entire front), placed as a monoprostyle to, or in advance of, a deeply recessed loggia, within which is a flight of steps (not however extending the whole width of the recess) leading up to the door, which is placed upon a sort of landing, and which is the only aperture within the portico, there being fortunately no windows. Though without more pretensions to design than many other things of the kind that have been erected all over the country, the Devonport Column stands with an air of very unusual dignity, not merely stilted upon a pedestal borrowed from the broken stylobates of Roman and Italian architecture, but rearing itself upon a lofty substructure of masonry, the whole being on a higher level than the pavement of the street. Yet we suppose the Royal Hotel at Plymouth generally passes for Foulston's *chef d'œuvre*, it being his largest building—one rivalling the post-office at London in size, as well as resembling it in design; for the Plymouth structure measures 268 by 218 feet, the other 390 by 130 feet, and therefore it is even somewhat larger in plan, the respective areas being 58,424 and 50,700 square feet. It is also, like the London one, an insulated edifice; but unfortunately the principal front, with its Ionic octastyle, faces the north, and consequently, as that portico is only a simple monoprostyle not even recessed, it produces comparatively little effect, the sun very seldom striking upon it. There are two other porticoes to the same building, both of them Ionic tetrastyle, and placed in the same front; but as it happens to be the east one, they again have not the advantage of much sun; besides which that façade makes no composition, there being no central feature between the two porticoes, nor are they so placed as to form the extremities of the general mass.

There is a portrait of Foulston, apparently a strong likeness, prefixed to the above-mentioned collection of his designs.

FOUQUIERA'CEÆ, a natural order of plants belonging to Lindley's syncarpous group of polypetalous Exogens. The species are trees or shrubs, with entire oblong fleshy clustered leaves seated in the axil of a spine or a cushion, with scarlet flowers arranged in a terminal spike or panicle. The sepals are five, imbricated, ovate, or roundish; the petals 5, regular, combined in a long tube, arising from the bottom of the torus or calyx; the stamens 10 or 12, arising from the same line as the petals, but distinct from them, exserted; the anthers 2-celled; the ovary superior, sessile; the style filiform, trifid; the ovules numerous; the capsule 5-cornered, 3-celled, 3-valved; the valves bearing the dissepiments in the middle; the seeds in part abortive, compressed, winged, affixed to the axis; the embryo strait, in the centre of thin fleshy albumen; the cotyledons flat. This order was separated by De Candolle from Portulaceæ for the following reasons:—'1, because the petals were in a long tube of the same nature as that of gamopetalous Crassulaceæ; 2, because the capsule consists of three loculicidal cells, that is to say, which separate through the middle, forming three septiferous valves; and, 3, because the embryo is straight, with flat cotyledons, and stationed in the centre of fleshy albumen.' (Lindley, *Nat. System.*) In the structure of their flowers Fouquieraceæ resemble Crassulaceæ; and in the character of their fruit, Loasaceæ, Turneraceæ, and Stackhousiaceæ.

There are only two genera comprehended in this order: *Fouquiera*, named after Dr. Peter Edward Fouquiere, a professor of medicine at Paris; *Bronnia*, named in honour of Henry George Bronn, who has written on leguminous plants. Each of these genera has a single species: both plants are natives of Mexico. Of their properties little is known.

F. formosa is a showy shrub, and may be grown in a light rich soil, and propagated by means of cuttings, which will root freely in sand under a hand-glass in heat. Bronnia has been referred by some botanists to Tamaricaceæ.

(Lindley, *Natural System*; Burnett, *Outlines of Botany*; Don, *Gardener's Dictionary*.)

FOURIER, CHARLES, was born at Besançon in Franche-Comté, on the 7th of April, 1772: he died at Paris on the 10th of October, 1837, in his sixty-sixth year. He lived and died a bachelor.

He was the son of Charles Fourier, a merchant and magistrate (juge consulaire) of the city of Besançon, who died when Fourier was in his ninth year, leaving a widow with a family of four children, and a property of about eight thousand pounds. Fourier was the youngest child and the only son. The property was divided into five parts; two-fifths being apportioned to him, and one-fifth to each of his sisters. Fourier's sisters married well, and have left large families.

After completing his studies at Besançon and Dijon, Fourier was placed in a commercial house at Rouen, where he remained a short time, and then removed to Lyon, in the year 1790, when the French Revolution was commencing. It was a most eventful period. New philosophies and theories were almost annually tried experimentally, and found deficient, notwithstanding their plausibility. Fourier, though young, was led to think of principles and causes; social evils and their remedies; the horrors of convulsive anarchy, and all the aberrations of philosophy which then distracted his unhappy country. He reflected long and deeply on these subjects, in the midst of his commercial occupations, and experience confirmed him in the opinion that something must be radically wrong, to cause so much injustice and antagonism in society. He studied much, and made himself acquainted with the principles and theories of all the leading parties. From them he turned to real science in its various branches; travelled much to gain experience, and laboured constantly with various feelings of alternate fear and hope, to discover the cause of social misery, and an efficient remedy. For years he laboured unsuccessfully, though not without increasing his experience and knowledge of the world. His studies were to some extent retarded also by the necessity of devoting a portion of his time to business. By the decree of the National Convention, August 23, 1793, Fourier was compelled to enter the army, and was drafted into the 8th regiment of 'Chasseurs à Cheval,' which joined the army of the Rhine and Moselle, where Fourier remained about two years; not without profiting by all that could be learned of scientific evolutions, as his writings indicate, when treating of gymnastic exercises and the disciplines of education. He also paid great attention to the theory of music during his connexion with the army: but his health began to sink, and he obtained his release in January, 1795. In 1799 he was employed in a commercial house at Marseille, and he had to direct the operation of submerging a considerable quantity of corn by night in order to avoid the vengeance of the people, who were suffering from scarcity of bread in the surrounding country. The wheat which was thus thrown into the sea at midnight, had been spoiled by being kept too long, in order to increase the scarcity and raise the price. The scarcity of food had been so general in the country, that the poor inhabitants of many parts were suffering from famine and disease when this occurred, and Fourier was more impressed than ever with the awful state of social and commercial and political disorder which deranged the general economy of civilised society. His mind had been already fixed upon the problem for about ten years, but the first discovery of general importance and undoubted certainty was made soon after this remarkable event in 1799.

In 1800 he passed some months in Paris, and then returned to Lyon, where he published articles in the newspapers, which were noticed by the government for their remarkable acuteness and extensive range of thought. One of those articles, published in the 'Bulletin de Lyon,' in 1803, and headed 'Continental Triumvirate,' attracted the attention of Napoleon, who caused inquiries to be made about the author, but nothing further occurred. Fourier had to work out the details of his plans, and years elapsed before they were sufficiently mature for publication. Meanwhile he was employed as a commercial agent, and only known to the society in which he moved as a man remarkable for his learning in geography and general statistics. In conversation with his intimate acquaintance he had mentioned many things connected with his new discovery, and they at length induced him to commence publishing before he had completed all the secondary combinations of detail. To satisfy their curiosity he issued a Prospectus, in which his general views were broadly stated, but without an attempt at demonstration. This Prospectus was a small octavo volume, published in 1808, at Leipzig, according to the title-page, but there is reason to believe that it was printed and published at Lyon, with a feigned place of publication and without a printer's name, in order to avoid the censorship of Napoleon.

This Prospectus was intended to announce the publication of his new discovery in a series of eight octavo volumes, to be published by subscription, and commenced as soon as a sufficient number of subscribers had sent in their names. The work was entitled 'Théorie des Quatre Mouvemens et des Destinées Générales.' It is the strangest and most startling of all his works, though merely given as a general announcement of his theory. Surprise and wonder were the only effects which it produced on those who read it and the few public writers who reviewed it. It was too strange and mystical to excite the interest of general readers, and after being noticed by a few persons in the neighbourhood of Lyon, it sunk into oblivion, without a dozen copies being sold.

After publishing this voluminous 'Prospectus' of his theory of the cardinal movements, Fourier remained fourteen years without publishing the continuation of his theory. Soon after it appeared in 1808, he became aware of several imperfections and omissions in the leading theorems, and ordered it to be withdrawn from circulation. A dozen copies had been sold, at most, perhaps, besides what he had given to his private friends or sent to be reviewed by public journals. Nothing therefore happened to bring Fourier or his theory into public notice. He continued quietly his studies in the solitude of private life, interrupted only by his mercantile pursuits. He passed a portion of the following year (1809) in Switzerland; his general residence however was at Lyon for some years afterwards.

In the month of May, 1812, Fourier's mother died at Besançon, where she had always lived. Being exceedingly religious, and desirous that her son should be so too, she had been much alarmed at his new theories, for fear they should be leading him away from his religious orthodoxy. She was however satisfied with his intentions and his explanations, and she died in peace.

Fourier's portion of the property which she left was an income of 900 francs a-year, and that was nearly all he had to live upon besides his earnings as an agent for commercial houses. He still continued therefore in his mercantile position in Lyon.

Little is known of his habits or his movements from 1808 to 1815, except a few incidents mentioned by himself, which lead us to suppose that he was much absorbed in study. In one of his unpublished MSS. he says, in reference to the long interval which elapsed between his first and second publications, 'It was well that I deferred the publication of my theory, for it was not until 1814 that I discovered the principal laws of equilibrium in combined associative harmony, and other branches of transcendental theory. It was not until the year 1819 that I discovered the possibility of organizing associative unity without disturbing the present laws of marriage.

'My commercial duties had always prevented me from giving that undivided attention to my discovery which its infinite details required. The stagnation however in which mercantile affairs were plunged by the political events of 1814 and 1815 induced me to retire from business and devote my time exclusively to study. In 1816 I commenced the preparation of materials for publication, but the problems to be solved were so diversified and numerous—the subject so immense—that I could not succeed in bringing them within the limits of an ordinary book. Twelve months were lost in trying to condense the matter and improve the plan of distribution. At length I fixed upon a plan of partial publication, which contained about one-quarter of the whole theory, but sufficient for all purposes of practical association on a simple scale.'

During the Hundred Days of Napoleon's reign Fourier was placed at the head of the statistical department of the prefecture or provincial government of Lyon, by his namesake the Count Fourier, but after the second restoration of the Bourbon family everything was changed again, and Fourier retired from Lyon to Tallissieu in the autumn of that year, to pass the winter in his sister's family. From Tallissieu he went to Belley to reside with his other sister, and there he remained from 1815 until 1821, occupied exclusively in preparing the MS. of his future publication.

Hitherto no one had seriously thought of Fourier's ideas or his studies, but in 1814 a copy of his first volume fell accidentally into the hands of M. Just Muiron, of Besançon, a gentleman of studious habits and high standing in the provincial administration of Franche-Comté, and also proprietor of its leading provincial newspaper, 'L'Impartial de Besançon.'

The views of Fourier's theory announced in that volume made a deep impression on Muiron, who wrote immediately to the author to obtain more information on the subject. This led to a long correspondence and an interview, which tended to confirm Muiron in the high opinion he had first conceived of both the author and his theory. After a due consideration of the principles and an intimate acquaintance with Fourier, from whom he gathered ample information on all points of doctrine, Muiron became the intimate friend and the first avowed disciple of Fourier. He became more anxious than Fourier himself to have the theory completely published, and undertook to furnish a part of the funds for the expense of printing, as soon as the manuscripts could be made ready for the press. Fourier sold a part of his little property to defray the rest of the expense of printing. The correspondence between Muiron and Fourier became frequent. It is an interesting history of Fourier's opinions and pursuits during the period of his studious retirement from 1816 to 1821. The whole of Fourier's theory was written during this period, though not more than one-fourth of it has ever been published: the rest remains in MSS. unpublished at the present day. The MSS. were bequeathed by Fourier to his first disciple Muiron, and are now deposited in the private library of the Phalansterian School of Science, at Paris. The writer was permitted to peruse them during the summer months of 1843. These interesting documents treat however chiefly on cosmogony, psychology, analogy, and other very abstruse subjects, which are not attractive to the general reader.

In one of his letters to Muiron he says, 'I have positively failed, after fourteen years' repeated application, to solve the problem of Passional Diffraction.' This, in the language of Fourier, is the principle of prophetic inspiration. It is an abstract question, but we may give it one short paragraph of explanation.

If we compare the light of Revelation from the spiritual Sun of the universe on the eye of the mind, with the light of the natural sun on the eye of the body, we shall have the exact analogy beween the two, in harmony with the language of Fourier. There are three modes of action in the transmission of natural light: *Refraction*, *Reflection*, and *Diffraction*. In the sphere of Revelation, or the transmission of spiritual light to the mind of man, Nature is the great fact of undoubted divine origin, which *reflects* to the eye of the inquiring mind the laws of God, which it reveals in its stupendous harmony. The mind of man itself which is of divine origin also, is the power which *refracts* or divides the rays of mental light into their magic beauty of variety and colour. *Diffraction* is a mixed mode of action between refraction and reflection; and prophetic inspiration is a mixed mode of mental revelation, *written* in words similar to human verbalism, and *reflecting* divine wisdom just like Nature, but participating in the characteristic peculiarities of both; inasmuch, as it is partly reflective without explanation, like Nature; and partly refractive and explanatory, like the word of man. It is that mental or 'passional diffraction,' which Fourier could not find until he came to look for it in sacred prophecy, which he did before he published his 'New Industrial World' in 1829. In the following letter to Muiron, we shall find his reason for not coming to it earlier. Up to that period it is evident that he had consulted only two sources of divine authority and revelation, the human affections and universal nature.

'Belley, February 20th, 1818.

. . . . 'What is the use of looking backwards always, and reasoning about the origin of evil and of suffering, when it is manifest beyond a doubt that both exist and press with all their weight upon humanity? It is better to look forward to find the remedy, and reason on the necessity of its existence from the nature of the following attributes of God:—

1, 'Universality of Providence.
2, 'Unity of System.
3, 'Economy of Principles.

'If God's providence be universal, of which we cannot doubt, He must have provided a law of social harmony and justice, and it is our duty to seek that law.

'If there be unity in the system of nature, the principle of *attraction*, which rules the material world, must also be the principle of harmony in the passional or social world.

'If economy in principles of action be the law of divine harmony in every other sphere, it must be so also in human society; and all experience, as well as science, proves that association is the source of all economy in social industry.'

In April 1821, Fourier, having prepared his MS. for the press, went to reside at Besançon to superintend the printing of his work, which was distributed in nine volumes under the following heads:—

1, 'The abstract principles of Passional Attraction, and their partial application to Industrial Association.' 2, 'Familiar Synthesis of the Principles of Attraction, and their equilibrium in practice.' 3, 'The Analysis of Man's physical, moral, and mental Nature, individually and collectively, with regard to Individual Variety and Universal Unity.' 4, 'Methodical Synthesis, and Transcendental Theory.' 5, Commercial Duplicity, and Ruinous Competition.' 6, 'The False Development of Human Nature, and a regular Analysis and Synthesis of False Development in Universal Nature as an exception to Universal Harmony.' 7, 'Universal Analogy and Illustrations of Cosmogony.' 8, 'The Scientific Theory of the Immortality of the Soul.' 9, 'Dictionary of Contents, References, &c. &c. of the whole Work.'

Each of these volumes contains between five and six hundred closely printed large octavo pages; but the first and second only, with a few extracts from the others, were printed and published in 1822, under the title of a 'Treatise on Domestic and Agricultural Association.' The other seven volumes still remain in manuscript, and unpublished for two reasons: first, because the friends of Fourier could not afford to be at the expense of printing them in 1822; and secondly, because Fourier and his friends have deemed it unnecessary to incur the expense of publishing the transcendental speculative part of the theory before the practical part, already published, has become more generally known and admitted.

The title of the whole work, we are informed by Fourier, in his preface to these two volumes, should be 'Theory of Universal Unity;' but as these two volumes relate chiefly to the practical science of domestic and agricultural association, he has given them that title only. The second edition, however, of his works, published in 1841 by the Phalansterian School at Paris, is entitled 'Theory of Universal Unity.' The first edition consisted of one thousand copies, and has been sold off between the years 1822 and 1842.

In this work Fourier professes to teach the science of associative unity, by which the produce of social industry may be increased from three to seven fold, and the economy of general and individual expenditure improved ten-fold; so that the practical advantages of association to all classes of society would be as thirty to one, and more in many instances, compared with the present state of things. Many of his statements are exceedingly simple and convincing; but to master his whole theory of universal science would require more time and mental application than the study of all the branches of mathematics. This is probably the reason why his writings are so little known and understood by general readers.

In November, 1822, Fourier's two large volumes were completed, and he went to Paris to have them advertised, reviewed, and sold if possible. Here he was disappointed. Few of the reviewers noticed his work, because he had no influence with the literary cliques of that city, and those who mentioned it said little more than that it was a voluminous and abstruse production.

After waiting twelve months to have his book reviewed, without obtaining any notice from the press beyond the mere mention of 'voluminous abstruseness,' Fourier published a summary of some one hundred and fifty pages, in the hope of obtaining a more favourable and detailed review. Here again he was disappointed. He was a stranger in Paris, and without friends of influence. He sent his work to many of the leading statesmen of the time, such as Benjamin Constant and others, but those who were polite enough to acknowledge the present, alleged their multifarious occupations as a reason for not having time to read the book.

Unable to continue the expensive residence of Paris, and perceiving that without more influence he could not succeed with the reviewers to obtain a proper notice of his works, Fourier returned to Lyon in the month of March, 1825, where his necessities compelled him to accept the office of cashier in a commercial house, at a salary of twelve hundred francs a year. In the meantime his book had been read by some inquiring minds in various parts of the country, and a few influential persons became professed disciples. In the summer of 1825, M. Grea, a gentleman of large property, invited Fourier to his country residence at the château of Rotalier, near Lons-le-Saulnier, where he was anxious that Fourier should remain and write a more elementary work for general readers. Fourier complied with the request, and commenced his compendium, but did not then complete it. He returned to Lyon for a short time, and in January, 1826, to Paris, where he remained nearly two years. In July, 1828 he went again to Besançon to print the compendium to his theory, which was published early in 1839, under the title, of 'The New Industrial World;' a large octavo volume of 600 pages, and the most methodical and elementary of all his works. In this volume he has devoted a long and elaborate chapter to the 'Confirmation of associative principles from the Gospel.' From 1822 he appears to have studied the Sacred Scriptures with devout attention, and to have altered his mind with regard to the influence of their authority in corroboration of his science.

During the time of his last visit to Besançon, his native city, to superintend the printing of his 'New Industrial World,' he resided in the house of a lady, Madame Clarissa Vigoureux, who had recently become a convert to his views, and who has since then devoted her whole fortune to the propagation of his theory.

In March, 1829, Fourier returned to Paris, where he continued to reside permanently. His compendium was treated by the press with the same indifference and silence as the larger work of 1822, and his name remained unknown to the public until the year of the Revolution, 1830, when the St. Simonians in Paris began to attract general attention by their eloquence and eccentricity. As this new sect professed to take an interest in social industry and combinative unity, Fourier sent a copy of his works to each of their leaders, offering to assist them in organizing practical associations, if they were willing to avail themselves of his theory. He had made the same offer to the English Socialists some years before; but his offer of assistance was treated with polite indifference by both the English and the French sects of social innovators. They believed their own theories superior to his, and declined the aid of his proffered instruction. This treatment soured Fourier's mind against both parties, and he resolved to publish a critical refutation of their respective systems, which he had hitherto regarded with complacency as indications of a desire to better the condition of the people, rather than with critical severity in analyzing their numerous omissions and defective principles. In 1831 he published a pamphlet of seventy-two pages, entitled 'The Fallacy and Charlatanry of the St. Simonians and the Owenites.' This pamphlet contains a very severe criticism of the two systems, and was probably a powerful agent in neutralising the influence of the St. Simonians in France. Its tone is exceedingly bitter, but the arguments are irresistible. Whether his own theory be correct or not, he shows very plainly that both Owen and St. Simon are very far from possessing anything like a practical and scientific knowledge of associative principles. Most of Fourier's writings display an irritable temper, but this pamphlet is lamentably deficient in equanimity, however just the arguments may be. It produced however a very great sensation amongst the St. Simonians, and several of their conscientious leaders openly embraced Fourier's views, and left the St. Simonian sect.

This was the beginning of Fourier's notoriety and influence in Paris. Men of talent and of property began to group themselves around him in numbers, and in 1832 they were able to afford him the means of publishing a weekly journal, the first number of which appeared on the 1st of June, 1832, under the name of 'The Phalanstery,' a journal of industrial reform. Fourier edited this journal with the aid of several of his new adepts, who had left the St. Simonians. Many of his articles are deeply interesting, inasmuch as they are less abstruse and scientific than his books.

Being surrounded by new disciples, who were not thoroughly acquainted with his theory, and who were therefore partly imbued with preconceived ideas on many subjects, Fourier signed all his own articles, and declined all responsibility for those which bore the signature of his assistant editors. The journal was very ably conducted and extensively circulated, but it was too exclusively serious and scientific to meet with a sufficient sale to clear expenses. It was continued however two years, and laid the foundation of that Phalansterian Propaganda which has since spread over all parts of the globe.

The gentlemen who enabled Fourier to commence this journal, enabled him also to form a Joint-Stock Society for the practical experiment of his theory. Fourier was elected president, and his first disciple, M. Just Muiron, and M. Paul Vigoureux, vice-president and treasurer; M. Baudet Dulary and M. Grea, members of the Chamber of Deputies, were elected governors of the society and comptrollers of accounts. Shares were taken to the amount of twenty thousand pounds, and an estate of twelve or thirteen hundred acres of waste land was purchased at Condé-sur-Vegres, near Rambouillet. Buildings were commenced and other operations, almost immediately, against Fourier's will, before a sufficient number of shares had been sold to warrant such precipitancy; but his friends were so anxious to proceed rapidly, and so sanguine in their hopes of selling shares as fast as they could spend the capital in practical operations, that he could not prevail upon them to act strictly in accordance with the means in hand. The result was, that they were stopped short for want of sufficient capital. But M. Dulary, who was the principal shareholder, paid up all the other shares, and took the estate into his own hands until the means for continuing the experiment could be found.

In the spring of 1834 the weekly journal was also discontinued, and Fourier's theory was without an organ of publicity. The number of converts had however been increasing gradually, and Fourier's books were beginning to sell rapidly. His first volume was out of print in 1834, and the others were selling steadily. The public journals and reviews began to notice him and his system, superficially and sneeringly, but sufficiently to advance the sale of his works.

In 1835 he published another 8vo. volume, entitled 'False Industry;' but it was chiefly filled with criticisms of the present state of things, and contained nothing new in regard to his theory. In 1836 a monthly journal was commenced by his friends, under the name of 'La Phalange;' and this journal has been steadily increasing in influence ever since. In 1837 it was published twice a month: in 1840, three times a week, and it is now a daily paper, under the name of 'La Démocratie Pacifique."

The writer of this article first became acquainted with Fourier personally in Paris, a few years before his death. He was a man of dignified simplicity, friendly and polite, indulgent and sincere, but somewhat misanthropic in the latter part of his life, partly from disappointment in failing to realize his theory during his own lifetime. In person he was slight, and of a nervous, irritable temperament: his stature about five feet seven inches. His physiognomy was expressive, his hair light brown, complexion fair; his eyes blue and of a mild expression. His nose was aquiline and chin large, his lips thin and much compressed. His head was of the 'Gaulois' form, less oval than the Celtic, prominent in front, depressed behind, and very full on each side, and yet rather small than large. In early youth his favourite study was geography; his favourite amusements were music and the cultivation of flowers. In one of his unpublished MSS. we observed an incidental comment on an author who asserts that any man without a family may be happy with a small income. Fourier's note is '*non ego*. My delight would be to travel, and publish maps of a superior kind. This I cannot do with my small income.' He acquired a perfect knowledge of music, both as an art and a science; and in fact has made some improvements in it which may ultimately be of considerable importance.

In 1837 Fourier's health began to decline rapidly, and on the 10th of October he died, leaving a second volume of his 'False Industry,' partly printed, but not published. The whole of his published works consist of—'Théorie des Quatres Mouvements et des Destinées générales,' 1 vol. 8vo., 420 pages, published in 1808; 'Traité de l'Association Domestique Agricole,' 2 vols. 8vo., published in 1822, and a summary of the same, published in 1823, making altogether a work of 1448 closely printed pages: 'Le Nouveau Monde, Industriel et Sociétaire,' 1 vol. 8vo., published in 1829, with a livret d'annonce of the same, published in 1830, 664 pages: 'Pièges et Charlatanisme des deux Sectes St. Simon et Owen,' an 8vo. pamphlet of 72 pages, published in 1831: 'La Fausse Industrie, morcelée, repugnante, mensongère; et l'Antidote, l'Industrie naturelle, combinée, attrayante, véridique, donnant quadruple Produit,' 1 vol. 8vo., published in two parts, the first in 1835, the second in 1837, 840 pages.

Besides these books he published a long series of interesting articles in his weekly journal, the 'Phalanstere.'

A second edition of his two first works has been published at Paris by the Phalansterian School of Science. The first edition of the others is not quite sold off, or was not some few months ago, though few copies then remained on hand.

Fourier's theory is based on One universal principle—that of attraction and repulsion, in all spheres of life and movement. The cardinal division of this One principle or law of movement, pivots on, or terminates in, what he terms Passional or Social harmony. When stated mathematically his science resolves itself into three theorems—three aspects of universality—which are these:

Les attractions sont proportionnelles aux destinées.
La Série distribue les harmonies.
Analogie universelle.

These are fundamental axioms of science, and susceptible of demonstration. These axioms of science are accepted by the Phalansterian school, and all that Fourier has been able to demonstrate with them is admitted, but when he only conjectures from them, with regard to future periods, which he does to a very great extent, his school of science rests on his axioms, leaving him to roam alone in the romantic regions of imagination. They do not teach his speculative doctrines, but confine themselves to practical economy. All their writings are directed to that object chiefly, and exceptionally only to mere speculative controversy.

There can be no doubt that one principle of unity governs all the infinite varieties of nature, and that these varieties must, therefore, correspond to one another in some degree of close or of remote analogy, as well as to the One great principle in which they all unite; and hence the evident necessity of Universal analogy as a connecting link in nature, and a ladder for the human mind to climb upon in rising to the infinitely great, or in descending to the infinitely small in creation.

That order is heaven's first law, the law of universal harmony in fact, there cannot be a doubt in healthy minds; and that variety is harmonised in unitary order, by the law of series or gradation, is self-evident, and hence the truth of Fourier's second theorem. The application of this law, however, is infallible in superhuman wisdom only, not in fallible humanity; and hence it is that Fourier's school accept the law of order or series, as he explains it scientifically, but reserve their free assent in cases where a special application of this law is not sufficiently supported by experience or scientific demonstration. They never doubt the *truth* of this great law, but sometimes the *correctness* of Fourier's startling and prospective applications to the moral order of society.

That the general impulsions of created beings are adapted to the ends for which they are created, is a theorem which cannot be denied without imputing imperfection to the author of our being, and hence the first theorem of Fourier, that attractions are proportional to final destinies.

From this he argues that the affections and desires of human nature for individual and social happiness, are permanent impulsions destined to seek, and ultimately to find, the laws of their harmonious satisfaction. He also argues that these innate aspirations are eternal, and that they cannot be eradicated from the soul, but that they may be, and too often are, corrupted by temptation, instead of being developed in harmonious discipline. Whence he concludes that the disciplines of life for every age and occupation, or the institutions of society in moral and religious and industrial education, government and progress, are alone within the power of man to alter and improve, as a medium of due development for those impulsions which God has implanted in human nature, and over which man has no control but that of discipline, which may be good or bad, general or partial, and which may influence the destiny of human souls for good or evil, though it cannot alter human nature.

Fourier's whole life was devoted to this problem of social disciplines in every sphere of life, but particularly in the sphere of social industry. Whether his solution of the problem be complete or not, it cannot be denied that he has thrown considerable light on many questions of the highest moment to the present and the future welfare of mankind.

The general tone of his mind may be gathered from his answer to an allegation of scepticism from the 'Gazette of France,' two years before his death. He states that 'there are two doctrines which he could not deny without denying his own: the doctrine of Christ in religion; that of Newton in science.' Religious and political discussions are carefully avoided in all Fourier's writings. He professes not to meddle either with the throne or the altar. He establishes a 'School of Science,' but denies that he has any wish to form a new religion. He proclaims himself a Christian. Theology as well as politics he deems a proper subject for discussion, but not Revelation. He differs from philosophers and divines on many points of natural and Scriptural interpretation, but he never doubts of Revelation in the Word and in the works of God. If we have understood him rightly in his views of future unity in Christian faith, he believes the Roman Catholic religion will be universally adopted, when its œcumenical councils have been re-established, and the principles of love and charity regain as much ascendency as will admit of private liberty and toleration of opinion in the Church. The unity of Roman Catholic devotion will then harmonise the liberty of Protestant opinion, as the solar light includes the various coloured rays without destroying them in one refulgently impartial colour, White. Doctrinal variety and pure devotional unity appear to be the Phalansterian view of Christian harmony.

Since Fourier's death, the progress of his theory has been rapid, in almost all parts of the civilized world, but more especially in France and North America.

In 1840, Mr. Arthur Young purchased the estate of Citeaux, near Dijon, in France, for the purpose of commencing a joint-stock society, to carry out Fourier's theory of domestic and agricultural association. The estate contains more than thirteen hundred acres of excellent land, and a splendid château in the centre. Sixty thousand pounds have been invested in this estate, and it is now in active preparation for associative unity. There are one hundred and thirty persons residing in the château, and two hundred farming labourers are employed in busy seasons. The Phalansterians in France are numerous and active. In 1843 an appeal was made to the party for funds to establish a daily journal, and nearly thirteen thousand pounds were subscribed immediately for that purpose. The editor of the Phalansterian Journal in Paris is M. V Considérant, whose life has been devoted to the cause.

In North America the progress of this party has been very rapid since 1840, owing chiefly to the efforts of Mr. Albert Brisbane, an American gentleman, who became acquainted with Fourier and his theory in 1832. Besides the aid of several daily and weekly journals in New York, and other cities, the Phalansterians have commenced a dozen or more practical experiments in the United States.

In England the Phalansterian School has also its representatives. In 1840, Mr. Hugh Doherty commenced a periodical in London, called the 'Morning Star,' and in 1841 this journal became a weekly stamped newspaper, under the name of the 'London Phalanx.' It was not however able to sustain itself more than twelve or fifteen months as a weekly paper, and in June, 1842, it was continued in the form of a small monthly magazine, published in Catherine Street, Strand, which completed one yearly volume.

The Phalansterians have made little progress in England, owing perhaps to the abstruseness of their writings. They have not appealed to the popular feelings and interests in this country, as in America, probably from a fear of being misunderstood and misrepresented as political agitators and sceptical Socialists.

In Germany, and Italy, and Spain, books, and journals, and reviews, have been published by converts to the Phalansterian theory. In South America they have also published books and journals, and commenced two practical experiments in the Brazils. In Belgium and in Holland they are also gaining ground.

They call themselves a 'School of Science,' and object to being termed a religious or a political sect, on the ground that they meddle not with the interests of the throne or of the altar, though they claim the right of private judgment in matters of civil and religious liberty. They discuss freely also the doctrines of theology and politics, but not with a view to the subversion of established authorities in Church and State. Their object in discussing principles is to enlighten the authorities, but not subvert them. They conform to the established laws and government wherever they are, and profess to innovate in social industry alone, which interferes with the established institutions of society. They do not argue that the innovations which they contemplate in the sphere of social industry, would not ultimately modify the higher institutions of the State, but they maintain that such reforms would not be sudden or injurious to any class of vested interests, inasmuch as they would come into existence gradually.

As a school of science, the Phalansterians accept without reserve that part only of Fourier's theory which is susceptible of scientific demonstration; reserving all his speculative and conjectural assertions for the judgment of posterity; particularly with regard to marriage. They accept the principle of his discovery, the 'law of series,' as the law of universal harmony, but not the infallibility of his novel applications of that law in the sphere of moral and domestic life.

They have published many elementary works on social science and general principles. The following is a list of their most important books, but their minor tracts and pamphlets are too numerous to be named here.

French works published in Paris:—'Essai sur les Procédés Industriels,' 1 vol. 12mo., 230 pages, by Muiron; 'Transactions sociales, religieuses, et scientifiques,' 1 vol. 8vo., 200 pages, by Muiron; 'Etudes sur la Science Sociale,' 1 vol. 8vo., 480 pages. J. le Chevalier; 'Destinée Sociale,' 2 vols. 900 pages, V. Considerant; 'Politique Générale,' 1 vol. 8vo., 160 pages, *id.*; 'Manifeste de l'Ecole Societaire,' 1 vol. 8vo., 160 pages, *id.*; 'Débacle de la Politique en France,' 1 vol. 12mo., 150 pages, *id.*; 'Science Sociale,' 1 vol. 8vo., 240 pages, by Doctor Paget; 'Calculs Agronomiques et Considérations Sociales,' 1 vol. 8vo., 180 pages, Lemoyne; 'Solidarité,' 1 vol. 8vo., 300 pages, Reynaud, captain of artillery; 'Ménage Sociétaire,' 1 vol. 8vo., 200 pages, M. Harel; 'Fourier et son Système,' 1 vol. 12mo., 300 pages, Madame Gatti de Gamond; 'Le Fou du Palais Royal,' 1 vol. 8vo., 500 pages, F. Cantagrel; 'Théorie de l'Association,' 1 vol. 8vo., 400 pages, Ed. De Pomperey; 'Charles Fourier, sa Vie, et sa Théorie,' 1 vol. 12mo., 560 pages, C. Pellarin.

English Works published in America:—'Social Destiny,' 1 vol. 8vo., 500 pages, Albert Brisbane; 'Doctrine of Association,' 1 vol. 8vo., 100 pages, double columns, small type, *id.*

English Works published in London:—'Fourier and his System,' translated from the French of Madame Gatti de Gamond, 1 vol. 8vo., 100 pages, T. Wood; 'A Journey to the Phalanx, and Hints for Railway Travellers,' 3 vols. 12mo., 700 pages, C. H. Crewe; 'Biography of Fourier, with a critical Introduction to Fourier's Social Science,' 1 vol. 8vo., 170 pages, Hugh Doherty; 'The London Phalanx,' weekly series, one large volume in folio, *id.*; 'The Monthly Phalanx,' 1 vol. 8vo., 416 pages, *id.*

Phalansterian Tracts:—'High Rents and Low Wages;' 'Social Maladies and Social Doctors;' 'Hints on Poor Law Legislation;' 'Position of Woman in Harmony.'

FRACTIONS, DECOMPOSITION OF, a method of much use in the integral calculus for reducing products of the form $X(x-a)^{-m}(x-b)^{-n}$ . . . . . in which X is rational and integral to the sum of terms of the form $K(x-a)^{-k}$, in which K is independent of x. But if X be of a higher dimension than $m+n+$ . . . there is also a quotient.

This quotient may be easily found by the short rule for division by $x-a$. To divide $px^m+qx^{m-1}+\ldots$ by $x-a$, take the first coefficient, multiply it by a and add the next; repeat this process to the end, taking care to use 0 for the coefficient of any missing term. The results, beginning with the first coefficient, are the coefficients of the quotient, except the last, which is the remainder. Thus in dividing $2x^7-2x^6+x^3+x-1$ by $x-3$, the coefficients are

$$2 \quad -2 \quad 0 \quad 0 \quad 1 \quad 0 \quad 1 \quad -1$$

The results of the rule are

$$2 \quad 4 \quad 12 \quad 36 \quad 109 \quad 327 \quad 982 \quad 2945$$

Hence the quotient is $2x^6+4x^5+12x^4+36x^3+109x^2+327x+982$, and the remainder is 2945. To divide by $x+a$, or $x-(-a)$, use $-a$ as a multiplier.

Thus to find the quotient of x^8-2x^3+4 divided by $(x-1)^3(x+1)^2(x-5)$, the process is as follows, it being seen beforehand that the answer is of the second degree. We omit all the work which is of no use in the final result.

$$\begin{array}{ccc}
1 & 0 & 0 \\
1 & 1 & 1 \\
1 & 2 & 3 \\
1 & 3 & 6 \\
1 & 2 & 4 \\
1 & 1 & 3 \\
1 & 6 & 33
\end{array}$$

When we divide x^8-2x^3+4 by $x-1$ the three first terms of the quotient are $x^7+x^6+x^5$: two divisions more by $x-1$ give $x^5+3x^4+6x^3$. We then divide twice following by $x+1$, still preserving only three terms, and the result is x^3+x^2+3x, and the final division by $x-5$ brings out $x^2+6x+33$ for the three first terms of the final quotient, that is, for the whole quotient. For verification the order of the divisions may be varied.

When all the roots of the denominator are unequal, that is, when the quantity to be reduced is of the form $X(x-a)^{-1}(x-b)^{-1}(x-c)^{-1}$ . . . . where a, b, c, &c. are all unequal, the process for finding the reduced form of the remainder is very easy. Strike out $(x-a)^{-1}$ and make $x=a$ in the form thus mutilated; let this result be A. Next strike out $(x-b)^{-1}$, and make $x=b$; let the result be B; and so on. Then the fraction $X(x-a)^{-1}(x-b)^{-1}$ . . . . is the quotient, if any, $+A(x-a)^{-1}+B(x-b)^{-1}+\ldots$. Thus to reduce the expression $x^6\div(x-1)(x-2)(x+1)$, we set down all the work, as follows; the quotient being of the third degree—

$$\begin{array}{cccc}
1 & 0 & 0 & 0 \\
1 & 1 & 1 & 1 \\
1 & 3 & 7 & 15 \\
1 & 2 & 5 & 10
\end{array}
\qquad
\begin{array}{r}
1^6\div(-1\times2)=-\dfrac{1}{2} \\[2ex]
2^6\div(1\times3)=\dfrac{64}{3} \\[2ex]
(-1)^6\div(-2\times-3)=\dfrac{1}{6}
\end{array}$$

And the final result is

$$\frac{x^6}{(x-1)(x-2)(x+1)}=x^3+2x^2+5x+10$$
$$-\frac{1}{2}\,\frac{1}{x-1}+\frac{64}{3}\,\frac{1}{x-2}+\frac{1}{6}\,\frac{1}{x+1}$$

When the roots of the denominator are not all equal, the way of proceeding which is most easy in the simple cases which generally occur in practice, will be best caught from an example. Suppose for instance, that $(x^4+1)\div(x-1)^2(x-2)(x+1)$ is the fraction to be reduced. Begin with the denominator $(x-1)(x-2)(x+1)$, and, by the preceding rule, obtain the result,

$$\frac{x^4+1}{(x-1)(x-2)(x+1)}=x+2-\frac{1}{x-1}+\frac{17}{3}\,\frac{1}{x-2}+\frac{1}{3}\,\frac{1}{x+1}$$

Divide both sides by $(x-1)$, and turn $(x+2)\div(x-1)$ into $1+3\div(x-1)$, and also by the rule, convert

$$(x-1)^{-1}(x-2)^{-1} \text{ into } -(x-1)^{-1}+(x-2)^{-1}$$
$$(x-1)^{-1}(x+1)^{-1} \text{ into } +\frac{1}{2}(x-1)^{-1}-\frac{1}{2}(x+1)^{-1}$$

and the result is

$$\frac{x^4+1}{(x-1)^2(x-2)(x+1)}=1-\frac{16}{6}\,\frac{1}{x-1}-\frac{1}{(x-1)^2}$$
$$+\frac{17}{3}\,\frac{1}{x-2}-\frac{1}{6}\,\frac{1}{x+1}$$

More complicated examples may be seen in the 'Differential Calculus' (*Library of Useful Knowledge*, p. 273. The above will be sufficient for ordinary purposes.

FRAMBÆSIA. [SKIN, DISEASES OF, P. C. S.]

FRANCESCA, PIE'RO DELLA, called also Piero Borghese, from his native place, Borgo San Sepolcro, where he was born about 1408. His chief service was in perspective, which he was the first to fully developed in practice; in other respects his works, of which few remain, are in the prevailing antique style of the period, such as we find it in the works of Perugino and other contemporaries. Piero's greatest work is the legendary history of the Cross, in San Francesco at Arezzo, from the very seed placed in the mouth of Adam at his burial, from which the tree grew of which the Cross was made: it is still preserved, though much injured by time and ill-usage. He died about 1496.

Piero's theoretical knowledge of perspective appears to have been considerable, and he was, according to Vasari, one of the best geometricians of his time: he wrote several treatises on these subjects, some of which are still preserved at Borgo San Sepolcro. Some of his writings, says Vasari, were dishonestly published by his pupil Fra Luca dal Borgo, or Luca Pacciolo, as his own; but the truth ofthis statement is doubted. Luca's works are, 'Summa Arithmeticæ;' 'La divina Proporzione,' with figures by Lionardo da Vinci; and 'Interpretazione di Euclide.' He did not write on perspective; but where he notices the subject, he alludes to Piero della Francesca as 'el monarca de la pictura.' A Life of Piero was published at Florence in 1835, by Gherardi Dragomanni.

(Vasari, *Vite de' Pittori*, &c., and the Notes to Schorn's German translation of Vasari; see also Rumohr, *Italienische Forschungen*.)

FRANCIA, FRANCESCO, the name by which Francesco Raibolini is known, and which he wrote upon his works, after the name of his master the goldsmith. Francia is one of the most celebrated of the Italian painters, and the most perfect in his style, the *antico-moderno*, or that transition style between the comparatively meagre works of the most distinguished early masters and the fully developed form and character of the works of Raphael and his great contemporaries. The exact period of his life is not known, but he was born at Bologna about 1450, or the middle of the fifteenth century, and he died there after 1522, surviving Raphael several years: a St. Sebastian, one of his best pieces, is dated 1522; there is a copy of it in the Misericordia. The story told by Vasari, therefore, about his dying of vexation upon seeing the St. Cecilia of Raphael, which was consigned to him in Bologna, in 1518, supposing the signature of the St. Sebastian to be authentic, is incorrect, as is also Calvi's account, that he died in 1517, though the latter is adopted by Giordani and Waagen in their catalogues of the galleries of Bologna and Berlin: he died, according to Lanzi, in 1533. Francia was by education a goldsmith and a die and niello engraver, and he is supposed to have taken up painting at a comparatively late period: he must however have had some reputation as a painter in 1490, as he was then employed on extensive works in the Palazzo Bentivoglio at Bologna. He was an admirable colourist, and the greatest master of Bologna before the Carracci. He signed himself *Aurifex* on his paintings, and *Pictor* on his jewelry. The two pictures by him in the National Gallery are admirable specimens of his style, and more perfect individual specimens than any other of the foreign pictures in the collection: they were formerly in the Duke of Lucca's collection, and were purchased for the nation in 1841 for 3500*l.*

Giacomo Francia, the son and pupil of Francesco, painted in his father's style, and, though far from equalling his father, was a good painter: he died in 1557. A Life of Francia was published at Bologna in 1812, by J. A. Calvi.

(Vasari, *Vite de' Pittori*, &c.; Malvasia, *Felsina Pittrice*; Lanzi, *Storia Pittorica*, &c.)

FRANCIA, DOCTOR JOSE' GASPAR RODRIGUEZ (and he himself at least appears to have written the name with the feudal prefix, De Francia), the late famous Dictator of Paraguay [P. C. xvii. 226], is said to have been born near the town of Assuncion, the capital of that country, in 1757 or 1758. His father, who was a chacarero, or small proprietor cultivating his own land, is admitted on all hands to have been a European; but it is doubtful whether he was French or Portuguese. Francia himself, who had a passion for everything French, alleged that his father came from France; if it was so, the name he bore may have been given him to mark his original country. Most probably however the name may have suggested this pretension to the dictator. However that may be, old Francia had come over to Brazil, and, proceeding thence to the Spanish possessions in the interior, had finally settled in Paraguay, where he married a Creole, and had this José and other sons and daughters. José was his eldest.

When he came to the proper age, young Francia was sent to the University of Cordova, in the neighbouring province of Tucuman, to be educated for the church; and he passed through the usual course of theological instruction, or the greater part of it. According to one account, indeed, he took his doctor's degree in that faculty. It is most probable however that his doctorate was not of divinity but of law, which he ultimately determined to make his profession. The change was perhaps prompted in part by the turn which his opinions had taken or begun to take towards deism, the avowed creed of his latter years, which he had imbibed from reading the works of Rousseau, Raynal, and other French writers of that school. He seems to have spoken as well as read the French language; and he also brought away with him from college, besides what he learned of law, and what he may have preserved of his theological acquirements, some knowledge of mathematics and of mechanical philosophy, a taste for which departments of study he preserved to the end of his life.

Establishing himself in the town of Assuncion, Francia spent there perhaps the next thirty years of his life as an advocate or barrister. He had a good practice, and a high reputation both for legal learning and for integrity and independence of character. 'He never,' we are told, 'would defend an unjust cause; while he was ever ready to take the part of the poor and the weak against the rich and the strong.' This is the testimony of Messrs. J. P. and W. P. Robertson, in other respects far from favourable witnesses.

The revolution which brought about the independence of the Spanish possessions in South America began in Buenos Ayres in 1810, when Francia was fifty-two or fifty-three years old. Paraguay refused to join the other La Plata provinces in this movement, and was successful in repelling a force sent from Buenos Ayres under General Belgrano to compel its adherence; but the next year, nevertheless, it set about and accomplished a revolution of its own. Francia had probably been active in directing this course which things had taken; and when the independent junta was set up, with Don Fulgencio Yegros, the general who had defeated Belgrano, as president, Francia was appointed secretary. Yegros and the others however could not get on with him—or he with them—and he soon resigned his post, retiring to a country house in the neighbourhood of Assuncion. One account says that he was brought back again and withdrew more than once; and it would also appear, that after serving as secretary he was for a time a member of the junta; but he seems at any rate to have finally retired sometime in 1812. Everything now went from bad to worse; and the Paraguayan public mind seems to have taken up a fixed idea that only Francia could set matters right. Accordingly, a new congress which assembled in 1813 placed him and Yegros at the head of the republic under the name of joint consuls. It is admitted that from this moment the state of public affairs began to improve in all respects; in particular the protection of the country from foreign invasion, a calamity which had actually begun to come upon it before from some quarters, and been threatened from others, was effectually secured. It was with a view to this particular object that Francia first introduced his non-intercourse system. The conflagration of civil war and confusion was already spreading fast through the rest of the South American continent: this was Francia's plan, in which he was perfectly successful, of preserving Paraguay from being enveloped in the same calamity. The peculiar character which had been impressed upon society in that country by the Jesuits at the same time favoured and may have partly suggested the policy which he thus adopted; and the course of events, after it was tried and found to answer, led by degrees to its more strict enforcement. It became at last so complete that, as is well known, all ingress into Paraguay or escape from it became nearly impossible, nor had the country any political relations, or almost any commercial communication, with any other part of the globe.

Before matters came to this, however, Francia's joint consulship had been converted, first in 1814, by a third congress, into a dictatorship for three years, and then in 1817, into a dictatorship for life. Yegros, who had been all along a mere cypher or useless incumbrance, was of course got rid of. He afterwards, in 1819, involved himself in destruction by engaging in a conspiracy for the assassination of his former colleague: the detection and defeat of which at the same time consolidated and greatly strengthened Francia's power. It appears to have been principally during the existence of the critical state of affairs produced by this plot, a period of two or three years, that the system of somewhat sanguinary severity which has been called the reign of terror, was kept up by Francia. In that time he is said to have put to death about forty persons.

Francia remained supreme and absolute master of Paraguay till his death on the 20th of September, 1840, when he was succeeded by a Directory, or governing junta, of three persons.

The instances of what is called Francia's tyranny as exercised on foreigners that have had the greatest noise made about them are those of his treatment of M. Bonpland, MM. Rengger and Longchamp, and the Messrs. Robertson. Bonpland, the distinguished botanist, had set up an establishment for the culture of Paraguay tea in the adjoining district of Entre Rios, a sort of debateable land, and was there seized, in 1821, by order of Francia, and carried off into Paraguay, which he was not allowed to leave so long as the dictator lived. He seems to have been considered by Francia to have trespassed upon the rights of the republic by his tea-growing speculation. However, beyond his forcible detention he was never harshly treated, and he continued in the country of his own accord for some time after Francia's death, if he be not there still. Messrs. Rengger and Longchamp were two Swiss surgeons who had found their way into Paraguay in 1819, and were detained by the dictator, principally, it would appear, for the sake of their professional services, till 1825. After their return to Europe they published an account of their adventures and of the country, under the title of 'Essai Historique sur la Révolution de Paraguay, et le Gouvernement Dictatoriel du Docteur Francia,' which contains on the whole the best materials that have yet been given to the world for the history of Francia and his administration. As for the Messrs. Robertson, they were not detained in the country, but turned out of it. They have told their own story, though rather confusedly, in their 'Letters on Paraguay,' 2 vols. 8vo. Lon. 1838, and 'Francia's Reign of Terror,' 8vo. Lon. 1839. The most distinct and graphic sketch that has been drawn, at least in English, of Francia and his career, is in a very characteristic paper by Mr. Carlyle, in the 62nd No. of the 'Foreign Quarterly Review' (for July, 1843), pp. 544-589. If it should be thought too much to soften some of the more startling points in the dictator's character and conduct, and to give him the benefit of a favourable doubt somewhat too liberally, it may be corrected by comparison with the Messrs. Robertson's unmixed and unmeasured condemnation. Mr. Carlyle has derived some of his facts from a funeral discourse delivered at the celebration of the obsequies of Francia by the Rev. Manuel Antonio Perez, in which his government is lauded in the highest terms. He certainly appears to have been to the last looked up to both with respect and gratitude by the Paraguayans. Perez says that when he was dying the people crowded round the government house in tears.

FRANCKLIN, THOMAS, D.D., was born at London in 1721. Being the son of the well-known printer, Richard Francklin, who, for his paper 'The Craftsman,' and other services to Walpole's enemies, expected or had been promised a provision in the church for his son, he was educated at Westminster School, and thence sent to Cambridge, where he became a fellow of Trinity College. Afterwards, while an usher in Westminster School, he gained some reputation by translations of Phalaris's 'Epistles,' and of Cicero 'De Natura Deorum;' and in 1750, after a contest, he was chosen Greek professor in the University of Cambridge, an appointment to which he appears to have done as little credit by the regularity of his deportment as by his literary exertions. After having held lectureships in London, he was presented by his college, in 1758, to the livings of Ware and Thundrich in Hertfordshire. Although, however, several sermons of his were published during his life, and three volumes of them after his death, he was always chiefly employed in London, in literary labours and literary quarrels. Among his disputes, that with Arthur Murphy was the most noted. He died in London on the 15th of March, 1784. His writings were numerous and varied, but of little value. Among his original works were a poem called 'Translation,' 1753; a periodical called 'The Centinel,' intended as a continuation of 'The World,' but dropped at the twenty-seventh number; contributions to Smollett's 'Critical Review;' and one or two indifferent plays. His translations were voluminous. Several were of tragedies from the French of Voltaire and La Harpe, in the presenting of which to the stage the sources borrowed from were not always acknowledged. But the only translations of Francklin that are now remembered by any one are his Sophocles and Lucian: the Sophocles first published in 1759, 2 vols. 4to., and the Lucian in 1780, 2 vols. 4to. The latter is much the better of the two.

FRANCO, BATTISTA, called Semolei, a painter and engraver, born at Udine, according to Vasari, about 1498: he died at Venice in 1561.

Though of the Venetian State, Franco was of the Florentine school. He was a great imitator of Michael Angelo, with whose style of design he combined some of the excellences of Venetian colour. He painted much at Florence and at Rome; but few easel pictures, and his works are accordingly rarely seen in galleries. His engravings or etchings are numerous, but nearly all after his own designs; they are mannered, but executed with great power. Franco was the master of Baroccio.

(Vasari, *Vite de' Pittori*, &c.; Bartsch, *Peintre-Graveur*.)

FRANCUCCI. [Imola, Innocenzio da, P. C. S.]

FRANK PLEDGE. [Leet, P. C.]

FRANKALMOIGNE. This tenure is thus described by Littleton (§ 133): 'Tenant in Frankalmoigne is when an abbot or prior, or other man of religion, or of holy church, holdeth of his lord in Frankalmoigne; that is to say, in Latine, *in liberam eleemosinam*, that is, in free almes. And such tenure beganne first in old time. When a man in old time was seised of certain lands or tenements in his demesne as of fee, and of the same land infeoffed, an abbot and his covent, or prior and his covent, to have and to hold to them and their successors in pure and perpetual almes, or in frankalmoigne; or by such words, to hold of the grantor, or of the lessor and his heires in free almes: in such case the tenements were holden in frankalmoigne.' From this it appears that lands which are held by religious bodies or by a man of religion, are held by tenure; but neither fealty nor any other temporal service is due. The spiritual services which were due before the Reformation are thus described by Littleton (§ 135): 'And they which hold in frankalmoigne are bound of right before God to make orisons, prayers, masses, and other divine services for the souls of their grantor or feoffor, and for the souls of their heires which are dead, and for the prosperity and good life and health of their heires which are alive. And therefore they shall do no fealty to their lord; because that this divine service is better for them before God than any doing of fealty; and also because these words (frankalmoigne) exclude the lord to have any earthly or temporal service, but to have only divine and spiritual service to be done for him.'

On this section (§ 135) Coke has the following remark, which explains how most lands are now held by the clergy of the church of England, and by spiritual corporations in England:—'Since Littleton wrote, the liturgie or book of Common Praier of celebrating divine service is altered. This alteration notwithstanding, yet the tenure in frankalmoigne remaineth; and such prayers and divine service shall be said and celebrated as now is authorized; yea, though the tenure be in particular, as Littleton hereafter (§ 137) saith, viz. to sing a mass, &c., or to sing a *placebo et dirige*, yet if the tenant saith the prayers now authorized, it sufficeth. And as Littleton hath said before (§ 119), in the case of Socage, the changing of one kind of temporall services into other temporal services altereth neither the name nor the effect of the tenure; so the changing of spiritual services into other spiritual services altereth neither the name nor the effect of the tenure. And albeit the tenure in frankalmoigne is now reduced to a certaintie contained in the book of Common Prayer, yet seeing the original tenure was in frankalmoigne, and the change is by generall consent by authority of parliament (2 Ed. VI. c. 1; 5 & 6 Ed. VI. c. 1; 1 Eliz. c. 2), whereunto every man is party, the tenure remains as it was before.'

The statute 12 Charles II., which abolished military tenures, expressly excepts tenures in frankalmoigne.

Those who hold lands in frankalmoigne must do the services for which these lands were given. These services are now determined, as Coke says, by the book of Common Prayer. The mode of compelling these tenants to do their duty is thus described by Littleton (§ 136):—'And if they which hold their tenements in frankalmoigne will not, or fail to do such divine service (as is said), the lord may not distrain them for not doing this, &c., because it is not put to certainty what services they ought to do. But the lord may complain of this to their ordinary or visitour, praying him that he will lay some punishment and correction for this, and also provide that such negligence be no more done, &c. And the ordinary or visitour of right ought to do this,' &c.

Since the statute of 18 Ed. I., called *Quia Emptores*, from the introductory words, there can be no gift in frankalmoigne except by the crown. This tenure, however, as Blackstone observes, 'is the tenure by which almost all the ancient monasteries and religious houses held their lands; and by which the parochial clergy and very many ecclesiastical and eleemosynary foundations hold them at this day, the nature of the service being upon the Reformation altered, and made conformable to the purer doctrines of the Church of England.'

FRA'NKENIA, a genus of plants, the type of the natural order Frankeniaceæ, and named in honour of John Frankenius, a professor of botany at Upsal, and the first enumerator of the Swedish plants in 'Speculum Botanicon.' It has a 5-cleft style, the lobes oblong, with the stigmas within. Capsules 1-celled, with three or four valves, and many-seeded. These plants are small and heath-like, with prostrate stems; the flowers usually rise from the forks of the stem or are disposed in terminal corymbs.

F. pulverulenta, or the Powdery Sea-heath, has its leaves opposite in whorls, obovate, retuse, glabrous, and the under surface powdery, with ciliated petioles; a slender root, and axillary terminal flowers of a pale-red colour. This plant grows in the sand by the sea-shore in many parts of Europe and Asia; it is occasionally found on the coast of Sussex in England, but is very rare.

F. lævis has clustered, linear, glabrous leaves, with revolute margins, ciliated at the base; prostrate downy stem, and terminal axillary solitary flowers. It is a native of the muddy salt-marshes by the sea-coast, in many parts of Europe and the Canary Isles. In England it is found principally on the eastern coast, and flowers in the months of July and August. The flowers are generally flesh-coloured, but sometimes white, with yellow claws.

Don enumerates sixteen species of this genus, besides those already named as being found in Great Britain. Of those not British plants the majority occur in Africa and New Holland, and some are found in South America. *F. hispida* grows on the rocks extending from the island of Cyprus to Siberia. The hardy species of this beautiful evergreen genus are well adapted to ornament rockwork, and may be easily cultivated. They may be propagated by cuttings or by dividing the roots, and may also be grown from seed under a hand-glass.

(Don, *Gardener's Dictionary*; Babington, *Manual of British Botany*.)

FRASER, SIMON. [LOVAT, LORD, P. C. S.]

FRAUDS, STATUTE OF. [STATUTE OF FRAUDS, P. C. S.]

FRAUDULENT CONVEYANCE. [CONSIDERATION, P. C. S.]

FRAUENREUTH (*Berchtesgaden*) is a village of Bavaria, in the district of Berchtesgaden, in the circle of the Isar. There are salt-works here, where the rock-salt from the Salzberg is boiled down. There are quarries of marble in the neighbourhood.

(Stein, *Handbuch*, by Hörschelmann.)

FRAUNHOFER, JOSEPH, a distinguished optician of Bavaria, was born at Straubing in that kingdom, in 1787, of parents in humble life; and, by their death, he was left an orphan when eleven years of age.

He had been accustomed to labour from his childhood, and he was early engaged as an apprentice to a manufacturer, who exacted from him an unremitting attention to the mechanical operations connected with his calling: yet, though few and far between were the intervals of relaxation which his daily occupations afforded, the youth found means, without the aid of an instructor, to supply in a certain degree the deficiencies of his education, and to make some progress in the study of mathematics.

An accident, which nearly cost him his life, was the cause that the merit of Fraunhofer became known: an old house in which he lodged fell down one day and buried him in the ruins; he was extricated however, and, almost by a miracle, came out unhurt. The interest excited by the danger which the young man had escaped drew upon him the notice of several persons of rank and fortune; and these, being struck with admiration on discovering the efforts he had made in the midst of many adverse circumstances to cultivate the sciences, procured for him an introduction to the celebrated Reichenbach, who received him, he being then about twenty years of age, into the great manufactory for the construction of mathematical and philosophical instruments which that artist had established at Benedictbaiern, near Munich. In this situation Fraunhofer had ample scope for the exercise of his talents; and he distinguished himself as much by his inventive genius as by his skill in executing the mechanical processes on which he was employed. Enabled now to study optics as a science, he used the means at his disposal to make many important experiments on light, and to construct instruments of superior kinds for celestial observations. By his discoveries and improvements he greatly increased the reputation of the establishment to which he belonged; and at length it became his own property.

Fraunhofer was a member of the University of Erlangen and of the Royal Academy of Sciences at Munich; and in 1822 this academy appointed him keeper of the Museum of Physics. The King of Bavaria conferred on him the order of Civil Merit, and the King of Denmark that of Danebrog. He died in 1826, in the thirty-ninth year of his age.

His most remarkable discovery was that of the existence of a series of dark lines in the spectrum produced by the refraction of the sun's light in a prism of glass or other transparent medium. The prisms were formed of a material free from veins, and, in the experiments, they were disposed so that the light entered and emerged at equal angles with their sides, by which means each of the coloured spaces in the solar spectrum on the screen were homogeneous: on examining these with a telescope, it was perceived that they contained many black lines parallel to one another and to the breadth of the spectrum; and Fraunhofer ascertained that they amounted in number to about 354; Sir David Brewster has since discovered many more. By means of a theodolite he measured the angular distances between the most strongly marked of these lines in every two of the differently coloured spaces in the spectrum produced by each of the prisms employed in the experiments; and thus he was enabled to determine with great accuracy the indices of refraction for the mean rays of the prismatic colours in each of the media of which the prisms were formed, as well as the dispersive powers of those media. He observed similar black lines in the spectra of the Moon, Mars, Venus, and some of the fixed stars; also in the spectra formed by the two polarized pencils produced by a prism of Iceland spar. An account of the observations on spectra was published in a pamphlet entitled 'Bestimmung des Brechungs- und Farbenzer-Streuungs-Vermögens verschiedener Glasarten in Bezug auf die Vervollkommnung achromatischer Fernröhre,' 4to., Munich, 1815.

Fraunhofer also made experiments on the phenomena arising from the interference of light in passing through small apertures of different forms, and through wire gratings. In these experiments the direction of a pencil of solar light was fixed by means of a heliostat, and was examined through the telescope of a great theodolite: the apertures, which were circular, triangular, and rectangular, were formed in a metal plate which was placed before the telescope; and the gratings at first consisted of very fine wires arranged parallel to one another in a frame, but Fraunhofer afterwards used glass plates covered with gold leaf or with a thin film of grease on which were ruled parallel lines at distances from one another equal to $\frac{1}{3300}$ inch. The light was allowed to traverse the grating or plate of glass after having passed through a very narrow aperture: the image of the aperture appeared well defined as if the grating had not been there; on each side of it was a broad band quite black, and beyond these were spaces brilliantly coloured with homogeneous light, in which were seen dark lines as in the solar spectrum: to the coloured bands succeeded, on each side, a dark space, and beyond this were other bands of colour. Remarkable spectra were also produced by two wire frames placed one behind the other, the wires crossing one another at right angles: the aperture through which the light proceeded was circular, and the coloured spaces, which were seen on a dark ground, are described as being very brilliant. An account of the experiments on the inflexion of light were published in 4to. at Munich, under the title of 'Neue Modifikation des Lichtes durch gegenseitige Einwirkung und Beugung der Strahlen und Gesetze derselben.'

Fraunhofer executed an equatorially mounted telescope for the observatory at Dorpat. The diameter of the object-glass is nearly 10 inches and its focal length about 16 feet; it consists, as usual, of a convex lens of crown glass, and a concave lens of flint glass, but the materials were compounded by himself, and the performance of the instrument is said to be superior to that of any which had been made before. A description of the telescope is given in the 'Astronomische Nachrichten,' Nos. 74, 75, 76, with a memoir on the refractive and dispersive powers of different kinds of glass. In the same work is a memoir by Fraunhofer on halos, parhelia, and the like phenomena: in this he ascribes the formation of the small solar and lunar halos to the inflexion of light in the vapour of the atmosphere; and that of the larger kind, to the refraction in hexagonal prisms of ice.

(*Biographie Universelle*, and the works quoted.)

FRAXINELLA, the common name of a plant belonging to the genus *Dictamnus*, which is referred to the order Rutaceæ. Dictamnus has a 5-parted, unequal, deciduous calyx; 5 unequal unguiculate petals; 10 declinate stamens with awl-shaped, filiform, unequal filaments, having glandular tubercles at their apex, and roundish anthers; the style single, declinate, striated lengthwise, terminated by a blunt papillose stigma; the capsule stipitate, composed of 5 carpels, which are connected on the inside, compressed, 2-seeded.

D. Fraxinella, Bastard or False Dittany, False White Dittany, Fraxinella, has 4-5 pairs of leaflets, cordate at the base, acute at the apex, finely serrulated, the racemes long, the calyx unequal. It is found wild in the south of Europe, especially in Germany, France, Spain, Austria, and Italy.

The leaves, flowers, and stem of this plant, when gently rubbed, emit a strong lemon odour, and when bruised the scent is more powerful. The volatile oil which gives it its peculiar odour is secreted in the largest quantities in the pedicles of the flowers, which are covered with little glands of a rusty red colour, which exude a viscid resinous juice. The volatile oil from this plant is evolved in so large quantities that it will burn when a light is held near it, and, in a dark place, may be seen to take fire. It was formerly used in medicine under the name of *Dictamnus albus*, and the root was considered stomachic, anthelmintic, and aperient. Stoerck, to whom we are indebted for the re-introduction of so many European plants into modern medicine, recommended it in epilepsy, intermittent fever, and amenorrhœa. The plant used in medicine under the name of *Dictamnus Creticus*, the Dittany of Crete, is the Origanum dictamnus of Linnæus. [Origanum, P. C. S.]

D. angustifolia, has 4-5 pairs of leaflets, alternate, ovate-lanceolate, acuminated, finely serrulated, the racemes long, the calyx nearly equal. It is a native of the Altaian Mountains.

There are several varieties of Fraxinella found in gardens, with white, red, and purple flowers. They will grow in any common garden soil, and may be grown from seeds, which ripen well in this country.

(Don, *Gardener's Dictionary*; Burnett, *Outlines of Botany*; Lewis, *History of Materia Medica.*)

FRAXININ. [Chemistry, P. C. S.]

FRAZE'RA, a genus of plants belonging to the natural order Gentianaceæ, named after John Frazer, a collector of North American plants. It has a 4-cleft deeply-parted calyx. The corolla 4-parted, rotate, deciduous, with a bearded orbicular gland in the middle of each segment. The stamens 4, enclosed; filaments filiform; the capsule compressed, partly margined, 1-celled. The seeds few, imbricated, elliptical, winged, and fixed to the margins of the valves.

F. carolinensis, the *F. Walteri* of Michaux, is the only species of this genus. It has a biennial root; stem from 3 to 5 feet high, erect, sub-quadrangular, and smooth; leaves opposite and verticillate, oblong, lanceolate, the lower ones a foot long and more than three inches broad; flowers in aggregate clusters. This plant is indigenous in the swamps of the Carolinas, and is found on the borders of lakes in Pennsylvania and New York. The whole plant has a very stately appearance, and in character approaches so near to Swertia that, without examining the fruit, it might be mistaken for a species of that genus. The root yields a powerful bitter, nearly as pure as that of quassia, and wholly destitute of aroma. It is fully equal in its medicinal effects to gentian, and when fresh is said to be emetic and cathartic. The roots have been imported into Europe as a sort of Calumba, and hence have acquired the name of American Calumba. This plant requires moisture, and flourishes best in a peat soil. It should be protected the winter after being raised from seed, or that preceding its flowering.

(Don, *Gardener's Dictionary*; Lindley, *Flora Medica.*)

FREDERIC WILLIAM III., King of Prussia, was the eldest son of King Frederic William II., by his second wife, Friederike Louise, princess of Hesse-Darmstadt: he was born on the 3rd of August, 1770. Frederic William, the subject of this notice, was the grand-nephew of King Frederic II., or the Great, under whose superintendance he was prepared for the important functions which he was destined to discharge on the throne of Prussia. Frederic II. was extremely fond of the young prince. As Prussia owed her grandeur to the genius of a warrior, the sword was thought to be the main instrument of her future prosperity; and the hero of the Seven Years' War was much pleased whenever his youthful grand-nephew announced by some sprightly remark or spirited answer that courage and enterprise were prominent features of his mind. On one occasion the young prince was playing with a ball in the royal gardens in the presence of old King Frederic. The ball having rolled to the feet of the king, he picked it up and refused to give it back. With his face flushed with anger, and his hands on his sides, the boy called out, 'Will your majesty give me the ball or not?' The king laughed, and giving the ball up, 'Sure Fred.,' he cried, 'they will not take Silesia from thee!' The prophecy proved true, for though the greater portion of his kingdom was wrested from King Frederic William III., by Napoleon in 1807, Silesia remained with her lawful sovereign. The chief tutor of Prince Frederic William was Benish, one of the king's privy councillors; General von Backhoff instructed him in the military sciences: both are said to have been honest men, but unfit for training the mind of a youth; and well-informed writers of that period assert that the education of the prince was bad. Frederic William was sixteen when, through the death of Frederic II. in 1786, he became Crown-Prince, his father Frederic William II. having succeeded King Frederic. During the reign of Frederic William II. Prussia lost much in general opinion. The successor of the great Frederic was utterly unable to maintain the dignity of a kingdom exposed to so many chances as Prussia then was. Jealousy more than interest induced him to declare the equilibrium of Europe endangered through the combined war of Austria and Russia against Turkey; his unjustifiable interference in the domestic disturbances in Holland, his presumptuous war against the French republic, and, above all, his conduct towards Poland, in its two last partitions, placed him in the eyes of liberal Europe among the worst of tyrants; and the system of intolerance and hypocrisy which he introduced through the medium of his minister Wöllner, into the administration of his kingdom, exposed him to both hatred and ridicule. The haughtiness which he showed in his conduct towards the French republic seemed to promise that he would prove a faithful ally of the powers that were united against France, if it were only through fear of disgracing himself by negotiating with the 'republican mob.' Great was therefore the surprise of Europe when he concluded with France the separate peace of Basel in 1795. That peace, however, would have been a wise act, but for the neutral position in which it placed Prussia at a time when all Europe was arming—a position which was more dangerous than a protracted war with France. Death saved Frederic William from reaping that harvest of shame and disgrace of which he had sown the seeds, and which became the portion of his son and successor.

Frederic William III. succeeded his father on the 16th of November, 1797. He had already distinguished himself at Landau and Pirmasens, against the French, as commander of part of the Prussian avant-garde, and he had concluded a marriage of pure love and esteem, in 1794, with the accomplished Louise Auguste Wilhelmine Amalie, Princess of Mecklenburg-Strelitz.

At that time the Prussian monarchy contained about 124,000 English square miles, with a population of above ten millions, —an area and a population three times greater than those which constituted the kingdom when the great Frederic came to the throne. But one-third of this country was formed of the provinces acquired by Prussia in the partitions of Poland, and the Polish capital, Warsaw, was then a provincial town of Prussia; from this portion of the monarchy the king derived more nominal than actual strength, and among its inhabitants there was not one in ten thousand whom he could call a loyal subject. The treasures left by the great Frederic had been squandered away by Frederic William II. in his campaigns in Holland, France, and Poland, and a considerable debt, contracted by the same king, now added to the difficulties in which the state was placed through his unwise policy. Under these circumstances Frederic William III. turned his attention to the re-organization of the financial department, and the introduction of a better system of administration. The direction of affairs was intrusted to more enlightened ministers; many functionaries, either suspected or guilty of maladministration or embezzling the public funds, were dismissed; and the young king gave a still stronger proof of his love of justice by sending into exile the Countess of Lichtenau, the mistress of his father, who had exercised a most pernicious influence over him.

These changes were, however, far from being radical, nor were they calculated to extricate Prussia from the dangers of her political position. From the moment that King Frederic William II. had signed the peace of Basel, Prussia was caught in a net, and the favourable moment to disentangle herself by again joining Austria in her struggle against France had been neglected. Frederic William III. directed all his efforts towards upholding his neutrality in the great European struggle, and the French press was active in persuading him of the advantages of his policy. The first consequence of this policy was distrust on the part of Austria, Russia, and Great Britain towards Prussia, and still more on the part of the petty German princes, who hitherto had looked upon Prussia as their protector against the ambition of the house of Austria. But it soon became manifest that the king intended, with the aid of France, to aggrandise his dominions at their expense. He made his first acquisition by the peace of Luneville, when he received the bishoprics of Hildesheim, Paderborn, part of that of Münster, and some other territories, with an area of about 5130 English square miles and 600,000 inhabitants, as an indemnity for some districts on the left bank of the Rhine, which had been ceded to France by the peace of of Basel, and which had an area of only 900 English square miles, with 170,000 inhabitants. These territories were seized long before the decree of the diet of Regensburg (Ratisbon) in 1803, through which the partition of Germany was legally settled, and which he thus anticipated, being sure of the support of Russia and France. For as early as 1801 Frederic William adhered to the plan of the Emperor Paul of Russia to resist the English supremacy on the sea, and a Prussian ship having been carried by an English cruiser to the port of Cuxhaven, the king sent troops to that place and seized her, although Cuxhaven was within the territory of Hamburg. England was then far from wishing to have Prussia as an enemy, and, anxious to prevent a rupture with her, George III. sent his son Adolphus, now Duke of Cambridge, to Berlin, to settle the affair in an amicable manner. In spite of these friendly overtures Frederic William gave way to the dangerous advice of some of his ministers, and secretly prepared for taking military possession of the electorate of Hanover and the whole German coast between Denmark and Holland. This gave rise to fresh distrust, and Prussia would, perhaps as early as 1801, have felt the consequences of her policy, but for the assassination of the Emperor Paul of Russia, and the friendly dispositions of his son and successor Alexander towards Great Britain; in consequence of which the convention of the 17th of June, 1801, was signed, and peace restored between Russia and England. Nelson's attack on Copenhagen, in April, 1801, had already forced Denmark to withdraw from the Northern Coalition, and thus Prussia also was compelled to abandon her hostile designs towards England. Yet there was no real friendship between Prussia and either England or Russia, and the conduct of Frederic William towards Austria was so equivocal, that he was not only considered at Vienna as an intriguer, but as a secret enemy who was to be compelled by the sword to adopt another line of policy.

During this time the friendship between Prussia and France was strengthened, and the intercourse between the two governments and between the king and the first consul Napoleon Bonaparte. It was, however, evident than when Prussia claimed anything from France, she seldom got it; but when France was the claimant, Prussia always yielded. No sooner had Bonaparte declared that the residence of so many French emigrants in the Prussian dominions seemed to be dangerous to him, than Frederic William ordered them to leave his kingdom immediately, and this order was likewise extended to Louis XVIII., who was residing quietly at Warsaw, but was now compelled to take refuge in Russia. The legitimists in Europe now treated Frederic William as a traitor to the holy cause of kings. Their astonishment was still greater when, after Napoleon had crowned himself Emperor of France, in 1804, the King of Prussia was the first of the potentates of Europe to recognise him, and to accept and bear the Grand Cross of the recently founded order of the Legion of Honour, in acknowledgment of which the king sent Napoleon the Grand Cross of the order of the Black Eagle. It seemed to be settled that the King of Prussia was to receive all northern Germany as the price of his neutrality and friendship, as soon as it could be occupied with safety. Napoleon used to speak of King Frederic William in terms of the highest esteem, but events soon showed that he despised him.

In 1805 Napoleon's designs against England were frustrated through a new coalition headed by Great Britain, Austria, and Russia. From Boulogne, where the French army had been concentrated for the intended invasion of England, it advanced by rapid marches to the frontiers of Austria. Berlin was the centre of the most important negotiations; for the king's aid seemed to promise victory to the side to which he should incline; and a large party in Prussia, tired of the king's indecisive policy, declared that Prussia had been treated with contempt by Napoleon, and that it was now time to fight against the usurper. Frederic William, however, still professed friendship for Napoleon; he assembled a strong army on the frontiers of Austria, but whom that army was to oppose was known only to a few. The Emperor Alexander now demanded a free passage through Silesia for a Russian army, which was either to join the Austrians in Bohemia, or more probably to occupy Hanover, and having met with a refusal, he repeated his demand in an imperious tone. The King of Prussia answered that his generals had received orders to treat any Russian who should set his foot on the Prussian soil as an enemy. There was little doubt that in this struggle also Frederic William would remain either neuter, or wait till one of the belligerent parties should have been weakened by defeats, and then join the victor and have his share in the spoliation of Austria or France. No sooner had the war broken out than the violation of the Prussian dominions in Franconia, by Marshal Bernadotte, showed how little Napoleon cared for the Prussian king—or rather, how well he knew that Frederic William was a man of indecisive character, who would not avenge an insult unless he could do it with impunity and profit. However, that insolent violation roused the war-party in Prussia; and Frederic William, always influenced by circumstances, now followed the advice of his minister the Baron von Hardenberg, and consented to an interview with the Emperor Alexander, which led to the Convention of the 3rd of November, 1805; in consequence of which a Russian army was allowed to pass through Silesia.* Napoleon's wrath at this unexpected news was indescribable; but being then in the heart of Austria and on the eve of a battle, he concealed his vexation. Through his intrigues, however, he induced Frederic William to dismiss Von Hardenberg, and to appoint in his stead Count Haugwitz, a nobleman of immense wealth, great talents, and distinguished as an able statesman, but whose political principles were too much like those of his master to steer Prussia with safety through the sea of dangers on which she was then embarked. Haugwitz hastened to the head-quarters of Napoleon in Moravia. A battle between the hostile armies was unavoidable; and the general opinion in Prussia was that Haugwitz was to present his master's ultimatum to Napoleon, and either to compel him to make peace with Austria on the *status quo*, or to have a new enemy in Prussia. One hundred and fifty thousand Prussians were on the Moravian frontier, ready, as it seemed, to join the Austro-Russians, from whom they were separated only by a few days' march. No ultimatum was tendered to Napoleon. Haugwitz waited till the Austro-Russian army was annihilated by Napoleon in the battle of Austerlitz (2nd of December, 1805), and the day after the battle impudently congratulated Napoleon in the words 'Dieu merci, nous avons vaincu!' 'If I had lost, said Napoleon to his ministers, after Haugwitz had left him, 'he would have said the same to the Emperors of Austria and Russia.'

Only thirteen days after the battle of Austerlitz (15th of

---

* In a secret article of that Convention, Frederic William promised to join the coalition against Napoleon unless he withdrew from Germany before the 15th of December.

December, 1805) a treaty was concluded at Vienna, through Haugwitz, between France and Prussia, which astonished all Europe, caused deep indignation in England, and filled all Prussian patriots with shame and despair. Prussia ceded to France her dominions in Franconia, the violation of which had caused so much indignation in Germany, and received as the reward of her duplicity the electorate of Hanover, though only *de facto*, and till a general peace to which Great Britain should be a party should be made. Hanover had been occupied by the French in 1803, against the law of nations. In that year George III. renewed the war against France as King of Great Britain and Ireland, but not as Elector of Hanover; and in order to establish that distinction, he sent a circular to the courts of Europe informing them that Hanover was out of the question, and was consequently a neutral territory. In this case however, as in so many others, Napoleon disregarded international law; and the consequence was, that Hanover was first occupied by the French, and afterwards by the Prussians. According to the condition on which Prussia was put in possession of Hanover, she could only hold it as a trustee for the Elector King George III.; but a second convention, concluded at Paris on the 15th of February, 1806, showed that Frederic William intended to annex Hanover to his dominions, which he actually effected, declaring that he had received Hanover as a lawful conquest of Napoleon. Thus a king, whose love of justice was afterwards extolled in such extravagant terms, committed an act of robbery through which he violated the law of nations no less than the rules of political decency. His policy in those transactions was most severely but most justly commented on in both Houses of Parliament; and he who would write a history of Prussia without a careful examination of those debates would fall far short of doing what truth and justice demand.

Prussia soon received the due punishment for the duplicity of her government. The first consequence of the treaty of Paris was a declaration of war by Great Britain; in a few months several hundred Prussian ships were seized by the English cruisers; and England's ally King Gustavus Adolphus IV. of Sweden occupied the duchy of Lauenburg, an appendage to the electorate of Hanover, for George III., and threatened to invade Prussia. However, as neither Great Britain nor Sweden was able to injure Prussia much by land, King Frederic William hoped to settle his differences with those powers and to enjoy the profits of his neutrality, but he was roused from his dreams by the insolent conduct of Napoleon, and at last brought to see clearly his dangerous position. The history of those times shows plainly that in such a contest as was occasioned by the French revolution, there was no lasting neutrality possible for any power which was in direct contact with French influence, and that there was no chance left but to fight either for or against France. In the struggle against French aggression, Great Britain, never vanquished—and Austria, often vanquished but never discouraged—were foremost in showing that perseverance and consistency in political principles that should characterize great powers. There was less stability in the policy of Russia, since its government was less guided by principle than by selfish and ambitious plans; but Russia could waver, because political faults or want of character did not expose her unwieldy body to the danger of being overthrown by a single blow. But how could Prussia, the neighbour of France, stand untouched by that violent storm, when distant Portugal was summoned to surrender, and did surrender her position among the kingdoms of Europe at a day's notice? And even Turkey was so deeply engaged in the political intrigues of the time, that she too was on the eve of crumbling under the dissolving spirit of the Revolution, although the elements of her political existence had no affinity with those on which the imperial throne of France was based. The king and statesmen of Prussia had ill understood the French revolution, and they now suffered for it.

As to the personal character of Frederic William, he was considered to be a just man, of plain understanding, more admired by his subjects for the qualities of his heart than those of his head, and little disposed to admire others for their talents or genius. There is no doubt that Napoleon expressed his real opinion when he spoke of him with contempt, and his contempt changed into animosity in proportion as the Prussian cabinet deranged his plans without exactly thwarting them. On ceding Hanover to Prussia, Napoleon could boast of having caught Frederic William in a trap from which he could not escape without becoming either his vassal or his enemy; and matters being once in this condition, the French emperor boldly proceeded towards pushing him to extremities. The foundation of the Rhenish confederation, which, as Napoleon openly said, would be as useful to him against Prussia as against Austria, was only notified by Napoleon to the Prussian cabinet after it was completely established, though it would seem that such a union of most of the members of the German empire would not even have been proposed to any of them without previously consulting Prussia, if Frederic William had been regarded by Napoleon with that respect and deference which he owed to the head of one of the great European kingdoms. Another provocation was the occupation by the new Grand-Duke of Berg, Murat, who was the brother-in-law of Napoleon, of the territories of the Prince of Nassau-Dietz-Orange, the brother-in-law of the King of Prussia; and perhaps a direct order of Napoleon only could induce Murat to take possession of three abbotships in Westphalia which had belonged to Prussia since 1803. In order to soothe Frederic William's anger at the establishment of the Rhenish Confederation, Napoleon, with apparent friendship, proposed to him to form a similar union in northern Germany; but, with still more manifest disrespect towards him, he ordered the Hanse-Towns not to adhere to the contemplated confederation, because he would take them under his immediate protection, and he secretly enjoined several princes in northern Germany to refuse any closer alliance with Prussia. At the same time Von Hardenberg, the successor of Count Haugwitz as prime minister of Prussia, was maliciously attacked in the French official newspapers; nor was there lack of articles in which Frederic William was ridiculed, or the pride of his queen provoked. The majority of the Prussian nation, headed by their queen Louisa, called loudly for war; but the king was now accustomed to neutrality, and time was required to prepare him for acting with decision. A fresh insult from France at last roused his spirit; he learned, either through his ambassador in Paris, or indirectly through the British ministers, that in the secret negotiations which were then carried on between Great Britain and France, Napoleon had promised to restore King George III. to the possession of Hanover. His language against France became now bolder, and he listened to the proposal of the Emperor Alexander, who promised to assist him with a powerful army if he would wage war with France, and in order to make a strong impression upon the king and to show him that he was in earnest, he declined to ratify a treaty of peace with France, the result of those long negotiations which were carried on between that country and Russia ever since the peace of Presburg between France and Austria in 1805. Under such circumstances hostilities between Prussia and Great Britain were suspended, and Frederic William sent his ultimatum to Napoleon, demanding that the French armies should immediately evacuate Germany and retire beyond the Rhine; that no German prince not belonging to the Rhenish Confederation should be prevented from adhering to the contemplated Northern Confederation; and that the Prussian territories occupied by the Grand-Duke of Berg should be restored to Prussia. This ultimatum was rejected by Napoleon, who stood with his main army on the frontiers of Franconia and Thuringia, and thus the war broke out on the 6th of October, 1806. The Prussian main army was in Thuringia; it was composed of troops who, down to the meanest drummer, thought themselves equal to those warriors with whom Frederic II. had resisted Europe, and it was increased by the numerous and well-disciplined contingents of the Elector and the Dukes of Saxony, the Elector of Hesse-Cassel, the Duke of Brunswick, and several other princes, who had concluded an offensive and defensive alliance with the king of Prussia.

As this article does not profess to give a sketch of the history of Prussia, but of that of her king, we shall omit all details of the war. But a short explanation of the moral, social, and political elements from which Prussia drew either strength or weakness will be the more necessary as they were the forces with which Frederic William thought himself able to bring his material means into action against the French power.

Several millions of Prussian subjects were Poles, more ready to fight against than for their king. In the electorate of Hanover the Prussians were regarded as usurpers, and thousands of the male inhabitants, headed by gentlemen of the first families of that country, had left, and were still leaving their homes, to serve under the English banners, against the French in Sicily, Spain, and Portugal. In the western part of the monarchy there were several old possessions of the House of Brandenburg, the inhabitants of which were among the most warlike and most loyal of the Prussian subjects; but in those which had been acquired since 1803, the people, mostly Roman Catholics, showed little sympathy for their king, while the wealthy nobles either served in the Austrian army or lived in proud retirement at their country-seats in Westphalia. Different from these were the inhabitants of the ancient dominions of the house of Brandenburg in north-eastern Germany; and even in Silesia, though it had belonged to Prussia only since 1742, and the greater number of the inhabitants were Roman Catholics, King Frederic William could reckon upon as many loyal servants as he had subjects there. In these parts the peasant now enjoyed perfect personal freedom, but he was still bound to assist the owners of noble estates in their agricultural labours and to pay them tithes and similar contributions. But the vicious system of government education, and still more the social influence of the petty nobles, had a demoralizing effect upon that class, as well as upon the inhabitants of the towns, and generally speaking the Prussian of that time was more like a serf than a free man. To bring men down to that condition was however consistent with the plan of the government, because everything, down to the most trifling transaction of daily life, was under its immediate inspection; and blind obedience was the principal virtue of a Prussian citizen. The nobility were considered the main support of the king and the kingdom. But that nobility differed widely from what we understand by the name in England. Among the members of the real German nobility, who previous to the dissolution of the empire participated in the government of Germany, as princes, counts, or knights of the empire, there were very few who had become subjects of Prussia, and in the antient possessions of the House of Brandenburg there were none of that class. The cause of this was that Brandenburg and all the other German provinces east of the Elbe were originally inhabited by people of Slavonian origin, who were subdued by a few great barons of northern Germany, especially the dukes of Saxony of the house of Anhalt; and these barons alone formed the nobility in those provinces, as the term was then understood, namely, peers of the German Empire. Only two native Slavonian princes were acknowledged as such by the emperors, the Duke of Pomerania and the Duke of Mecklenburg, who, by submitting to the supremacy of the emperors, became peers of the empire, and henceforth belonged to the German nobility. A protracted resistance of the Slavonian population against their conquerors occasioned long and bloody wars, in which more than one-half of the oppressed race perished, while others emigrated into Poland. In order to keep the remaining Slavonians in obedience, and to repeople the country, a system of colonization was carried on in those provinces, of which the reader will find an excellent account in Von Wersebe, 'Die Deutschen Colonien in den Wendischen Ländern,' and the main features of which were these:—A few of the great native landowners were maintained in the possession of their estates, either as freeholders or as vassals of the conqueror; the bulk of the native population were made bondsmen, and one part of their lands was given to the knights and other freemen who had assisted the German conqueror in subduing the country; and the other part was divided among thousands of German colonists, mostly Saxons and Westphalians, who were invited thither by the conquerors, and either lived as farmers or settled in the ruined towns. Henry the Lion, Duke of Saxony, was particularly successful in making Slavonian conquests, and he also was the first to introduce a regular system of colonization. The extent of country thus colonized and gradually Germanized was so great that its government was entrusted to special officers called Margraves, who held the rank of princes of the empire, and among them the Margrave of Brandenburg was the most powerful. In the kingdom of Prussia Proper colonization was carried on through the Teutonic knights, and there, as well as in the more western countries, the foreign element was absorbed by the German. This sketch will show that the present kingdom of Prussia is originally a German colony, and although its assimilation to Germany was rendered complete through the policy of its princes and the spirit of its inhabitants, traces of its origin were still visible in 1806. The freemen who had received larger estates in those parts obtained the same privileges which the large landowners possessed in Germany Proper; they had a share in the administration of their province; and they rendered knights' service to their prince, each bringing with him as many men as his estate would allow. The dignity of knight having become hereditary in their families, they claimed the title of nobles also, and as early as the sixteenth century the members of this class, or the landed gentry, were called nobles by courtesy, and they finally became noble by right, thus constituting the lower nobility, but being still considered of inferior blood to the high nobility. In the time of Frederic William III. this class had lost their political privileges; but they took precedence of other gentlemen, from whom they were distinguished by the prefix 'Von' before their family name, in as much as the places of officers in the army and in the higher branches of administration were nearly exclusively conferred upon them; nor could any man obtain a place of consideration in the household of the Prussian king unless he was by patent or immemorial prescription entitled to put the prefix 'Von' before his family name. In consequence of these practices the whole class of petty nobles became the born servants of the crown, and we cannot wonder that they were looked upon as its firmest support. They were nevertheless detested by all the other classes, and for good reasons. Sons of conquerors, yet without any political rights, they were proud of their social importance; but while they treated other people with insolence and contempt, they behaved with abject servility towards the government and the king. Most of them depended entirely upon the crown for their livelihood, for they were, generally speaking, not rich; swarms of younger sons had no property, and no other occupation was considered by them as befitting their rank except commissions in the army or the numerous places in the judicature. Such persons would seldom practise the law as advocates; not independence, dependence on government was their pride. There was more independence among the heads of the families, but it was as wavering as their fortunes: owners of a country that draws its riches principally from the trade in corn, of which it produces four times more than it consumes, they were proud or humble according to the price of corn in England, and a falling off in the London market was sufficient to bring some dozens of haughty landowners at the foot of the king who would otherwise have continued the independent occupations of their forefathers. The vanity and insolence of the officers of the army had reached its height. Every man arrogated a part of the glory of the great Frederic, and he who had served in the Seven Years' War was promoted to the highest military honours, however unfit he might be for the rank. Hence commands of the highest importance were given to officers broken by age, or enervated by an idle life in the garrisons during a long period of peace, and who afterwards so shamefully betrayed the confidence of their king by surrendering, without resistance, the strongest bulwarks of the kingdom. The French, with whom they had now to fight, were viewed as a band of adventurers and scoundrels, void of every principle, virtue, and honour. A colonel of the king's guard, when he set out with his regiment and was cautioned to be on the watch against such an enemy as the French grenadiers, cried out, 'A shame it is to make use of arms against such dogs as the French! Sticks and horsewhips are the weapons they ought to be beaten with.' This anecdote is from the work of Bishop Eylert, who is anything but a detractor of Prussian virtue. If King Frederic William had possessed a little sagacity, he would have discovered that his hopes rested on a rotten foundation, and that he was going to fight against the best general and the best troops of Europe, with an army whose natural courage and excellent discipline were led to the field by vanity and overbearing insolence.

The war broke out on the 1st of October, 1806: a fortnight afterwards the glory of the Prussian name was prostrated on the field of Jena. The king behaved most gallantly in this unfortunate battle; he had two horses killed under him, and his cloak was pierced by bullets. Another fortnight, and Napoleon entered Berlin. The Prussian army was annihilated: corps of 20,000 or 30,000 men, commanded by heroes of the Seven Years' War, laid down their arms to small detachments of the French. Spandau, Stettin, Cüstrin, Hameln, Glogau opened their gates, before their walls had been touched by a cannon-shot; Magdeburg surrendered without resistance, though occupied by a garrison of 20,000 veterans, who were to defend there the great magazines of the army. 'In the Seven Years' War,' wrote Frederic William to his queen, 'Prussia stood alone against Europe, and was often in a more dangerous position than now: we are not alone now, we have Russia.' This is another instance that the fact of Prussia having been victorious in the Seven Years' War was still considered as a proof that she would always remain so: but there is a difference between talking of great things and doing them. The assistance of Russia only delayed the ruin of Prussia. In the battle of Eylau (8th of February, 1807) both the French and the Russians claimed the victory; but on the 14th of June, the anniversary of the battle of Marengo, the fate of Prussia was decided in the field of Friedland. A few days afterwards Napoleon entered Königsberg, his troops pushed still farther on towards the Russian frontier, and before the month of July the whole of the Prussian kingdom was in the hands of the French with the exception of a few fortified places, and Memel, an open town in the extreme eastern corner of Prussia Proper. Both Alexander and Frederic William now sued for peace: separate conventions of peace had already been made between Napoleon and the German allies of Prussia, namely, Saxony and some smaller states. The town of Tilsit was chosen as the place for the ensuing negotiations. The three sovereigns were to meet on a raft constructed on the river Niemen, which formed the boundary between Prussia and Russia. The first interview took place between Napoleon and Alexander alone, on the 25th of June, 1807. On the following day Alexander presented Frederic William to his victor. Napoleon was haughty, sometimes bitter; Frederic William, worn out by care, showed himself cold and reserved, speaking little, yet betraying his personal hostile feelings towards Napoleon. Some days afterwards Queen Louisa arrived, and it was expected that she would succeed through her amiable character and ability in bringing Napoleon down from his conditions; for it was already known that he did not intend to give back many of his conquests. But so far was she from making the slightest alteration in Napoleon's intentions, that he treated her several times rather rudely, giving her to understand that he guessed very well the motive of her presence at Tilsit. When, in the course of the negotiations it became clear that Frederic William had to cede all his dominions west of the Elbe, the queen in vain tried to persuade Napoleon to give Magdeburg back, and it is said that she threw herself at his feet, imploring him with tears to restore that great fortress to its former master. But this also was of no avail.

Peace was concluded at Tilsit on the 7th of July, 1807. The first article of this peace, referring to Prussia, is a proof that Napoleon not only despised Frederic William as a man, but wished to make him feel it, for the article begins with these words: 'Moved by esteem for the Emperor of Russia, and in order to give a proof of his earnest desire to unite the Russian and French nations through the bonds of friendship and unalterable confidence, the Emperor Napoleon consents to give back to the King of Prussia part of his conquered kingdom.' Upon this follows the description of those territories which Napoleon gave back, but not of those which the vanquished party ceded, as is generally the case in transactions of the kind, and this circumstance is another instance of Napoleon's desire to humble his unfortunate enemy. By this peace Frederic William lost the greater part of his realm; all the territories west of the Elbe, and nearly the whole of his Polish dominions, altogether about 70,000 English square miles, with a population of 6,000,000. The Polish dominions were given to the Elector of Saxony, who had assumed the title of King of Saxony, as the grand-duchy of Warsaw, except the district of Bialistok, which Russia received; and thus the Emperor Alexander was rewarded at the expense of his unfortunate ally. Out of the German dominions was created the new kingdom of Westphalia, and some parts were given to Saxony and the grand-duke of Berg. The king was further required not to prevent any German prince from adhering to the Rhenish Confederation; to promise to become a member of this confederation at some future time; to reduce his army to 40,000 men, and to pay 146,000,000 of francs (nearly 6,000,000*l.* sterling) to France. Till this money was paid French troops were to occupy Berlin and the principal fortresses of Prussia.

Thus, one terrible blow prostrated Prussia, and reduced one of the great monarchies of Europe to the rank of a third-rate power. The remaining part of Prussia was completely exhausted. Upwards of 7,000,000*l.* sterling had been paid to France, during the war, under the title of contribution or fine, according to the circumstances; as much in money or in value had been taken by the French soldiery, and wherever the French had been quartered—and they had been quartered in all parts of the kingdom—the houses were burnt, the fields destroyed, the cattle killed, and the horses taken away. Under these calamities the king remained calm, and never for one minute betrayed any symptoms of despair. The reorganisation of his kingdom occupied all his thoughts. Such a sudden downfall of his power and glory at last taught him that he had laboured under a most fatal mistake, that his glory was that of his ancestors, and his power a phantom. Still at the mercy of Napoleon, he nevertheless conceived the plan of removing the causes of so much evil, and of introducing radical reforms into all the branches of administration; and he carried his plan out with a patience, a resignation, a perseverance for which he deserved more praise than he deserved blame for his insolent conduct in the time of his prosperity. No sooner was the peace concluded than he proceeded to St. Petersburg; he afterwards lived at Memel and Königsberg till the French troops evacuated Berlin, when he returned to his capital in December, 1809, after an absence of three years. Most of his ministers, and many high functionaries, were dismissed, and the Baron Von Stein appointed prime minister. Those among the generals who had behaved like cowards in the field, or shamefully surrendered the strongest fortresses, were tried and punished; others who had behaved well were promoted, and among these were the generals Scharnhorst and Gneisenau, the regenerators of the Prussian army, and the brave Blücher, who alone saved the Prussian name from eternal disgrace, till he also was compelled to surrender to the superior forces of Bernadotte after the battle of Lübeck in November, 1806. Stein having displeased Napoleon, the king was obliged to dismiss him; he appointed Von Hardenberg in his stead, who however acted in the same spirit as his predecessor. The principal changes effected during this period were as follows:—The last remnants of the bondage of the peasantry were abolished: the difference existing between gentlemen who had the prefix 'Von' before their family name, and those who had it not, with regard to their capacity to hold commissions in the army, in the judicature, or in any other branch of administration, was abolished, and the king solemnly declared that henceforth merit, talent, and learning alone should guide his choice of servants; trade, and the exercise of all mechanical arts, were made free, and the existing corporations with their exclusive privileges were abolished; the municipal corporations in the towns received (in 1808) privileges of self-government of a nearly democratical character. All these, and many other reforms tended to create a nation of independent men, and showed that Frederic William had been mistaken when he considered the descendants of the first conquerors as the chief support of the state; all difference between these, the descendants of the first German settlers, and even those of the subdued race, was now abolished for ever. The military system was radically reformed: every subject able to carry arms was declared under obligation to fight in case of necessity, and to serve in the army three years; so that although the army was apparently only 40,000 men strong, it was really much stronger. There is no doubt that Frederic William had a personal share in these reforms, and though he did not design them, he deserves credit for following the advice of those who were the actual originators. The greatest difficulties in the reformation of the kingdom arose from the state of its finances; a system of economy was therefore introduced of which history offers few parallels. Frederic William set a noble example by selling his plate and jewelry, for which he received several millions of thalers from Hamburg merchants, and also many of the crown lands of which he was the owner; and he sent his brother William to Paris for the purpose of obtaining better conditions for the payment of the sums due to France. On the 8th of September, 1808, this prince made an agreement with Napoleon's minister de Champigny, according to which Frederic William was relieved from his obligation to enter the Rhenish Confederation, and the French troops were to evacuate Prussia, on condition of seventy-three millions of francs being paid within twenty days, and twelve bills given for seventy-two millions, each of six millions of francs, payable at one month, two months, and so on. Prussia being still unable to raise so much money in so short a time, another convention was made by which the debt was diminished by twenty millions of francs, on condition that the rest should be paid in thirty-six monthly instalments. Even this obligation Prussia would not have fulfilled, if the king had not declared that he could pay one half of it, feeling himself bound to do so as possessor of the (remaining) crown lands, which were then, and still are, more extensive than one might be induced to suppose from the little splendour that is exhibited by the Prussian court. Struggling with all these difficulties, the king approved of the plan of establishing a university at Berlin; and he showed much zeal in its foundation, which took place in 1810. He also invited distinguished men from other parts of Germany to assist him in his difficult task of regenerating Prussia: the historian Niebuhr, who deserves so much praise for his laudable conduct in this period, had entered the Prussian service as early as 1806. Upon this display of patriotic zeal and activity Napoleon looked with suspicious contempt till he became acquainted with the existence of the 'Tugendbund' or 'the League of Virtue,' which induced him to watch the movements in Prussia more closely, and perhaps to form the plan of ruining her entirely at the first opportunity. That league was a secret association of patriotic men and women, the object of which was to promote every social and political virtue, to raise the broken spirit of the nation, and by thus strengthening its moral force, to enable it to strive for independence at the first dawn of possibility. The queen Louisa was one of the principal leaders of this association, and some say that she first conceived the plan. Such however was the power of Napoleon that no one could foretell when Prussia would find an opportunity of breaking her fetters.

During the five years that followed the peace of Tilsit, Frederic William was the humble vassal of Napoleon, who seized every opportunity of humbling and weakening him still more. The means which he employed had however sometimes the contrary effect, and in one instance he showed his anger at being disappointed, in very strong terms. Napoleon had no sooner taken possession of Berlin than he issued his famous decree, by which the continent of Europe was shut against all intercourse with Great Britain, and which ordered the seizure of English goods wherever they might be found. By the treaty of Tilsit, Frederic William was compelled to give effect to that monstrous decree in his remaining dominions, although England was nearly the only country in which the Prussians could sell their corn, hemp, and timber, and Napoleon expected that as Prussia had already suffered so much during the short war with England in 1806, she would now soon lose the last chance of raising money, and thus give him a pretext to put the whole country under his administration till she should have paid her debt. Just at the time when Prussia was reduced to such a state that the royal family had no better dinner than the humblest mechanic, and the king's plate and jewels were at Hamburg to be sold, an immense quantity of English goods was discovered at Stettin, and in some other sea-ports. The Prussian officers speedily and secretly sold them, their purchasers being mostly Frenchmen, and the money thus raised—1,000,000*l.* sterling as some say, or 700,000*l.* according to others—was employed in diminishing the French debt. When Napoleon was informed of the fact, he was outrageous, but it was then too late to seize the goods and put the money in his own purse.

In 1812 Napoleon set out on his campaign against Russia, and Frederic William was under the painful necessity of joining his oppressor and sending a body of 20,000 men to act against the Emperor Alexander. At Dresden Napoleon was received by a host of potentates. Among them was Frederic William, but though he was obliged to bow, he did it as stiffly as possible, spoke very little, and by his reserved yet dignified behaviour increased the ill feelings of Napoleon against him.

If Napoleon had been victorious in Russia, Prussia would have disappeared from among the kingdoms of Europe; and both Napoleon and Frederic William well knew that. The Prussian contingent fought under Marshal Macdonald, on the extreme left of the French, which was operating against Riga in the direction of St. Petersburg, and the Prussians behaved so well as to deserve the praise of their French commander. In consequence of Napoleon's retreat from Moscow, the left wing of his army retreated also, but slowly. Closely pressed by the Russians, the Prussian general York, the descendant of an English family settled in Prussia, suddenly made a truce with his Russian opponent, General Diebitsch, a German, who was afterwards created Prince Sabalkanski for his passage over the Balkan in the war between Russia and Turkey, in 1829. A few days afterwards, 30th of December, they concluded the famous convention of Posarum, in consequence of which the Prussian army retreated into Prussia, and all hostilities between the corps of York and Diebitsch ceased. York had no authority to make such a convention, though the French pretended he had acted under the orders of his master: his motives were to save the Prussian army, and to prevent Prussia from being treated as an enemy, for he knew that now or never Prussia ought to break her fetters. Napoleon's wrath at this unexpected event was indescribable, and he sent a threatening letter to Frederic William, demanding that York should be deprived of his command, and be tried by a court-martial for high treason. Frederic William was then in Berlin, surrounded by French troops, and disobedience to the orders of Napoleon would have brought upon him the fate of King Ferdinand VII. of Spain. He consequently declared the convention of Posarum null and void, and ordered York to be arrested. A sort of mock investigation of the case took place, but it was soon dropped, and subsequent events showed that, although without orders, York had acted according to the secret wishes of his royal master. No longer safe in Berlin, the king hastened to Breslau, where he had an affecting interview with the Emperor Alexander. On the 28th of February, 1813, he signed a treaty of peace and alliance with Alexander at Kalisch, in Poland, but as yet no war was declared against France, and the remnants of the French army, which retreated through Prussia, were hospitably received by the inhabitants, although they brought unspeakable misery over the country. At last, on the 17th of March, 1813, Frederic William declared war against France, and issued the famous proclamation to his subjects which roused the whole nation, from the proudest nobleman to the meanest ploughman, in arms against the foreign usurper, and made them ready to sacrifice their lives and the remnant of their property for the delivery of their country. The labouring classes rose in a body; the bar, the pulpit, the offices of the government, were deserted; the students in the universities and colleges stood foremost in the ranks; mere children were seen bent under the weight of a musket claiming to be enlisted, and when refused to be admitted, shedding tears and forming themselves into bodies and performing under the direction of aged veterans the duties of soldiers so as to be able to fight in a year or two when they should be strong enough to support the hardships of the field. When the French, again victorious, were burying the dead on the fields of Lützen and Bautzen, many a veteran of Napoleon was struck with surprise when on stripping the corpse of a slain enemy, he saw the naked body of a woman clad in the rough garments of a Prussian grenadier. One feeling animated the whole Prussian population; and supported by the general enthusiasm Frederic William was at last enabled to act decidedly, because he had now only to follow his own heart and was no longer in that position where his resolution was wavering under the influence of considerations from which his intellectual powers were not strong enough to extricate himself with dignity. In two pitched battles at Lützen, on the 2d of May, and at Bautzen, on the 20th and 21st of May, Napoleon was victorious over the combined Prussians and Russians; but neither of these victories had any important consequences for him, and so far were the allies from being downcast, that they retreated only a short distance, and immediately reassumed a threatening attitude. Where Napoleon did not command in person, and especially in the *little* war, the French were regularly beaten; and he accordingly listened to the proposition of Frederic William and Alexander to settle their differences peacefully. They made a truce at Poischwitz on the 4th of June to last till the 17th of August, and a congress was assembled at Prague under the mediation of Austria, which until then had kept a strict neutrality. Both of the belligerent parties endeavoured to draw Austria into their interest, and both of them wanted time to increase their armies in case of a new outbreak of hostilities. Napoleon having peremptorily rejected the main condition of definitive peace, namely, to give up all his conquests in Germany and to withdraw with his armies beyond the Rhine, Sweden and Austria declared for the allies; and as Napoleon had gradually augmented his forces by new levies in France, and by withdrawing 50,000 veteran troops from Spain to Germany, he broke off the negotiations, and the war commenced again on the 17th of August. The patriotic enthusiasm which first animated Prussia was then spreading over all Germany, and principally Northern Germany, whence the French had been driven out by the inhabitants immediately after Prussia's declaration of war against France; but although Marshal Davoust, and General Vandamme, surnamed the bloodhound, soon brought the people again to obedience, the allies could reckon upon a general rising at the first opportunity; and the history of the war proves that they were not mistaken. The forces of the allies in August have been estimated at 500,000 men, of which about 200,000 were Prussians; but this estimate is rather below than above the real number. The army of Napoleon was considerably less: but in the north Denmark had declared for him and damaged the operations of the allies on that side. On the 27th of August Napoleon gained another victory at Dresden; but having advanced upon Bohemia, part of his army was entirely routed at Kulm, by the Russians, and at Nollendorf by the Prussian general Kleist. Upon this the hopes of Napoleon were blighted by one defeat after another, and in the battles of Grossbeeren, Dennewitz, Katzbach, Görde, and many others, the Prussians and their brave commander Blücher restored the honour of their arms, and reduced Napoleon to a most critical position in the neighbourhood of Leipzig. In the battle of Leipzig the French power was broken, or rather in three successive battles on the 16th, 18th and 19th of October, and there again Blücher and the Prussians obtained the greater share of glory. It was on the 18th, in the evening, when Frederic William and the emperors of Austria and Russia met on a hill near Probstheida, where the centre of the French position had been, and descending from their horses, embraced each other in the presence of their soldiers, and kneeling down, remained long in silent prayer. From Leipzig the remnants of the French army fled to the Rhine. It is generally believed that the pursuit was far from being hot enough, and it is said that had Frederic William's wishes been complied with, scarcely one regiment of the enemy would have reached the frontiers of France. The passage of the Rhine was effected by Napoleon on the 2d of November. Frederic William, urged by Blücher, advised the allies to invade France, but there was a contrary opinion at head-quarters, and two months were spent in inactivity before at last the Russo-Prussians crossed the Rhine on the 1st of January 1814. It is said that the *matériel* of the allied army was very much reduced, and that money was scarce. Yet immense stores were taken in the numerous German fortresses occupied by French garrisons which surrendered one after the other, and England supplied liberally both stores and money. The beginning of the campaign in France was signalised by the battles of Brienne and La Rothière, where Blücher once more obtained an advantage over Napoleon. Frederic William and Alexander were witnesses of the battle at Brienne. During the subsequent negotiations at Châtillon Frederic William appeared to be satisfied with moderate conditions, but Napoleon was victorious in several battles that were fought during the negotiations, and the French plenipotentiaries withdrew from Châtillon. They had acted with great spite, trying to create disunion among the allies; but their designs were fortunately seen through, and the allies now agreed by the convention of Chaumont that they would make no peace till France was reduced within her former limits; that Austria, Russia and Prussia should employ all their forces to that effect, and keep each, for the period of twenty years after the peace, an army of 150,000 men ready to enforce the conditions of such a peace, and that Great Britain should pay 5,000,000*l.* sterling. There was still a doubt at the head-quarters of the allies whether they should march upon Paris or not, the operations of Napoleon in their rear seeming to render such movement very dangerous, but Frederic William and Blucher constantly urged the necessity of finishing the war at Paris,* and so at last the great task was undertaken. On the 9th and 10th of March Blücher defeated Napoleon at Laon, Prince Schwarzenberg was victorious at Arcis-sur-Aube, and their united armies gained another battle at La Fère Champenoise. A few days afterwards they stormed the fortifications round Paris, and gained the battle of Mont-Martre, and on the following day, the 31st of March, Frederic William and Alexander made their triumphal entry into Paris. On the 2d of April Napoleon was deposed by the Senate.

During the negotiations that preceded the peace of Paris, Frederic William was active and prudent, but public attention was more directed to the Emperor Alexander. It appears that the king's vanity was not wounded by this, but that on the contrary he wished it, since he thus more easily avoided those intrigues by which his brilliant but less reserved friend was often ensnared. After the restoration of the Bourbons, Frederic William in company with the Emperor Alexander, several members of the Royal Prussian family, and the old field-marshal Blücher, paid a visit to England, where they were most enthusiastically received. He was present at the great banquet at the Guildhall in London. After a short stay in England he returned to Prussia, and made his triumphal entry into Berlin, and thence proceeded to the congress at Vienna, to take his seat among the distributors of the provinces ceded by France at the peace of Paris. There he claimed his former possessions, except the greater part of his share in the division of Poland, which he consented to leave to Russia, but he demanded, as an indemnity, the whole kingdom of Saxony. The king of Saxony, Frederic Augustus, was then Frederic William's prisoner of war, who wished to punish him for his defection in 1806 and his staunch adherence to Napoleon, by depriving him of his whole kingdom, and he was supported in his views by the Emperor Alexander. Both of them took so menacing an attitude in this affair, and met with so firm a resistance from the king of Saxony, as well as other potentates, that serious fears were entertained of a rupture between Prussia and Russia on one side, and Austria, Great Britain, and France, on the other, but the return of Napoleon from the island of Elba produced a salutary effect among the members of the congress, and Frederic William was obliged to be satisfied with the larger and northern half of the kingdom of Saxony. Besides this acquisition he received back the most western part of Poland, under the name of the grand-duchy of Posen, nearly all his former possessions in Germany, and several other parts of that country, namely, a large tract on both sides of the Rhine and the greater part of Westphalia. He also acquired Swedish Pomerania by exchange for Lauenburg, but left several small districts in the hands of some of the minor German princes. Comparatively speaking Prussia acquired less than the other powers, since the area of the kingdom as fixed by the treaty of Vienna was less than previous to the peace of Tilsit, and besides this the Prussian dominions were now divided into two large portions separated from each other by a small narrow tract belonging to Hanover and Hesse-Cassel, and the opinion in Germany was that Frederic William had not been dealt fairly with. Frederic William became a member of the German confederation for all his dominions which belonged to the German empire before its dissolution, namely, for the greater western portion of Prussia; but for the grand-duchy of Posen, the kingdom of Prussia Proper, and the province of Western Prussia he did not become a member of the confederation.

A powerful Prussian army under Blücher was ready to resist Napoleon, after his return to Paris in 1815, in the Netherlands. Against him Napoleon aimed his first blow at Ligny, on the 16th of June, and Blücher lost the day, but the spirit of the Prussian army was so excellent, that Blücher retreated in good order upon Wavre, kept his word to aid the Duke of Wellington at the battle of Waterloo, and had his glorious share in that great victory, by which the power of Napoleon was broken. Frederic William followed his army to Paris, and there signed with the other powers the second peace of Paris. To the proposition of the Emperor Alexander of forming that union called the Holy Alliance, Frederic William adhered with eagerness: pietists and enthusiasts praised him for it; lovers of civil and political freedom frowned; the people could not guess what the Holy Alliance meant; and the Holy Alliance is now forgotten.

After his return Frederic William undertook the difficult task of organizing a kingdom composed of incongruous parts, and exhausted by oppression, rapine, war, and its great exertions; and it is just to say that he had a large personal share in bringing Prussia to that state of strength, wealth, and political importance, in which he left her at his death. His intellectual capacities were very limited, but he had plain sense, loved and knew how to create order, and, guided by long and bitter experience, displayed remarkable ability in distinguishing things that would last from such as would not, and in choosing his servants among men whose principles promised a quiet and peaceable development of that state of things which he had in view. In a few years the finances were brought to a flourishing condition; trade, mechanical arts, agriculture, were promoted by liberal laws, and where laws were not sufficient the king would help with money from his own purse, lending or giving large sums to the great landowners in Eastern Prussia, when the high rate of the corn duties in England produced a stagnation of the corn trade in that province, and momentarily deprived the owners of immense estates of the means of paying the taxes or their creditors, or even of living decently. Nor was he less active in reforming the administration of law and the post-office, in constructing roads, and in founding universities, colleges, and schools. Unfortunately for him, public opinion in Prussia, and indeed in all Germany, with regard to civil and political freedom, became very liberal after the conclusion of the great war, during which the people were constantly urged to sacrifice their lives and property by appeals to their antient and promises of future freedom, so that soon after the publication of the Confederative Act of Vienna, in which a constitutional government was promised to all the States of the Confederation, the people expected that they would soon enjoy the freedom of England or France, and showed symptoms of great discontent when one year after another elapsed without bringing them a representative constitution. Their claims were the more just as they were not only founded upon their social wants, but upon rights also, and the Prussians in particular derived their right not only from the 18th Article of the Confederative Act, but still more directly from Frederic William's edict of the 22nd of May, issued after the return of Napoleon from Elba, and before the battle of Waterloo had removed all fear of France, wherein he promised to establish a general representative constitution for the whole kingdom. Such claims were most disagreeable to Frederic William, and although it may be doubted if he intended to deceive his subjects by illusive promises when he issued that edict, he nevertheless broke his word, inasmuch as he never fulfilled it. He thought it perhaps more prudent to leave the glory of putting Prussia on a level with England and France, by emancipating her by a constitution, to his son and successor, the present King Frederic William IV. The reasons why Frederic William III. broke his solemn and royal word must be found in his character. A real representative constitution which should give the nation a participation in the legislation, was a thing utterly detested by Frederic William. He was a king brought up in the old German doctrines of absolutism; but he never aimed at despotism or tyranny. He would be the father of his nation, the master in his house, and of course he expected from his subjects that sort of obedience which boys owe to their father and servants to their master. Like a good father he gave his children a good education, allowing them all sorts of amusements and liberty, and paying even their little debts occasionally, but he wanted all their actions to be confined within the limits prescribed by himself, and any claim to go beyond he would punish with angry words or the paternal cane, according to the case. There is no doubt that Frederic William was actually alarmed when cries for a constitution became loud in Prussia, and as the people ventured to give additional weight to their claims by alluding to the enthusiastic readiness which they had shown in rescuing him from ruin, he behaved like a father saved from drowning by his son, who asks for half of his father's property as a reward for having done his duty. When Frederic William promised a constitution he did not precisely know what it was, and moreover he could not fancy that his loyal Prussians would ever have the impudence to ask for it: this seems to be the only way of explaining why he broke his word.

---

* It is said that the plan was originally conceived by the Russian prince Wolkonsky, who spoke of it to the Emperor Alexander, by whom Frederic William was persuaded to adhere to it. Others say that Blücher was the only originator of the plan, and had never had any other.

The first to remind Frederic William of his promise were the inhabitants of the Rhenish provinces, who, during the period that they were united with France, had enjoyed only as much of the benefit of a constitution as Napoleon would allow them, which however, was much more than Frederic William would allow them. Early in 1818 the inhabitants of Coblenz presented an address to the king in which they humbly established the justice of their demand on the ground of the 18th Article of the Confederative Act, and the edict of the 22nd of May, 1815. Upon this they received the following rescript (Cabinets-schreiben) from the king:

'Neither the eighteenth article of the Confederative Act, nor the edict of the 22nd of May, 1815, fixes the time when the representative constitution shall be introduced. Not every time is the right time for making alterations in the constitution of the state. He who reminds the king,[*] who has voluntarily promised a constitution, of his word, manifests criminal doubts of the inviolability of his word, and anticipates his decision on the right time of its introduction; a decision which ought to be as free as was his first promise. Your petition could not but rouse my just indignation. I myself will fix the time when I shall realize my promise of giving a representative constitution to my kingdom, and I shall not allow myself to be anticipated by others in my quiet advance towards my aim. It is the duty of my subjects to wait with confidence in my own free will, which led to the promise to which you allude, as well as to the above-named article of the Confederative Act, till the time shall come which I, guided by my knowledge of the whole organisation of the state, shall think fit for fulfilling my promise.'

The time so clearly alluded to by Frederic William has not yet arrived. The attention of the public has lately been drawn to the king's conduct in these matters by a little pamphlet, 'Das Königliche Wort Friedrich Wilhelm's III.,' the author of which is Mr. Jacobi, an advocate of repute at Königsberg. While Frederic William thus evaded his promise to grant constitutional liberties to his subjects, he indirectly checked the spirit of liberalism in other parts of Germany, and was especially active in putting down the secret societies among the students in the universities, especially the society called 'Burschenschaft,' the object of which was the gradual regeneration of Germany, and the political independence of the whole nation under one government. It has been pretended, but it is not true, that that society intended to prepare the people for a democracy; for, though some of the conspirators might have formed such plans, the democratical tendency of the 'Burschenschaft' became prevalent only after the French revolution in 1830. The liberty of the press was likewise restrained by Prussia; and generally Frederic William was one of the chief promoters of the objects of the congress of Karlsbad, in 1819, where the plenipotentiaries of the German princes enslaved the press, and resolved upon the appointment of a permanent commission resident at Mainz, which was to prosecute and try students and other young men who had taken part in secret political societies. A special commission for Prussia was soon afterwards appointed by the king at Köpenick, near Berlin, and the dungeons of that town were soon filled with victims, chiefly belonging to the best families of the country. The people were the less prepared for such proceedings, as in the year previous to the congress of Karlsbad, Prussia had shown, by her conduct at the congress of Aix-la-Chapelle, that she no longer dreaded the direct political influence of France, since Frederic William consented to reduce the debt due by France to the formerly allied powers, and to withdraw his troops, together with those of Great Britain and the other allied powers, from the French soil. In 1820, and in the following years, the continental kings held successively the congresses of Troppau, Laibach, and Verona, where measures were taken against the political movements in Italy and Spain, and here again Frederic William showed that he hated representative constitutions in those countries no less than in his own. Prussia was astonished and indignant at this conduct in a king who owed his crown and his glory, nay his very honour, to promises of political liberty, and upon whom all Germany looked as a shield against despotism and oppression. Had Frederic William followed the course which he took in 1813, his name would have remained unsullied. But no sooner had peace been concluded than numerous Prussians, who had only affected liberalism during the war, or thought they were liberal and patriotic because they hated their former French oppressors, raised their heads and their claims. Between them and the liberal party the king was wavering for some time, with his accustomed want of decision in complicated matters, till he fell in with the Protestant pietists. From this time the spirit of the Prussian government became what it is now still more, a sort of Jesuitical despotism, dressed in the smooth garb of piety and philosophy, and decoying with titles and orders of knighthood, where the Bible was read in a different sense, or the court philosophy of Hegel declared to be unintelligible. It may be doubted if Frederic William saw that he would be acting like a despot while he thought he was only following the advice of his confessor, or realizing the sublime ideas of a school of philosophy by which the Prussian Code was declared to be an emanation of God, and divine in its meanest details (Sietze, *Philosophie des Preussischen Landrechts*); but it is unfortunately a fact that he adopted despotic measures of a most revolting character. One of the most glaring instances of this is the forced union of the Lutheran and Reformed churches, or the introduction of the new 'agenda,' as it was gently called, a violation of the liberty of conscience which in another age would have led to a religious war, and which even those would despair of justifying who are partisans of the monstrous theory, though it is admitted in Germany, that the Roman Catholic bishops having lost their ecclesiastical jurisdiction in the countries reformed by Luther, the Protestant princes had succeeded to episcopal jurisdiction in those countries. The persecutions by which Frederic William's government attained their object were numberless, but there is no space here to dwell longer upon the subject: gentlemen holding or aspiring to hold offices under government, and refusing to adhere to the new Evangelical church, were either not promoted or entirely disregarded; many clergymen, and among them men of great repute, who opposed the introduction of the agenda into their churches, were deposed; and at last a decree was issued, in 1827, by which no clergyman could receive any living till he had taken an oath to perform the rites of the agenda. Those who were most ready in conforming to the rules of the new church were rewarded with pensions, titles, and the cross of the order of the Red Eagle, and thus the poet Heine said that the new agenda was flying on the wings of a red eagle from steeple to steeple to all the churches of Prussia. Indeed, so great was the respect of the Prussians for the divine character of their government, that the Evangelical church was established in a few years in most of the Protestant districts of the kingdom. Frederic William is said to have been the originator of the new church, and to have considered it as his greatest work. Contemporary with this ecclesiastical reform was the establishment of the 'Landstände,' or provincial estates, a sort of paltry middle-age representation of the people in each province, but not a general representation of the whole nation. The provincial estates have only deliberative power, and are treated by the government with so little regard, that they are not allowed to make their meetings public, or to publish their debates through the press. The people called the states 'die Jaherren,' meaning gentlemen who always say Yes, and the following anecdote will show how they were considered by some of the great officers of the state. During the meeting of the States of Westphalia, the parliamentary debates were suddenly interrupted by the appearance of a general in full dress, who was no member of the States, but nevertheless boldly advanced towards the speaker, and addressed the assembly. It was the military governor of the province, the General Baron von Müffling, one of the heroes of 1813—1815, who thus intruded upon the representatives of the people, and impudently told them to remember that their first duty was obedience to the king, and that non-compliance with his wishes was little better than high treason. He was with difficulty removed from the hall, but nobody dared to prosecute him for his offence, nor would such a step have been of any avail. A striking instance of Frederic William's misconception of the reciprocal 'obligations between king and subject,' was his conduct towards the inhabitants of the Rhenish provinces. On getting possession of this fine tract, he solemnly declared that they should continue to live under the French code, but it is only due to the manly resistance of the Rhenish people that they have not been deprived of their laws, and yet they have not been strong enough to prevent several alterations contrary to the very spirit of the French Code, and intended to give support to absolutism, and to create a privileged landed aristocracy. We allude to the decree of Frederic William by which the jurisdiction over public functionaries in criminal cases was withdrawn from the courts in those provinces where, as in England, the accused is tried by a jury of twelve men; by the same decree these courts were deprived of power to try persons guilty of political offences, in which cases judgment is now given by a special commission appointed by the king; and, lastly, by the decree of 1836, there was established an equestrian order in those provinces, by conferring upon nobles possessed of a certain extent of landed property the privilege of erecting them into fidei commissa; also the privilege of autonomy, that is of fixing rules of succession, and making certain family regulations, contrary to the common law of succession, as well as that referring to landed property. For according to the French law, lands in Rhenish Prussia are divided among the heirs either male or female of the deceased owner, in equal parts, according to the degree of consanguinity, just as personal property is in England.

---

[*] The German word is 'Landesherr,' lord of the country, an old term, but still in general use, although disliked by the present generation, because it implies an idea of conquest and feudal despotism.

In matters of judicial reform, the king unfortunately listened too much to the advice of Von Camptz, whose name is branded in Germany as the principal persecutor of young men suspected of belonging to secret societies, and who for a considerable period held the office of minister of justice. The consequence of this line of policy was that Frederic William was detested in his Rhenish provinces. He returned their aversion by the same feeling towards them, for he could not understand why he was disliked; he thought his paternal care for their welfare was rewarded with ingratitude. The king indeed did much for those provinces. Previous to the French revolution they were under the government of some ecclesiastical princes, and the people were kept in such a state of ignorance by the clergy that they became proverbial in Germany; to German literature they contributed nothing, but spent their lives in the enjoyment of sensual pleasures; the higher classes however loved the fine arts, especially music. During the French occupation they made no progress, except in the appreciation of civil and political liberty; but they cultivated neither literature nor science, except mathematics, and they even lost their taste for the fine arts. Neither they nor the French government did anything for learning: trade, agriculture, and manufactures were languishing; the towns were decaying, and streets deserted and covered with grass. The country swarmed with smugglers and swindlers, who got a livelihood or enriched themselves by all sorts of jobs with the military government of Napoleon and his unscrupulous and rapacious functionaries. No sooner had Prussia got possession of these countries than this immoral state of things ceased. For the new-established schools no teachers could be found in the country, and they were consequently invited from other parts of Germany, and this created jealousy in the Rhenish people. Most of the functionaries of Napoleon being either uneducated or men of bad character, Frederic William had to provide others from among his old subjects, and no one was appointed to any office of importance unless he had received a university education—a thing almost unknown in the Rhenish provinces, and this caused disappointment and anger among the Rhenish people. Lastly, the host of speculators were compelled to live only on their ill-gotten riches in well-deserved shame and obscurity: or when poor, to get a livelihood by honest occupations, which they could not, or to starve, which they would not: and thus arose slander, hatred, and enmity to the Prussian government. In addition to all this, there was the difference of religion, and the attempt of the Prussian government to reduce the Roman Catholic religion, which is professed by the majority of the people in Rhenish Prussia, to a religion of the lower classes, and so create by all sorts of Jesuitical stratagems a Protestant gentry and nobility. We have dwelt longer upon these topics since Frederic William and his government have been attacked in the Rhenish provinces, chiefly through the medium of the Belgian press, in so venomous a manner, as to puzzle or mislead those who in studying the life of that king would resort to Rhenish or Belgian sources without knowing the causes of their discontent. There is, however, no doubt that from the moment Frederic William was restored to his throne by his people he lost his popularity more and more, and gave occasion to just censure.

Small as the political liberties of Prussia were, and vexatious as the military system was which reigned throughout the whole administration, a period of fifteen years was sufficient for Frederic William and his councillors to raise Prussia again to the rank which she occupied among the powers of Europe previous to the battle of Jena. In her exterior relations Prussia behaved with prudence and dignity. The object of Frederic William was to make Prussia powerful, and he succeeded. He was an advocate of the Greeks in their struggle against the Turks, because he saw in them a nation that was throwing off the yoke of insupportable tyranny imposed upon them by a people who were not Christians; and he was active and successful in bringing Turkey to terms with Russia in 1829, since he dreaded a European war which would have thwarted his plans for the improvement of his kingdom. Peace was the great object he had constantly at heart, and he maintained peace even through the dangers occasioned by the French revolution in 1830. Though certainly averse to the principles of the French Revolution, he contented himself with keeping the French within France, by declaring that he would make common cause with Austria and Russia against her from the moment the French made their cause a European one by continuing to revolutionize Europe through her emissaries. He had to experience the dangers of the French Propaganda in a riot at Aix-la-Chapelle, which was the first and also last outbreak of a well-organized plot to revolutionize the Rhenish provinces. He was severely blamed for having been a quiet spectator of the French entering Belgium in 1832, and taking Antwerp from the Dutch; but in this case again he was bound to neutrality by his own principles, as well as by his agreements with other powers. If he deserved blame, it was for having abandoned those principles, during the last Polish revolution, when he not only supplied the Russian army with provisions and military stores, but allowed the Russian generalissimo, Field-Marshal Paskiewicz, to cross the Vistula on the Prussian territory, which enabled him thus to attack Warsaw and to put down the insurrection. A great number of Polish subjects of Frederic William, having joined the army of their brethren in Russia, were severely punished when they returned to Prussia after the fall of Warsaw; but many Prussians who had fought in the French army against the Arabs and Kabyles in Algeria were not punished; and Frederic William was so far from identifying the causes of the Poles and the Algerians, that he allowed many officers to help the French in taking possession of that country. During the disturbances caused in Germany through the effects of the French revolution, Frederic William showed himself a decided though not violent adversary of constitutional reforms; and the constitutions of Saxony, Baden, Hesse, Würtemberg, and several other states having been made more free than they were previously, he secretly aided the princes of those countries in their attempts to bring them back to their former condition as soon as circumstances allowed him to do so.

Towards the end of his reign Frederic William committed an act of palpable despotism and injustice, which created a great sensation in Europe, by arresting and imprisoning the Archbishop of Cologne, the Baron Clement Augustus von Droste-Vischering, for his energetic conduct in the disputes on mixed marriages. The archbishop of Gnesen, Mr. Von Dunin, imitated the example of the archbishop of Cologne, and was treated in the same way. The causes which led to these disturbances are by no means so complicated as the writers in the pay of the Prussian government tried to persuade the public. According to the concordat of 1820, between Pope Pius VII. and Frederic William III., the issue of mixed marriages was to follow the religion of the father, unless the parents agreed otherwise; and the Roman Catholic priests were enjoined not to withhold their blessing from such marriages. But when it became evident that by appointing a disproportionate number of Protestant functionaries in the Roman Catholic provinces, and encouraging Protestant gentlemen, especially bachelors, to settle in those parts, the Prussian government intended to create a Protestant gentry in these provinces, and to confine the Roman Catholic religion to the lower classes, then the archbishop enjoined his clergy to withhold their blessing from mixed marriages, unless the children were to be brought up in the Roman Catholic religion. The archbishop's intention was plainly to prevent those Protestant gentlemen who could not easily conclude a marriage except with Roman Catholic ladies, from bringing up so many Protestant families. It is true that the king appointed a considerable number of Roman Catholic gentlemen to public places in the Protestant provinces; but as the government took more care in establishing Protestant churches and schools in the Roman Catholic provinces than Roman Catholic churches and schools in the Protestant provinces, Roman Catholic gentlemen living in Protestant districts had often no opportunity of bringing their children up in their own religion, and consequently consented to their being educated in the Protestant religion. Annoyed by this policy of the archbishop of Cologne, the Prussian government set spies upon his transactions with the Belgian clergy; and as spies are always liars, and act from dishonest motives, they made up a plot and represented the archbishop as if he belonged to the league of Belgian Ultra-Montanists and democrats, and intended to kindle, with their help, a revolution in the Rhenish provinces. This led to the sudden arrest and extra-judicial imprisonment of the archbishop. The affair was settled between the Pope and the present king in such a way as to leave no doubt that Frederic William had not only acted unjustly, but also very imprudently, as he had undertaken a thing which neither he nor his successor had power to carry out. As a consequence of these disturbances, Frederic William lost the last remnant of his popularity among his Roman Catholic subjects, the number of which is about five millions. His policy in promoting the material welfare of his subjects was wiser; and never have the trade, manufactures, agriculture, and navigation of Prussia been in so flourishing a condition as towards the close of his reign. He attained his object in a great measure by concluding a commercial league with most of the other German states, the plan of which was originally conceived by the late minister of finances, Mr. Von Maassen, and which is known under the name of the 'Zollverein.'

Broken down by the infirmities of age, Frederic William III. died after a short illness, on the 7th of June, 1840, still beloved by many of his subjects in the antient dominions of the House of Brandenburg. He was twice married. By his first wife, Louisa of Mecklenburg-Strelitz, he had four sons, the eldest of whom is the present King Frederic William IV., and three daughters. His second wife was Auguste, Countess von Harrach, created Princess of Liegnitz, with whom he was united, in 1824, in morganatic marriage, and by whom he had no issue.

Frederic William was the model of a good husband and father, and by his domestic virtues he often regained the hearts of those whom he had alienated from him by his political conduct. Although his political principles were those of an absolute king, and consequently not always in harmony with truth and justice, he was upright in the application of established principles to particular cases, and he proved a good arbiter in several questions between foreign powers which he was chosen to decide. His person was commanding; he was rather goodlooking, but his features were harsh, and he was more like a general than a king. He did not speak well, and it required long experience to understand his questions, and to guess the meaning of his answers. He disdained pomp and pageantry: in an unseemly dark-coloured carriage drawn by two ordinary brown horses, and seldom accompanied by more than one servant or attendant, he used to drive through the streets of Berlin, unobserved by all except those who happened to know the conveyance. His moral principles were pure, and his private conduct was an example to all his subjects. The dissolute and insolent conduct of some of his sons often roused his anger. Frederic William was pious, and his piety was certainly sincere. Although surrounded by philosophers and enlightened divines, he was rather superstitious; and we cannot refrain from finishing this sketch of his life by the following anecdote, which we give on the faith of the well-informed author of his biography in 'Neuer Nekrolog der Deutschen.' During his sojourn in Paris he used to talk much with the celebrated Mademoiselle Lenormand. She once told him that Napoleon would die in 1821, and he in 1840. This prediction having proved true as to the death of Napoleon, Frederic William was convinced that he would die in 1840. In the beginning of that year the king gave a great entertainment in his palace at Potsdam, and while he was quietly listening to the performance of some musicians, a large marble stone fell from the ceiling of the hall at the feet of the king, who immediately left the room, saying it was a bad omen, and foreboded his death. Soon afterwards a rumour was spread in Berlin that the 'White Lady' had made her appearance. The 'White Lady,' according to an old belief, is a ghost which appears in the royal palace at Berlin shortly before the death of a member of the royal family; and the people believe that every case of death in the House of Brandenburg has been, and will be, announced by that mysterious being. The king was then already very weak, and great care was taken to prevent the rumour from reaching his ears; but he was nevertheless informed of it, and from that moment became the prey of a deep melancholy, which may have accelerated his death, for he died a few weeks afterwards.

All works published on Frederic William, or the history of Prussia generally, since the accession of the present king, ought to be read with great caution; for a law has been issued by Frederic William IV. which forbids any person to speak disrespectfully of any king of Prussia, either alive or dead, under a severe penalty. Speaking disrespectfully means, of course, mentioning or blaming the faults of a king.

(*Geschichte der Preussischen Monarchie unter Friedrich Wilhelm III.*, Berlin, 1825; Zedtlitz, *Die Staatskräfte der Preussischen Monarchie unter Friedrich Wilhelm III.*, Berlin, 1828; *Histoire de la Prusse*, 3 vols., Paris, 1828; *La Prusse et sa Neutralité*, London, 1800; *Matériaux pour servir à l'Histoire des années* 1805-7, Paris, 1808 (by a Prussian gentleman of distinction); Sir Robert Adair, *Historical Memoir of a Mission to the Court of Vienna in* 1806, London, 1844; Eylert, Bishop, *Character-Züge aus dem Leben Friedrich Wilhelm's III.*, &c.; this book, the panegyrical work of a court preacher, ought to be perused with more than a moderate degree of distrust: there is an English translation of it.)

FREE CHURCH OF SCOTLAND, the name adopted by a large body of clergy and laity who seceded from the Church of Scotland in 1843. The history of this secession is as follows. It was part of the policy of the Harley ministry, in Queen Anne's reign, to encourage the Episcopal party and the landed gentry of Scotland, and to depress the Presbyterian. In 1712 they accordingly passed an act (10 Anne, c. 12) restoring to its full vigour the right of lay patronage, which had been virtually abolished in 1690. The church became thenceforward divided into two parties, the supporters of patronage, or the 'Moderates,' and the anti-patronage men, or, as they were more lately termed, 'Nonintrusionists.' In 1834 the latter party obtained the majority in the General Assembly, and on the 31st of May of that year the Assembly passed an 'Overture and Interim Act on Calls,' a measure generally known by the name of the 'Veto Act.'

To understand the character of this measure, it is necessary to keep in view the method of collating a qualified person to a benefice in Scotland. The licensing of a clergyman, and his ordination and induction to a benefice, are distinct acts. Many clergymen are licensed to preach who never obtain benefices, and in this position they are called 'probationers.' When a licentiate receives a presentation to a benefice, he presents it, along with an acceptance, to the presbytery within which it lies, and they pronounce a sentence sustaining the presentation, and appointing such formalities as the laws of the church sanction, before the presentee is finally ordained and inducted to the benefice. The object of the Veto Act was to make it a law of the church that no presentee was to be held fit to be ordained as minister of a parish unless he were acceptable to the majority of the parishioners. Accordingly, by the Veto Act and other rules for carrying out its principles, presbyteries were directed, when a presentee laid his presentation before them, to appoint him to preach twice in the church, and also to appoint a day for 'moderating in a call,' or receiving dissents. If a majority of the male heads of families in the parish in communion with the church dissented, the presentee was to be rejected as an unfit person. There was no doubt that it was within the power of the General Assembly to settle what qualifications should be required, in the way of education, character, &c., of every presentee; but the question came to be, whether the church was entitled to require such an external test as the acceptability to the parishioners, and thus virtually counteract an act of parliament under which important civil rights were held.

On the 14th of September, 1834, Lord Kinnoul, patron of the parish of Auchterarder in Perthshire, issued a presentation to that parish in favour of Mr. Young. The presbytery applied the Veto Act to this presentation, and it was found that in a roll of 330 male heads of families, 287 dissented and objected to the presentee's ordination. The presbytery accordingly rejected the presentee. An appeal against these proceedings was taken to the immediately superior ecclesiastical court, the Synod, and thence to the General Assembly, but the acts of the presbytery were confirmed in both these courts. The next step was to call in question the proceedings of these ecclesiastical tribunals in the civil courts. Accordingly an action of declarator was raised in the Court of Session by the patron and the presentee, and on the 5th of March, 1838, the court, by a majority of eight to five, found that the presbytery, in rejecting the presentee on the sole ground that the male heads of families in communion with the church had dissented without assigning reasons, had acted to the hurt and prejudice of the pursuers, illegally, in violation of their duty, and contrary to statute. On the 3rd of May, 1839, this decision was affirmed on appeal in the House of Lords. Mr. Young afterwards raised an action of damages against the presbytery, on the ground of his having been a sufferer by their illegal conduct, and obtained a verdict in his favour. This was called 'the Auchterarder case.' The presbytery had refused to retrace their steps, and had inducted another person before preventive legal measures could be taken in the matter. But the Lethendy case took a different shape. In 1835 Mr. Clark received a presentation to that parish from the crown, in which the patronage was vested. A majority having dissented, he was rejected by the presbytery. In the mean time the crown, yielding to these proceedings as legal, issued a presentation to another person; and thus the two presentees were able to fight the battle of the legality as a question of patrimonial right. Mr. Clark not only brought an action into court, as had been done in the Auchterarder case, but he likewise applied for an interdict, the counterpart of what is in England called an injunction, and the Court of Session accordingly interdicted the second presentee from presenting himself, and the presbytery from inducting him. The presbytery applied to the General Assembly for instructions, and the Assembly directed them to disregard the interdict of the Court of Session, and to put in force the Veto Act. They therefore proceeded with the induction of the second presentee. On this the majority of the presbytery were cited to appear before the Court of Session, to answer to a complaint for breach of interdict; and on the 14th of June, 1839, they were reprimanded at the bar of the court, and informed that a repetition of the offence would be followed by imprisonment.

The celebrated Strathbogie case assumed an aspect considerably different. In June, 1837, Mr. Edwards received a presentation to the parish of Marnoch, which he laid before the presbytery of Strathbogie, the majority of whom were opponents of the Veto Act. A majority of the communicants having vetoed Mr. Edwards, the presbytery, by the direction of the superior church courts, rejected him. A second presentation to a different person was granted by the patron, but Mr. Edwards, as in the case of Lethendy, obtained an interdict against the presbytery taking any steps against the second presentee, and raised an action to have it declared that his own rejection was illegal. In these circumstances the presbytery resolved to postpone their proceedings until the courts of law had given final judgment. Mr. Edwards obtained a decree to the effect that the refusal of the presbytery to take him on trial and induct him was to his hurt and prejudice, illegal, in violation of duty, &c., and enjoining them to take him on trial, and act as if no law of the church such as the Veto Act existed. The presbytery applied to the superior church courts, which directed them still to put the Veto Act in force. Thus, being directed by the courts of law to take a particular step, and by the superior ecclesiastical judicatories to take one in the reverse direction, the presbytery would of course act as their own views of a proper jurisdiction in the matter might direct. The majority being of the moderate party, they decided by a majority that they would obey the courts of law, and they consequently took Mr. Edwards on trial, and inducted him. Then occurred an event from which every one saw that the Church of Scotland must inevitably be split in two. On the 13th Dec. 1839, the commission of the General Assembly suspended the majority of the presbytery of Strathbogie from their ecclesiastical functions, directed other clergymen to perform their duties, and declared the minority of the presbytery to be entitled to perform the corporate functions of the presbytery. On the 27th May, 1841, this suspension was made perpetual by the General Assembly deposing the members of the majority of the presbytery, and recalling Mr. Edwards's licence as a preacher. In the mean time the court of session interdicted the practical application of these proceedings of the ecclesiastical courts, directing the interdicts against any clergymen of the established church usurping the functions of the majority of the presbytery of Strathbogie, whether individually or collectively. The execution of the sentence of deposition by the General Assembly was also interdicted. Thus the presbytery of Strathbogie was divided into two bodies—the one supported by the superior ecclesiastical courts, the other by the court of session. Both returned representatives to the ensuing General Assembly of 1842, but it was of course only the former who were declared by the Assembly to be duly elected, while the civil court interdicted them from sitting as members of the Assembly.

At the same meeting of the Assembly, in 1842, a vote was carried by 216 to 147, to the effect that patronage ought to be abolished. At the same time the Assembly issued a document called a 'claim of right,' against the 'encroachment of the civil courts,' which was transmitted to the government, and answered by the secretary of state for the home department, who left no hope in the minds of the non-intrusion party that their demands would be complied with. Some attempts were made in parliament to carry a measure for legalising the Veto Act, but they may be said scarcely to have had the support of any party, for those who held that the ecclesiastical courts were competent to pass such a measure into a law were not inclined practically to admit their incompetency by soliciting the intervention of Parliament. A further step was in progress in the civil courts. They had already protected individuals from the effects of the acts of the church courts by prohibiting these acts from being put in execution. Proceedings were commenced for having these acts of the ecclesiastical courts annulled by the civil tribunals as courts of last resort, to which those who felt themselves injured by the proceedings of any of the constituted judicatories might apply. The court indicated that it would give redress, but these proceedings were suddenly stopped by the event called the 'Disruption.'

It is the practice for the General Assembly to meet on the third Thursday of May. On its so meeting, on the 18th of May, 1843, before the roll of members was made up, the late Dr. Welsh, professor of church history in the university of Edinburgh, who had been moderator or chairman of the preceding Assembly, read a protest against the constitution of the Assembly, signed by 120 ministers and 73 lay elders. A copy of this protest being left with the clerk of the Assembly, those who had signed it, and their adherents, left the Assembly in a body, and constituted in another place 'the General Assembly of the Free Church of Scotland,' choosing Dr. Chalmers as their moderator. This step is presumed to have been taken in consequence of the tactics laid down in the deliberations of a considerable body of the non-intrusion party who had met at Edinburgh on the 17th of the previous November, and conducted its proceedings with closed doors, being called a 'convention of ministers and elders of the Church of Scotland.' On the 23rd of May an 'act of separation and deed of demission' was adopted by the General Assembly of the free church, and signed not only by those clergymen who were members of the Assembly, but by others who participated in their views. Thus no difficulties were put in the way of a complete separation of these persons from the benefits and burdens of the establishment. Whatever previous differences of opinion existed, and whatever objections there were to a body such as the General Assembly of the Church of Scotland, entitled to legislate and adjudicate for its own interests and according to its own feelings, being exempt from the control of the courts of law, the sacrifice of emolument and station thus made elicited general respect and sympathy, and was creditable to the sincerity of those who made it. The free church are now in possession of large sums supplied by voluntary contributions, and are widely extending their operations.

FREE-TOWN. [Sierra Leone, P. C.]

FREE TRADE. [Agriculture, P. C. S.; Capital, P. C. S.; Corn Trade, P. C.; Corn Trade, Ancient, P. C. S.; Demand and Supply, P. C. S.; Leases, P. C. S.; Monopoly, P. C.]

FREEMAN. [Boroughs of England and Wales, P. C.]

FREEZING-APPARATUS, an air-pump which was contrived by Professor (Sir John) Leslie for the purpose of freezing liquids in vacuo.

It is well known that liquids evaporate more readily when the atmosphere is removed from their surfaces than when they are subject to its pressure; the caloric producing the evaporation being that which exists in the liquid itself, and that which, in consequence of the disturbance of the equilibrium, enters the liquid from the neighbouring bodies: hence, if there be a quantity of liquid æther in a vessel under the receiver of an air-pump, and in it there be placed a vessel or tube containing a small quantity of water; on exhausting the receiver, the æther will rapidly evaporate, and, the operation of exhausting being continued, the vapour will be carried off as fast as it is formed. The caloric in the water is withdrawn at the same time, and at length the water is converted into ice.

In order to produce the congelation of water by a rapid evaporation from its own surface under the exhausted receiver of an air pump, Professor Leslie introduced in the receiver a shallow vessel containing highly concentrated sulphuric acid, above which was placed the vessel containing the water. The air being extracted as quickly as possible, the vapour, which, in consequence of the removal of the pressure, escaped continually from the water, even at the medium temperature of the atmosphere, was, by the strong attraction of the acid for it, absorbed as fast as it rose; and in two or three minutes the quantity withdrawn from the water was sufficient to allow a congelation of the water to take place. Instead of sulphuric acid, any substance which, as dry potash, muriate of lime, or calcined powder of basalt, has a strong attraction for humidity, may be used; but the first, if highly concentrated, is said to be the most efficacious.

The air-pump employed for the purpose by Professor Leslie was constructed in the usual manner, but of large dimensions, in order to obtain ice in considerable quantities, and the receiver was a segment less than a hemisphere, that the air contained in it might be extracted as speedily as possible. The sulphuric acid or absorbent earth was contained in a shallow vessel of glass, nearly equal in diameter to the base of the receiver; and from the centre of the vessel rose a hollow cylinder, on the top of which, above the acid or earth, rested the cup of glass, or rather of unglazed earthenware, which contained the water to be frozen. Several machines of this kind have been exported to India, to be used for the purpose of obtaining ice in that country.

Leslie, by means of the like apparatus, succeeded in freezing mercury by the absorption of caloric from a coating of ice in which the bulb of a thermometer was enveloped. In the performance of this experiment the thermometer was suspended from a wire which, passing through a collar of leathers at the top of the receiver, could be raised and lowered at pleasure. A cup of water was placed above the vessel containing the sulphuric acid, and the bulb of the thermometer, after being lowered into the cup, was drawn up and suffered to lose caloric by the evaporation of the adhering water, in the exhausted receiver: this process being repeated several times, the bulb was at length covered with a film of ice. The cup of water was then removed, and the thermometer, having its bulb thus covered, was allowed to remain suspended about half an hour above the sulphuric acid, the exhaustion of the air being made as complete as possible, so that the column of mercury in the barometer-gauge was within 1-20th inch as high as in a barometer which indicated the density of the external air. On re-admitting the air, and removing the receiver, a portion of the mercury in the ball of the thermometer was found to be frozen.

Such experiments have since been more effectually performed by enclosing mercury in a mass of ice worked by heat in the form of a cup, and suspended above the sulphuric acid in a small net made of wire: the mercury was introduced into the cup of ice, and on it was poured a small quantity of water: on exhausting the receiver, the water was immediately frozen, so that the mercury was then completely enveloped with ice; and in a few minutes, on removing the receiver, the mercury was found to be wholly frozen.

For the details of Leslie's experiments see his 'Short Account of Experiments, &c. on the relations of Air to Heat and Moisture,' Edinburgh, 1813.

FREIGHT. [Ships, P. C.]

FRESCO. A painting is said to be *a fresco*, or painted in fresco (*sul fresco intonaco*, upon the fresh coat), when it is executed in water-colours upon a freshly plastered wall, while the plaster is still wet; or upon wet plaster spread upon a wooden frame or any other object. Fresco is the most noble and imposing of all methods of painting. *Colouring* in fresco was practised by the antients, though it has not yet been shown that they *painted frescoes*. Some of the walls at Pompeii are coloured in fresco, but their decorations are executed in some species of tempera upon the fresco coloured wall. This is evident, because in many places the paintings have cracked off, and exposed the original colouring of the ground in perfect freshness, and the same as the rest of the wall where no decorations are painted. The Roman term equivalent to fresco is *udo tectorio*, and it is used by Pliny (*Hist. Nat.* xxxv. 31), who gives directions as to what colours it is safe or unsafe to apply in this manner. Vitruvius (vii. 3) explains the mode of preparing the walls for this species of colouring, and describes a method of varnishing them when coloured, to preserve them. They first covered the wall with a layer of ordinary plaster, over which, when dry, they placed successively three other layers, of a finer quality, mixed with sand; above these they placed again three layers or coats, of a composition of chalk and marble-dust, the upper coats in this case being each added before the under one was dry, and successively of finer qualities. By this elaborate process the plaster formed a solid mass, as it were, of marble; was capable of being cut away and transported in a wooden frame to any distance; and sometimes even tables were formed of it. (Vitruvius ii. 8; Pliny, xxxv. 49.).

The process of varnishing the walls when coloured, Vitruvius terms (vii. 9) a Greek practice, called καῦσις, 'a burning.' When the wall was coloured and dry, Punic, or purified and bleached, wax, melted and tempered with a little oil, was rubbed over it with a hard brush; this was made smooth and even by applying a *cauterium*, or iron pan filled with live coals, to the surface, near enough to melt the wax; it was then polished with a linen cloth.

1. *Walls.*—Fresco was not generally practised by the early Italian painters, and it appears to have been first used in the fourteenth century, simply as a preparatory process, the work being finished in *tempera*. The earliest frescoes are in the church of Assisi, in the cathedrals of Orvieto and Siena, in the Campo Santo at Pisa, and in San Miniato and Santo Spirito at Florence. These and other later frescoes are painted on four different kinds of walls: in the old gothic buildings, on ashlar walls covered with a thin coat of plaster; in more recent buildings, on brick and rubble walls; and in some of the most recent edifices, on lath covered with various thicknesses of plaster. In many instances the walls are very uneven, and no attempt has been made by the plasterer to correct this defect so detrimental to the appearance and pre-

servation of a painting, through the settlement of dirt and the injury it undergoes in cleaning. The plaster is liable to fall away from ashlar walls, especially if the stones are large and the joints close, as in the cathedrals of Siena and Orvieto; in the church of Assisi, where the stones are small and not closely jointed, the plaster has a better hold and is generally still firm, but ashlar walls condense the damp and are the worst of all walls for frescoes; brick, rubble, and lath are much better, and nearly all equally good if well constructed. Mr. Wilson, the director of the Government School of Design, in his report to Her Majesty's Commissioners on the Fine Arts, respecting the state of the middle age frescoes and other mural paintings—to inquire into which subject he was expressly sent into Italy—ascertained upon what species of wall the various frescoes of the most eminent Italian painters were executed, and has reported as to the present condition of those works, with reference to the walls on which they are painted, and the result is, that those executed on brick are the most general, and in the best state of preservation: equality of surface is a great advantage which the brick wall has over the rubble wall. Many of the best of the old frescoes however are upon rubble walls, and unfortunately upon badly constructed walls of this description, as those of Santa Maria Novella at Florence and St. Cecilia at Bologna. The older walls of the Vatican are of rubble, or of alternate courses of rubble and brick, or rubble and tufo, a coarse porous volcanic stone, and are thickly coated with rough-cast, or coarse plaster of sand and lime mixed.

The Trionfo della Morte, by Orcagna, in the Campo Santo at Pisa, is painted upon lath, and is the best preserved fresco there. By this provision his work was protected from the damp which rises from the soil, and that which infiltrates from the roof: the sea air therefore cannot have injured the other frescoes, or it would have injured this likewise. There are many frescoes at Florence and at Venice, on lath, and all are in tolerable preservation; many vaulted or coved ceilings are of lath, plastered above as well as below.

2. *Plaster and Lime.*—The method of plastering the walls for painting has been nearly uniform in most ages. The walls of the baths of Titus at Rome are covered first with a layer about half an inch thick of coarse sand and lime; above this a thicker layer of lime and pozzolana with an admixture of sand and pounded brick; the third and upper coat is of lime and pounded marble. The third loggia of the Vatican, painted by Giovanni da Udine, is much the same as this; the first layer upon the lath is a thin coat of coarse sand and lime, the second is also a thin coat of lime and pozzolana, and the third is of lime and marble-dust, but not finely pulverized.

In all plastering for fresco painting the lime should be rather old, even in the first coat or rough-cast; but it is indispensable in the last coat, or *intonaco*, upon which the painting is executed. Various directions are given by writers on art as to the proportions of lime and other materials for the several coats, and they all agree in essentials. The oldest writers are Cennino Cennini and Leon Battista Alberti. Cennini's 'Trattato della Pittura' was written in 1437, but was first published in Rome by the Cavaliere Tambroni in 1821; the work of Alberti, 'De Re Edificatoriâ,' though written after the treatise of Cennini, was published shortly after Alberti's death, in 1485, by his brother Bernardo.

Cennini recommends that both lime and sand should be well sifted, and if the lime be rich or recently slaked, that there should be two parts of sand to one of lime; that enough for fifteen or twenty days should be prepared at a time, and that it should be kept for some days to render it less caustic, for if too caustic, the *intonaco* will blister. Alberti speaks of three coats as necessary: in the first, or rough-cast, he recommends the use of pit sand and pounded bricks; in the second, or sand-coat, he recommends river sand; in the third coat, which should be white, he recommends pounded white marble instead of sand; but finely sifted well-washed river sand makes a superior *intonaco:* these three coats were called by the Italians—the *rinzaffato*, rough-coat; the *arriciato*, sand-coat; and the *intonaco*, the fresco ground. Cennini speaks only of two coats, both of which he terms *intonaco*. Similar directions in essentials are given by Armenini, in his treatise 'De' Veri Precetti della Pittura,' Ravenna, 1587; at the end of the treatise on perspective, 'La Prospettiva,' by Andrea Pozzo, Rome, 1693; and in still greater detail by Palomino, in his work 'El Museo Pictorico y Escala Optica,' Madrid, 1715. Various other writers also have given more or less concise directions for fresco painting, but they contain scarcely any information that is not given at greater length in the above-mentioned works, from which Mr. Eastlake has given several important extracts in an Appendix to the Report of the Commissioners on the Fine Arts for 1842. There is however no occasion to repeat them here, as what follows from the directions of Cornelius, Hess, and other eminent living fresco painters, from the same Report, agrees in every material point with the advice of those earlier practitioners in the art.

The selection of the limestone to be employed in fresco painting, both for the ground and for the white, is a matter of great importance; it should be nearly pure carbonate of lime, and should contain as few foreign materials as possible. The early Italian painters found Travertine the stone best fitted for the purpose; it is in great abundance in the Roman Campagna, being a deposit or calcareous sediment from the streams of water which run from the Apennines, which consist in Central Italy chiefly of a soft limestone. The following analyses of limestones are by Mr. Richard Phillips. The analysis of Travertine is—

Carbonate of lime	99·4
Alumina, with a trace of oxide of iron .	·6
	100

Its lime is pure white. The lime used now by the Florentine fresco painters is so nearly pure carbonate of lime that no appreciable quantity of any admixture can be detected. The limestone used by the painters of Genoa is also extremely good: its analysis is—

Carbonate of lime	63
Carbonate of magnesia	36
Earthy matter, oxide of iron, bituminous matter	1
	100

This lime is of the purest white, and the Genoese frescoes, notwithstanding their vicinity to the sea, are perfectly durable. The first fresco that was executed in Genoa, according to Soprani, is still in excellent preservation: it is the Annunciation of the Virgin, in Santa Maria di Castello, painted by Justus de Alemania, or Justus of Germany, in 1451. The lime used by the fresco painters of Munich is also excellent: it is made of the marble pebbles brought down from the Bavarian Alps by the Isar: the analysis of the stone is—

Carbonate of lime . . .	80
Carbonate of magnesia . .	20
	100

Excellent limestone for the purpose is found also in England, in the neighbourhood of Bristol and in other parts. That of the White Quarry on Durdham Down, near Bristol, gives—

Carbonate of lime . . .	99·5
Bituminous matter . . .	·3
Earthy matter	·2
	100

In other specimens—

Carbonate of lime . . .	99·6	99·7
Bituminous matter . . .	·2	·1
Oxide of iron and earthy matter .	·2	·2
	100	100

The analysis of the Wick (Bath) stone is—

Carbonate of lime	97
Impurity, chiefly oxide of iron . .	3
	100

Of that of the Vogrie quarry near Edinburgh, the analysis is—

Carbonate of lime	94·5
Silica, alumina, and a little oxide of iron and bituminous matter	5·5
	100

From these examples it appears that a rich or pure lime is used and is necessary for fresco painting, and that there are several limestones fit for the purpose in this country, and that that of Bristol (Durdham Down) is of more than an average purity, and eminently fit for the purpose.

Modern fresco painters recommend the lime to be kept a much longer period than Cennini and other early writers direct. If it is used too fresh, it blisters, and sometimes turns the colours to a brownish red: its caustic quality requires to be mitigated, but not destroyed, before it is used. On this subject Mr. Eastlake's Report contains several scientific observations, upon the authority of Mr. R. Phillips, of which the following is the substance:—

The purest limestone consists, in atomic proportions, solely of—

Carbonic acid . . .	22
Lime	28
Carbonate of lime	50

Thus constituted, whether in its original state or reproduced by chemical agency, it is not at all caustic. If the limestone be subjected to sufficient heat, it loses the carbonic acid, and there are left—

Lime (commonly called quicklime) . . . 28

Let there be added to this lime as much water as will combine with it, and the result is a compound of—

Lime	28
Water	9
Hydrate of lime (commonly called slaked lime)	37

It is to be observed that this proportion of water in *combination* with the lime does not (apparently) moisten it. Hydrate of lime is a dry powder; in the addition of more water, the water either mixes with the lime *mechanically* or dissolves it. If hydrate of lime is exposed to the air, the water is expelled by carbonic acid, and the result is, as at first, carbonate of lime:—

Carbonic acid	22
Lime	28
Carbonate of lime	50

which is, chemically speaking, the original limestone, although the original state of cohesion is never regained. The non-caustic state of lime therefore is arrived at when, by exposure to the air or by other means, it is restored to the state of a carbonate or has regained its maximum of carbonic acid. If buried and kept air-tight, it cannot acquire the carbonic acid which renders it non-caustic. Time therefore has no effect on pure lime, whether slaked or unslaked, provided it be not exposed to the air or some other source of carbonic acid.

'One of these sources, though not an abundant one, is spring or river water, which contains carbonic acid and carbonate of lime (recently boiled or distilled water does not contain either), and the frequent washing recommended by all the authorities on fresco-painting is a means of restoring the lime to a state of carbonate; pure or caustic lime being constantly carried off in solution with the water that is thrown away, and carbonate of lime being formed. The mixture of water with carbonate of lime is a mere mechanical mixture; non-caustic lime may therefore be kept in a moist state. It might also be kept in a dry state without further change, but whether moist or dry it would be wholly useless for the composition of mortar, and would possess no adhesive quality. In the last state of mildness it would resemble mere moistened chalk, and would crumble to dust. But as long as the lime is still caustic, as long as, in other words, it has not recovered its quantum of carbonic acid, it will, on exposure to the air in a moist state, rapidly attract it, and the surface soon becomes incrusted, and in a manner petrified. This is what takes place during and after the process of fresco-painting; moisture being always the medium—the conductor, so to speak—of carbonic acid.'

From the above it is evident, therefore, that the lime used for the *intonaco* in fresco painting must not be entirely carbonated, or it would not set; a certain degree of causticity is necessary—how much, however, can be learnt probably by practice only; and this is the greatest practical difficulty in the art. The picture must be executed while the *intonaco* is wet or soft; no more work therefore ought to be commenced than can be completed within the time (a few hours) that the plaster requires to harden. Numerous joints are thus necessary in a large fresco, and the judicious painter will contrive that these joints shall be identical with the inner outlines of the parts of the figures and their draperies, or any other object, so as to be no disfigurement to the work. To retard the process of the setting or hardening of the composition of the *intonaco* is a great desideratum in fresco-painting.

Cornelius recommends the following mode of preparing the lime. A pit, lined with brick, is filled with clean burnt limestones, which, on being slaked, are stirred continually until the substance is reduced to an impalpable consistence. Clean river-sand is then spread over the surface, to the depth of a foot or more, and then the whole is covered with earth so as completely to exclude the air. It is allowed to remain in this condition for at least three years: it retains its moisture for many years. It is excluded from the air, for the reasons assigned above, that it may retain its causticity, and not become entirely carbonated.

3. *Execution of the Fresco.* — Cornelius recommends three years' interval between the rough coating of the wall and the commencement of the actual preparation for painting, unless the lime used in the first instance was very old, when between six and twelve months will be sufficient. Before laying on the *intonaco* the prepared ground must be repeatedly wetted with rain-water or boiled water, until it will absorb no more; then a thin moderately rough coat of plaster of sand and lime must be laid over as much of the wet surface as can be painted in one day; as soon as this coat begins to set, in about ten minutes or so, another thin coat must be laid on with a wooden trowel, somewhat fatter, that is, with more lime and less sand, or with about equal parts of lime and fine river-sand; both layers together being scarcely a quarter of an inch thick. Upon this coat the fresco is to be painted: if the surface as left by the wooden trowel is found to be too smooth, it can be made slightly rough with a dry brush. This *intonaco* will be fit to paint upon in about a quarter of an hour: it is hard enough to receive the colour as soon as it will not yield to the pressure of the finger; if too soft, the wet brush will wash up the sand. The first process in executing the picture is to pounce or trace the outline of the allotted work, from the expressly prepared cartoon, of the same size as the fresco, upon the *intonaco* with a hard point (the artist must please himself as to the method of tracing); then the painting may be commenced in thin watery washes, from the finished coloured sketch, which must be placed so as to be conveniently seen while at work; for the process of fresco-painting should be simple copying; the mere execution requires so much attention, that it is necessary for the painter to be relieved of every other consideration. After the first wash is finished, an interval of twenty or thirty minutes should be allowed for the absorption of the water before commencing the second painting, otherwise in retouching and elaborating the design the surface would be washed up and the work destroyed. While the *intonaco* is wet, a repetition of the same tint will have the effect of a darker tint, as in water-colour drawing: the retouches for strengthening and rounding should be hatched, and, where great depth or force is required, repeated hatchings are necessary. The surface must be constantly kept moist (but not wet) while painting, or the superadded colour will not unite with what is beneath; the work is finished by glazings and washings. When the portion of the picture allotted for the day's work is completed, the superfluous portions of the *intonaco* should be carefully cut away. In the next day's operation the surface must be wetted as before, and the edging of the finished piece carefully moistened with a brush. If it should be necessary to leave the work for an hour or two, it may be kept moist by pressing a wet linen cloth against it, by means of a board padded and covered with a waxed cloth; the board may be propped against the wall by a pole from the ground.

If a piece of work should be unsatisfactorily executed, or accidentally damaged, it must be entirely cut away, and the whole operation be commenced afresh. A fresco cannot safely be retouched when dry, but if retouched the vehicle should be vinegar and the white of egg; this answers well for the shadows: the lights are sometimes heightened by crayons made of pounded egg-shells. It is useless, however, to retouch a fresco in the open air, as the rain would wash all retouches away: the fresco itself is not injured by rain.

The colours used in fresco-painting are all ground and mixed in water, boiled or distilled; they are chiefly earths; no vegetable and few mineral colours can be used with safety, but there is a mode of rendering vermilion durable. The white used is exclusively lime, which has either been well washed and long kept, or, by boiling and repeated manipulations and drying, is rendered less caustic. The following colours are used by Hess, the eminent fresco-painter at Munich:—*yellow*, all kinds of ochres, raw siena; *red*, all kinds of burnt ochres, burnt siena, oxides of iron, and lake-coloured burnt vitriol; *green*, terra-vert, or Verona green, cobalt-green, and chrome-green; *blue*, ultramarine pure and factitious, cobalt. These colours are perfectly safe; chrome-yellow and vermilion are also used, but not in every case with success. Lime destroys all animal and vegetable colours.

The tints should be carefully prepared and kept in pots, and if a great quantity of any one tint should be required in one picture, it should all be prepared at once, as it is almost impossible to match tints exactly, as they are of different degrees when wet and when dry.

The brushes are of the ordinary materials, but should be somewhat longer than those used in oil-painting. In addition to hog's-hair tools, small pencils of otter hair in quills are used: other hairs will not resist the lime, which burns and curls them. The palette, commonly made of tin, with an edge to prevent the colours from running off, should be covered with varnish, to preserve the tin from rust.

To know when to leave off is a great art in oil-painting, but in fresco it is of the utmost importance. On this subject Hess says, 'If the touches of the pencil remain wet on the surface, and are no longer sucked in instantaneously, the painter must cease to work, for henceforth the colour no longer unites with the plaster, but when dry will exhibit chalky spots. As this moment of time approaches, the absorbing power increases, the wet brush is sucked dry by mere contact with the wall, and the operation of painting becomes more difficult. It is therefore advisable to cease as soon as these indications appear.

'If the wall begins to show these symptoms too soon, for example in the second painting, some time may be gained by moistening the surface with a large brush, and trying to remove the crust or setting that has already begun to take place: but this remedy affords but a short respite.'

Fresco-painting as thus described is sometimes termed by Italians *buon-fresco*, to distinguish it from another method which they term *fresco-secco*, dry fresco.

Fresco-secco is practised at Munich as follows, as described in Mr. Wilson's report:—The plastering of the wall having been completed as for buon-fresco, the whole is allowed to dry thoroughly. Before painting, the surface of the *intonaco* must be rubbed with pumice-stone, and on the evening of the day before the painting is to be commenced, it must be thoroughly washed with water mixed with a little lime; it must be wetted again the next morning, and it is then ready for pouncing or tracing the outline, and painting; the wall must be kept constantly moist by means of a syringe. The colours used are the same as in *buon-fresco*, and the work is very durable. All fresco painters do not trace their outlines from cartoons, but it is the safest practice, and has been adopted by all the best masters. *Fresco-secco* is a good method for decorative painting.

4. *Cleaning and transferring Frescoes.*—In the opinion of Cornelius, frescoes are best cleaned with bread. The mouldy appearance which sometimes shows itself can be removed with a wet sponge, unless it arises from saltpetre in the walls, in which case there is no remedy. These injuries must be provided against in the construction of the walls: the vertical progress of damp may be intercepted by covering one of the lower courses of bricks or stones with sheet lead, which must be protected on each side by a coat of pitch; the wall may be then continued as usual. Frescoes may be safely washed with a soft sponge and water; vinegar and wine may likewise be used with safety; even frescoes that have been whitewashed over can be washed clean. The frescoes by Raphael, in the Stanze of the Vatican, of nearly two centuries of dirt, were washed with wine by Carlo Maratta.

As many valuable frescoes, if left in their original localities, must have inevitably perished, through the bad construction of the walls, unfit situations, or from other causes, the invention of some mode of removing them from their objectionable situations became an object of great interest, and several very ingenious methods of transferring frescoes from walls have been devised, and often practised with success. Mr. Ludwig Gruner removed and transferred to canvas, in 1829, at Brescia, some frescoes by Lattanzio Gambara in the convent of St. Eufemia, in the following manner:—the first process was to clean the wall perfectly; then to pass a strong glue over the surface, and by this means to fasten a sheet of fine calico upon it. The calico, being made fast by the glue to the irregularities of the wall, was itself covered with glue, and some strong linen glued over it. 'In this state heat was applied, which caused the glue, even on the fresco, to sweat through the cloths, and to incorporate the whole. After this a third layer of strong cloth was applied on a new coat of glue. The whole remained in this state two or three days (the time required may vary according to the heat of the weather). The superfluous cloth extending beyond the painting was now cut off so as to leave a sharp edge: the operation of stripping or rolling off the cloths began at the corners above and below, till at last the mere weight of the cloth and what adhered to it assisted to detach the whole, and the wall behind appeared white, while every particle of colour remained attached to the cloth. To transfer the painting again to cloth, a stronger glue is used, which resists moisture, it being necessary to detach the cloths first used, by tepid water, after the back of the painting is fastened to its new bed.'

Some frescoes by Paul Veronese, in the Morosini villa, near Castel Franco, were transferred by Count Balbi of Venice. Cloth was fastened to the wall by means of paste made of beer and flour, and riveted to the irregularities of the surface by means of a hammer composed of bristles.

Several works on this subject have recently appeared in Italy:—Leopoldo Cicognara, *Del Distacco delle Pitture a Fresco*, 1825, in 'Antologia di Firenze,' vol. xviii. num. 52; Girolamo Baruffaldi, *Vita di Antonio Contri, Pittore e Rilevatore di Pitture dal Muro*, Venice, 1834; Cenni, *Sopra diverse Pitture staccate dal Muro e trasportate su Tela*, &c., Bologna, 1840. See the *Appendices to the Reports of the Commissioners on the Fine Arts*, 1842, 1843, which contain many details on subjects connected with fresco-painting, to which there is not space in this article even to allude.

FRESNEL, AUGUSTIN JEAN, a very distinguished French mathematician and natural philosopher, was born in 1788, at Broglie near Bernay: his father, who was an architect, endeavoured early to communicate to him the rudiments of education; but considerable difficulty was experienced in effecting this desirable object, partly from the delicate state of the pupil's health, and partly, it is supposed, from a distaste in the latter for the acquisition of that kind of knowledge which depends chiefly on the exercise of the memory; hence the youth made small progress in the study of languages, and he was eight years of age before he could write in a legible manner. An inquiring faculty was however manifest in him even at that time by the experiments which he made to determine the best materials and the best constructions for the small machines used in the sports of children.

At the age of sixteen years and a half he was admitted a pupil in the Ecole Polytechnique, where he soon made great progress in the study of the sciences, and where he attracted the notice of Legendre by his solution of a problem which had been proposed by that mathematician as a trial of the abilities of the students. On leaving that institution he was appointed engineer in the department of the Ponts et Chaussées.

It is remarkable, however, that it was not till the year 1814 that Fresnel began to study the branch of science in which he afterwards became so much distinguished: in that year he requested a friend, by letter, to inquire of his uncle what was meant by the 'polarization of light;' and it is to be presumed that he obtained the information he sought, for in eight months from that time he appears to have made himself fully acquainted with the subject. In 1823 he was made a member of the Académie des Sciences at Paris; in 1825 he was elected a Fellow of the Royal Society of London, and two years later this learned body awarded him the Rumford medal for his optical discoveries. At the time of his death, which happened in 1827, he held the post of secretary to the Commission for the Lighthouses of France, and he was succeeded in this post by his brother M. Léonor Fresnel.

The phenomena of the colours exhibited by crystallized plates when exposed to polarized light, and the rings which appear to surround their axes, were attentively examined by Fresnel, and, in conjunction with his friend Arago, he succeeded in reducing the interferences of polarized light to a few simple laws, which were duly verified by experimental analysis. This subject, which has also been investigated by Sir David Brewster, M. Biot, and subsequently by M. Mitscherlich, is treated by Fresnel in a Mémoire which was read to the Institute of France in 1816. He gave a formula for the intensity of a previously polarized ray when reflected from a surface under any angle of incidence in a plane inclined to the plane of primitive polarization; and this, with a general account of the deviations which the plane of polarization undergoes in consequence of the reflexion, is contained in two memoirs which were presented to the Académie des Sciences in 1817 and 1818.

In 1819 he gained the prize which, in the preceding year, had been proposed by the Institute for the best memoir on the diffraction of light. In his Mémoire he showed that rays passing at a sensible distance from a reflecting body deviate from their primitive direction and interfere with the direct rays; and, on the principles of the undulatory theory, he ascribed the effect to a number of small waves which originate with each portion of the surface of the primitive wave when it arrives at the reflecting surface. In his 'Mémoire sur la Diffraction de la Lumière,' 4to. Paris, Fresnel has given a complete explanation, on the undulatory hypothesis, of the coloured fringes produced by an opaque object when exposed to a luminous point; he has also given a table of the several maxima and minima of the intensity of light beyond the limits of the geometrical shadow, and he determined that, within those limits, the light gradually diminishes till total darkness takes place. In order to examine the effects produced by the diffraction of light when it is made to pass through a small aperture, he caused the image of the sun at the focus of a glass lens to fall precisely at the spot where a small circular orifice was made in a plate of metal; and, placing before his eye another glass lens, he suffered the cone of light from the orifice to fall on the lens, when the image of the orifice appeared as a bright spot, surrounded by rings of light of different colours. With a micrometer Fresnel measured the diameters of these rings, and he has given an explanation of the variations produced in the intensity of the light of the central spot when the distance of the eye-glass from the orifice is varied. He observed also the succession of bright and dark bands which are produced when light from a radiant point is reflected from two plane mirrors inclined to one another at an angle nearly equal to 180 degrees.

In a paper entitled 'Considérations théoriques sur la Polarisation de la Lumière,' which is printed in the 'Bulletin de la Société Philomathique,' 1824, Fresnel assumes that the eye is affected only by those vibratory motions of the particles of æther which take place transversely, or in planes perpendicular to the direction of the motion of the wave. Unpolarized light he conceived to consist of a rapid succession of waves in which the vibrations are performed in every direction perpendicularly to that of the ray; and common polarized light to consist in the transverse vibrations being parallel to one plane passing through the direction of the ray. By combining the hypothesis of transverse vibrations with the theory of undulations, Fresnel obtained formulæ for the intensity of reflected light at any angle of incidence.

He conceived that the phenomena of double refraction in crystals with one axis depend upon a modification of the actions of the æther by the action of the molecules of the crystal; the elasticity of the latter molecules in a direction perpendicular to the axis being supposed to be different from the elasticity in a direction parallel to the axis. In the year 1821 Fresnel presented to the Académie des Sciences a Mémoire in which the properties of double refraction and polarization in biaxal crystals were contemplated; and he investigated what he called the 'surface of elasticity:' a superficies conceived to be such that the force of elasticity by which the vibrations of a molecule in the direction of the radius of such surface are regulated is proportional to the square of that radius. He also gave, for doubly refracting crystals with two axes, an indication of the general equation to a wave surface, which has since been investigated by Ampère and Macculagh.

Fresnel's inquiries were also directed to the subject of rotatory polarization; and he found by experiments that the phenomena might be explained by conceiving the molecules of æther, which give rise to the rays in the direction of the axis of the quartz, or of the fluids in which the like phenomena are exhibited, to revolve uniformly in circles, with different velocities, some from right to left, and others in a contrary direction. The colours produced by such media he conceived to be owing to the interferences of two rays or pencils in which the molecules revolve in opposite directions.

Fresnel also proved that light was circularly polarized by two total reflexions from glass at an angle equal to about 54° 37′; and placing a crystallized plate between two rhomboids of glass, each of which polarized the light circularly, and had their planes of reflexion at right angles to one another, he observed that the light transmitted through the system exhibited phenomena similar to those which are seen along the axis of quartz. He succeeded in exhibiting before the Académie, in 1822, a division of the pencils, so that a line appeared double, by making the light pass through prisms of glass which were subject to strong pressure by means of screws; and he was the first who observed the change produced by heat on the tints of sulphate of lime, a subject which has since been more completely investigated by M. Mitscherlich.

Apparently unacquainted with what had been previously proposed by Brewster for a like purpose, this philosopher and engineer devised several constructions of great lenses for lighthouses; one of these constructions consisted of five concentric spherical zones (plano-convex) of glass disposed about a central lens, the whole being contained in a square frame. Eight of these, in vertical positions, constituted an octagonal case or lantern, which revolved about a vertical axis, and had in its centre a powerful lamp. Another construction consisted of two great lanterns, as they may be called, one within the other; the convex surface of each was formed of thin cylindrical refractors, and both revolved about a lamp in their common axis: the cylinders were so disposed as to produce, by the revolution, incessant flashes of light.

Fresnel made some experiments for the purpose of decomposing water by means of a magnet; and the method which he pursued consisted in producing a current in an electro-magnetic helix enclosing a bar-magnet covered with silk: on plunging the ends of the wire in water, he obtained some remarkable effects; but, being unable to account for certain anomalies which he observed, he abandoned the project.

(Duleau, *Notice sur Fresnel*; *Biographie Universelle*, Supplement.)

FREY, JACOB, one of the most able engravers of the eighteenth century, was born at Lucern in 1681. After learning the first rudiments of engraving of a cousin, in his native place, he went to Rome, where he obtained employment from and was instructed by Westerhout, who also introduced him to the notice of Carlo Maratta, with whom Frey perfected himself as a draughtsman.

Frey made an engraving for Maratta of a drawing of Hercules and the Serpent, after Annibal Caracci, which excited that painter's admiration and astonishment. Frey had used the needle more than was customary at that time with engravers; a practice which Maratta recommended him strongly to pursue.

Frey soon obtained the reputation of the greatest engraver at Rome and of his time. He engraved in all eighty pieces, including many of the finest works of Italian art. Among the principal are St. Jerome, and Martyrdom of St. Sebastian, after Domenichino; St. Romualdo, after Sacchi; a copy of a Holy Family, by Edelinck, after Raphael; the Aurora, after Guido; and several admirable plates after Maratta, Cignani, An. Caracci, and others. The Aurora, after Guido, was one of Frey's favourite pieces; it is beautifully drawn, and the Hours have a surprising degree of buoyancy and motion; though less careful in the detail of the accessaries, Frey's is a very superior print to that made by Raphael Morghen of the same subject, especially in the extremities and general treatment of the Hours and Aurora, which are the essential portion of the composition. He died at Rome in 1752. There is a notice of him and a list of his works in J. C. Fuessli's *Geschichte der besten Künstler in der Schweitz*; there is also an account of him in Gandellini's *Notizie Istoriche degli Intagliatori*.

FRICTION WHEELS. [WHEELS, P. C.]

FRISI, PAOLO, a distinguished Italian mathematician, was born at Milan, April 13, 1728, of a family which came originally from Strassburg; and at fifteen years of age he was placed in a monastery of the Barnabites, of whose order he became a member. At this time, apparently, the cultivation of the sciences formed no part of the discipline of the institution; Frisi acquired, however, some notion of geography from a number of old maps which lined the walls of the corridors, and he made considerable progress in the study of mathematics with almost no other aid than that of a few books of which he obtained possession.

From Milan he was sent to the university of Pavia, where he studied theology; and at intervals of leisure he greatly extended his knowledge of mathematics. He was afterwards appointed to give instruction in philosophy at Lodi; and while at this place he composed a treatise entitled 'Disquisitio Mathematica in Caussam Physicam Figurae et Magnitudinis Telluris nostrae,' which his friend Donato Silva, at his own expense, caused to be published at Milan in 1751. In this work proof is given, agreeably to the Newtonian system, that the earth has the form of an oblate spheroid; and its merit procured for the author an invitation from the king of Sardinia to deliver lectures in philosophy at Casal. Frisi accepted the invitation; but the Académie des Sciences of Paris having, in 1753, nominated him one of its foreign correspondents, the honour thus conferred upon him seems to have induced the principals of his order, at Milan, to give him the appointment of professor of philosophy in the college of St. Alexander in that city. His dissertation on the figure of the earth was about that time criticised by an ill-informed person, a Jesuit, who asserted that the arguments were inconclusive, and who reproached the author with attempting to obscure the glory of Italian science by the adoption of English ideas. Such an adversary was easily silenced; but the attack produced in the mind of Frisi a rooted dislike to the Jesuits in general. In answer to the objections made to some of the propositions he wrote a work called 'Estratto del Capo Quarto del Quinto Volume della Storia Literaria d'Italia,' &c., which was published at Milan in 1755.

In the same year he published at Lugano a tract entitled 'Saggio della Morale Filosofia,' &c.; and, at Milan, his work 'De Existentia et Motu Ætheris, seu de Theoria Electricitatis,' &c. About the same time he took occasion to oppose in public the belief in witchcraft and magic, which then existed in Italy; and this boldness, together with a certain freedom in his manner of living, appears to have raised up against him many enemies: fearing their machinations, he wished to withdraw from Milan, and he gladly accepted an appointment in the university of Pisa, which was conferred upon him in 1756 by the grand-duke Leopold. While holding this post he published, in Latin (Lucca, 1757), select dissertations on the subject of electricity, which two years before had been written by Euler, Resaud, and himself for the prize proposed by the Academy of Sciences at St. Petersburg; and a tract entitled 'De Motu Diurno Terræ' (Pisa, 1758), which had obtained the prize proposed by the Royal Academy of Berlin. He also published 'Dissertationes Variæ' in two volumes; of which the first (Lucca, 1760) contains a tract entitled 'De Atmosphærâ Cœlestium Corporum,' and the second (Lucca, 1761) two others, entitled 'De Inæqualitatibus Motus Planetarum omnium in Orbitis Circularibus atque Ellipticis' (in two books), and 'De Methodo Fluxionum Geometricarum.'

In 1760 Frisi made a journey to Rome and Naples in consequence of a commission which he received from the pope, Clement XIII., to examine and report upon a subject in dispute between the people of Ferrara and Bologna respecting the navigation of certain rivers: he also assisted with his advice the commissioners appointed by the Venetians to repair the damages caused by the overflowing of the Brenta; and for these services, though he appears to have excited the jealousy of the engineers of the country, and to have made enemies of many persons whose estates were affected by the measures which were taken in consequence of his reports, he was liberally remunerated both by the Pope and the Venetians. In 1761 he published, at Lucca, a tract entitled 'Piano de' Lavori da farsi per liberare e assicurare dalle Acque le Provincie di Bologna, di Ferrara, di Ravenna,' &c.; and, in the following year, one in three books, entitled 'Del Modo di regolare i Fiumi e Torrenti principalmente del Bolognese e della Romagna.' Of this there have been four editions. He returned to Milan in 1764, having been appointed professor of mathematics in that city, and, except occasional absences, he continued to reside there till his death. In the year 1766 he made a visit to France, and from thence he came to London, where, as well as in Paris, he received great attentions from the learned: the Portuguese ambassador in the latter city proposed to him an appointment in Lisbon, but this he declined, being unwilling entirely to leave his country. Two years afterwards he went to Vienna, where also he was well received, and where he was consulted on the subject of the disputes between the pope and the emperor.

Soon after his return, the pope (Pius VI.) gave him a dispensation from his monastic engagements, and he lived subsequently as a secular priest. In 1778 he made a journey to Switzerland, where he conceived the idea of writing a tract on subterranean rivers; and this, with dissertations on the meteorological influence of the moon, on conductors of electricity, and on the heat of the earth, he published at Milan, in 1781, under the title of 'Opuscoli Filosofici.'

In the year 1776, having previously enjoyed excellent health, he first felt the symptoms of a painful disease; these gradually increased in violence, and eight years afterwards, in the hope of obtaining relief, he underwent an operation: a mortification however ensued, and terminated his life at Milan, November 22, 1784, in his sixty-seventh year. He was buried in the church of St. Alexander in that city, and the Barnabites honoured his tomb with an epitaph in Latin.

In 1757 Frisi was elected a Fellow of the Royal Society of London: he was also a member of the Academy of Sciences of St. Petersburg, of the Academies of Berlin, Stockholm, Copenhagen, and Berne, and of the Institute of Bologna. He received a golden medal in 1759 from the archduke Joseph, afterwards emperor; and the empress Maria Theresa granted him a pension for life.

Besides the works which have been mentioned Frisi published many others; and of these the following are the principal:—'Prælectio habita Mediolani' viii. idus Maii, (1764;) 'Saggio sopra l'Architettura Gotica' (Leghorn, 1766); 'De Gravitate Universali libri tres' (Milan, 1768), a work much praised by D'Alembert and John Bernoulli; 'Della Maniera di preservare gli Edifizi dal Fulmine' (Milan, 1768); 'Danielis Melandri et Pauli Frisii alterius ad alterum de Theoria Lunæ Commentarii' (Parma, 1769); 'Cosmographiæ Physicæ et Mathematicæ,' 2 tom. 4to. (Milan, 1774, 1775) —this is considered his principal work; 'Del' Architettura, Statica, e Idraulica' (Milan, 1777); 'Pauli Frisii Operum:' tom. 1, Algebram et Geometriam Analyticam continens (Milan, 1782); tom. 2, Mechanicam Universam et Mechanicæ Applicationem ad Aquarum Fluentium Theoriam (Ibid. 1783). The third volume, which treats of Cosmography, was published by two of his brothers after his death. He published, at various times, notices of the lives of Galileo Galilei and Bonaventura Cavalieri, of Sir Isaac Newton, Donato Silva, and Titus Pomponius Atticus: he wrote a notice of the empress Maria Theresa, which was published at Pisa in 1783, without his name; and one of D'Alembert, which was published after his death. He also left several works in manuscript.

(*Biographie Universelle.*)

FRITILLA'RIA, a genus belonging to the natural order Liliaceæ. It has a perianth of 6 leaves with a nectariferous depression at the base of each; the style trifid at the apex; the seeds flat. Of this genus the common Fritillary, *F. meleagris*, is a native of Great Britain. It has a single-flowered leafy stem, the leaves all alternate and linear-lanceolate. It inhabits meadows and pastures, and is found throughout Europe. It has flesh-coloured flowers, with numerous dark and sometimes white spots. *F. montana* grows in the mountainous districts of Europe. It has the two floral leaves, opposite, and distinct from those of the stem. *F. pyrænaica* of Sibthorp, the *F. tulipifolia* of Bieberstein, is found in Greece. The species are often cultivated in gardens on account of their flowers. They blossom in April and May, and will grow in any common garden soil.

(Babington, *Manual of British Botany;* Koch, *Flora Germanica.*)

FUCHSIA, a genus of plants belonging to the natural order Onagraceæ. This genus was named after Leonard Fuchs, one of the earliest of modern cultivators of botany. He was born at Wembdingen in Swabia, in 1501, where he kept a school, but was made a professor at Ingolstadt in 1521, from whence he removed to Anspach, and subsequently to Tübingen, where he died in 1556. He wrote a great work on botany, with the title 'De Stirpium Historia Commentarii Insignes,' which was published in folio at Basle, in 1542. This work was illustrated with wood-cuts executed by Späcklin of Strassburg. These engravings are admirably done, and some of them would bear comparison with the wood-engravings of the present day. This work has been translated into almost every European language, and many editions of the original Latin have been published. It was, however, only a part of a great work which the author had on hand; and when he died, he left about 1500 drawings, with which he had intended to illustrate a second and third part.

The genus Fuchsia has the tube of the calyx adhering to the ovarium at the base, and drawn out at the apex into a cylindrical 4-cleft tube, whose lobes soon fall off; 4 petals alternating with the lobes of the calyx, and inserted in the upper part of the tube, very rarely wanting; 8 stamens; the ovary crowned by an urceolate gland; the style filiform, crowned by a capitate stigma; the berry oblong or ovate-globose, 4-valved, 4-celled, many-seeded. The species are shrubs, usually with opposite leaves, and axillary 1-flowered pedicels, which are sometimes disposed in racemes at the tops of the branches. The flowers, which are very elegant, are usually drooping, of a red colour, rarely white, sometimes 5-cleft, and decandrous. There are few genera of plants in which, under cultivation, there is a greater tendency among the flowers to sport; and thus they frequently afford the most interesting and important illustrations of the doctrines of morphology.

F. microphylla, Small-leaved Fuchsia, has pubescent branches, with opposite, small, elliptic-oblong, acutish, toothed, glabrous, a little ciliated leaves; the pedicels axillary, shorter than the flowers; the calyx funnel-shaped, with ovate acuminated lobes; retuse toothed petals. This plant is a native of the volcanic mountain Jorullo in Mexico. It has a scarlet calyx, with deep-red petals, and blossoms from June to September. It was first described by Humboldt, Bonpland, and Kunth, in their work on American plants, and was first introduced into England in 1828. It is now one of the most commonly cultivated of the species in the gardens of Great Britain.

F. coccinea, Scarlet Fuchsia, has glabrous branches, opposite leaves, or 3 in a whorl, ovate, acute, denticulated, on short petioles; the pedicels axillary, drooping, longer than flowers; the lobes of the calyx oblong, acute, exceeding the petals, which are obovate and convolute. It is a native of Chili, in marshy districts, and is found as far south as the Straits of Magalhaens. It is one of the species earliest introduced into the gardens of Great Britain; and was first described by Aiton in the 'Hortus Kewensis.' It has a scarlet calyx, with violaceous petals. In its native countries the wood is used for obtaining a black colouring-matter, and the leaves and young branches are used as medicine. It grows and blossoms in the open air in the summer, but requires protection in the winter.

F. corymbiflora (*corymbifera*, Walpers), Corymbose Fuchsia, has branches somewhat tetragonal; leaves opposite, petiolate, oblong-lanceolate, almost entire; the pedicels 3, nearly terminal, nodding, shorter than the flowers; the lobes of the calyx lanceolate-acute, twice the length of the petals, which are oblong-lanceolate. This elegant shrub is about 6 feet in height, and is a native of Peru about Chincao and Muna, in shady groves. It has scarlet flowers two inches long, which hang down in beautiful corymbs. The berries are ovate-oblong, of a reddish purple color. This plant, although described by Ruiz and Pavon, has only been recently introduced into our gardens, and is now justly considered the most ornamental species of this beautiful genus.

F. arborescens, Arborescent Fuchsia, has glabrous branches, the leaves 3 in a whorl, oval-oblong, acuminated at both ends, petiolate, quite entire; the panicle terminal, trichotomous, nearly naked; the calyx funnel-shaped, with the lobes ovate, acute, and spreadingly reflexed, also the petals. It is a native of Mexico, and has been introduced into this country since 1824. It is a larger plant than most of the species, not unfrequently attaining a height of 15 feet.

F. gracilis, Slender Fuchsia, has the branches finely pubescent; the leaves opposite, glabrous, on long petioles remotely denticulated; the pedicels axillary, nodding, as long as the calyx; the lobes of the calyx oblong-acute, exceeding the petals, which are convolute and retuse; the stigmas undivided. This plant was first described by Lindley, and has been grown in this country since 1823. The flowers have a scarlet calyx and purple petals.

About fifty species of Fuchsia have been described, and many more than those named above have been introduced into the gardens of Europe. They are all American plants. They thrive well in a rich light soil; and young cuttings of them strike root readily in the same kind of soil when covered over with a hand-glass. Many will grow in the open air in this country throughout the winter with a very slight protection. When planted in clumps on lawns or borders they should be mulched at the root to preserve them through the winter. In the spring, when the ground is cleared, the stems of the preceding year, which are generally dead, should be cut off quite close to the ground, to allow the young shoots to spring from the root.

(Don, *Gardener's Dictionary*, vol. ii.; Walpers, *Repertorium Botanices systematicæ*, vol. ii.; Bischoff, *Lehrbuch der Botanik*.)

FUCOI'DES, the vague title for many fossil marine plants, given by Brongniart. They are mostly referred to other genera by later writers. There is a peculiar geological interest in the distribution of Fucoids, since Dr. Forchhammer (*Reports to the British Association*, 1844) has shown the probability of their influence in the metamorphism of rocks.

FUENTE RABIA (antiently *Ocasro;* in Biscayan, *Ondarre-Ibaya*, *i. e.* the Frontier River; in English, *Fontarabia*) is a strong town in Spain, in the province of Guipuzcoa, and is one of the keys of the kingdom. It is situated in 43° 21′ N. lat. and 1° 47′ W. long., on a small peninsula on the left bank of the river Bidassoa, which forms the frontier between Spain and France, and falls into the Bay of Biscay between Fuente Rabia and Andayes. It is built on a small hill facing the sea; on the land side it is covered by a lofty mountain, and on the sea side it has a fort. It is, however, a place of small importance, with only 2100 inhabitants, and the harbour will admit only barques of forty or fifty tons burden. At the mouth of the Bidassoa is the Pheasants' Island, or Isle of Conferences, remarkable for the negotiations which led to the conclusion of the treaty of the Pyrenees in 1659. There is a ferry over the Bidassoa to Andayes, and, according to a convention, Spain levies the fare on passengers from France, and France on passengers coming from Spain, the Bidassoa being considered as a neutral river.

(Stein, *Geogr. Lexicon;* Hassel, *Handbuch*, vol. ix.; Cannabich, *Lehrbuch*.)

FUERTEVENTURA, one of the Canary Islands, lies between 28° 3′ and 28° 46′ N. lat. and between 13° 50′ and 14° 30′ W. long., and nearer the African continent than any island of the group, the harbour of Puerto de Cabras being only sixty miles from Capo Juby. The island is about fifty-two miles in length from north-north-east to south-south-west, with an average width of fifteen miles. This gives an area of more than 780 square miles, but, according to Mac Gregor, it contains 980 square miles, which is the extent of Warwickshire.

Fuerteventura consists of two regions, the main body and the Peninsula of Handia, which runs out from the most southern part of the main body to the west, and is united to it by a narrow sandy isthmus, about five miles in length and two and a half in breadth. The main body has a different aspect in its northern and southern districts. The northern half of the island has in general rather low and rocky shores, and the surface is covered with numerous hills of a form approaching more or less to that of a cone, which are probably of volcanic origin. Between them are numerous depressions and some valleys, among which that of Oliva is distinguished by its extent and fertility. It is about fifteen miles long and generally from two to three wide. To the north of it is Mount Atalaya, rising 1705 feet above the sea-level, in which two streams of pure water—the only streams of this description in the main body of the island—rise, which descend to the valley, and are husbanded with such care that they irrigate the whole of it. The hills south of the Vale of Oliva rise to a greater elevation; Mount Mudo, near the eastern shores, is 2160 feet above the sea-level. The hills that surround Santa Maria de Betancuria are much less elevated. Agriculture is almost entirely limited to this northern half of the island. The southern districts constitute a table-land, from 600 to 800 feet above the sea, surrounded by ridges of hills, which in most parts approach close to the sea and constitute elevated rocky shores. A great portion of these hills along the eastern coast are covered with a thick layer of lava. Those along the western coast rise to a greater elevation. Mount Chilegua is 2160 feet above the sea-level. The table-land is an extensive arid plain, over which several small villages are scattered, and from the summit of the hills the course of some brackish streams may be traced by the verdure which they cause. This part of the island is almost exclusively used as pasture ground for goats and camels. The Peninsula of Handia is composed of an isolated mountain mass, which, on the north-west, where it presents a precipitous face, rises to 2820 feet above the sea-level; but in other parts it is furrowed by narrow valleys. Though it is stated that it contains several sources of drinkable water, and has a good soil, it is uninhabited, and affords only pasture to the numerous herds which are sent to it from the main body of the island. Wild goats are very numerous here; and the largest part of the orchilla exported from Fuerteventura is collected on this peninsula.

The air of Fuerteventura is very dry, and the rains in general scanty. Sometimes not a drop falls for three years, which was the case from 1768 to 1771. This is attributed to the vicinity of the Sahara or Great Desert, from which the south-east wind, called El Levante, blows, and not only produces the most disagreeable feelings, but interrupts the occupations of the husbandman. Happily it rarely continues to blow longer than three or four days: sometimes it brings locusts to the island. The wind precipitates immense heaps of them into the sea, and they are then by the wind and waves carried to Fuerteventura and Lanzarote. Though the greater number of them perish in the passage, still those that come alive to the shores are numerous enough to lay waste all the fields and devour every blade of grass, and even the lichens that cover the rocks. In 1812 some fields were covered with a layer of locusts four feet in thickness. The climate is very equable, the temperature between the hottest and coldest season not differing more than twenty or twenty-five degrees.

Mac Gregor states that this island contains a greater proportion of cultivable land than any of the Canary Islands, but that for several reasons agriculture is much neglected. The principal objects of cultivation are wheat and barley; rye, maize, and potatoes are grown to a small extent; the wine is bad and not abundant. In the middle of the last century the culture of a soda plant (Mesembryanthemum crystallinum) was introduced, and since that time barilla has been exported, sometimes to the amount of 80,000 hundredweights. Goats and camels are reared in great numbers; but other animals are rare. Wild bees are numerous, and honey constitutes an article of export; but the attempts to introduce domestic bees have not succeeded.

The population amounted in 1831, according to a statement of Mac Gregor, to 13,500 individuals; but later accounts increase it to 18,000. If the area given by Mac Gregor is not exaggerated, not quite twenty persons are found on a square mile. They are very differently distributed over the surface of the island, five-sixths being found in the northern agricultural districts, and only one-sixth in the pastoral parts of the island. They are the descendants of the Spaniards who settled here in the beginning of the fifteenth century, but their complexion is much darker, and it is apparent that a mixture with the inhabitants of the Sahara has taken place. They are a robust race of men, fit for hard work, and patient, but they are lazy and improvident.

The capital of the island is Santa Maria de Betancuria, a small town with about 100 houses and 600 inhabitants. The largest place is Oliva, situated in the vale of that name, with more than 2000 inhabitants. Antigua, which lies in a fertile plain, is nearly as large.

Fuerteventura was conquered in 1405 by John de Bethencourt, a nobleman from Normandy, who however took it as a fief from King Henry III. of Castile and Leon. It is now the private property of the Marquis of Velamazan. During the fifteenth, sixteenth, and seventeenth centuries the island was frequently laid waste by the inhabitants of Marocco, and to these circumstances the bad state is ascribed in which the island remained up to the middle of the last century, when the cultivation of the barilla plant was introduced, which is now grown to a great extent, and constitutes the principal commercial wealth of the country. As late as 1802 all the produce of the island (barilla, orchilla, goats, skins, corn, camels, and honey) was exported to Lanzarote, and thence to other places. Since that year English vessels, sometimes as many as twenty in one year, have arrived from London and Liverpool at Puerto de Cabras, the only tolerable harbour of the island, where the anchorage is but indifferent, and the landing-place, which is a beach of shingles, still worse. The place itself contains about 1000 inhabitants.

(Glas's *History and Conquest of the Canary Islands*; Von Buch, *Physikalische Beschreibung der Canarischen Inseln; die Canarischen Inseln nach ihrem gegenwärtigen Zustande von Mac Gregor*; and Lieut. Arlett's *Survey of some of the Canary Islands*, &c., in 'London Geogr. Journal,' vol. vi.)

FÜGER, FRIEDRICH HEINRICH, a distinguished German painter, was born at Heilbron in Würtemberg, in 1751. He studied first in the academy at Dresden, whence he went in 1774 to that of Vienna, where he obtained the privilege of being sent as imperial pensioner to Rome. He remained about eight years in Rome, and in 1782 visited Naples, where he was employed to paint a series of frescoes in the library of Queen Caroline at Caserta, which he satisfactorily accomplished. In 1784 Füger was recalled to Vienna, and was appointed professor in and vice-director of the academy, and subsequently director. He died at Vienna in 1818. Füger distinguished himself in fresco, oil, and miniature painting, and likewise etched several plates with skill. His style of design was, however, too academic; he was a venerator of Mengs and imitated his style, and therefore, as with his model, the attainment of an imaginary ideal form engrossed his attention and became the chief object in his works, at the expense of character and other great qualities. Füger painted several pictures from Roman history; some from mythology and Homer; a few from early Bible history; and a series of twenty illustrations of the 'Messiah' of Klopstock. Many of his works have been engraved; the series from Klopstock, by J. F. Leybold and others. His last picture was a large allegory of the Restoration of Peace, painted in 1815, to the glory of Francis I.; it represents the gratitude of the people on the banks of the Danube, but the composition is very poor: it was engraved by G. V. Kininger in 1821. Some of his best works have been engraved by J. P. Pichler.

(Nagler, *Allgemeines Künstler-Lexicon.*)

FULGORA, a genus of hemipterous insects, popularly known as Lantern-flies, on account of their power of emitting light in the dark. The *Fulgora laternaria* of Linnæus is the type. It is a native of South America. The form of this insect is very remarkable, on account of the irregular inflated and enormous head, out of which the phosphorescence was said to proceed. The celebrated Mademoiselle Merian was the first naturalist who observed this property, and in her great work on the insects of Surinam she gives an account of her discovery. Strange to say, however, many travellers deny altogether the luminosity of the Lantern-fly, whilst others as strongly assert it. It is probably a sexual peculiarity, and only exhibited at certain periods in the animal's life.

FULLER, REV. ANDREW, was born February 6, 1754, at the village of Wicken, in Cambridgeshire, but received his very limited education chiefly at Soham, whither his father, who was a small farmer, of dissenting principles, removed while he was yet young. He was a younger son, and during his youth assisted his father in his farm, his relatives having no intention to train him for any higher position in society. In 1770 he became a member of the Baptist church at Soham, where, in the absence of a regular minister, he began to preach occasionally at a very early age. Early in 1775, his ministrations having proved very acceptable, he was regularly ordained pastor of the church of which he had for some time taken the charge at the request of his fellow-members; and in 1782 he accepted an invitation to remove to a Baptist church at Kettering, in Northamptonshire, over which he presided until his death on the 7th of May, 1815, in his sixty-second year. Fuller took an active part in the formation, in 1792, of the Baptist Missionary Society, of which he was secretary until his death; and he travelled extensively in England, Scotland, and Ireland to preach in behalf of this institution, the interests of which he promoted with untiring zeal in the face of much ignorant and prejudiced opposition. His theological works are numerous and highly prized, though many of them are small, and relate to controversial subjects, often of temporary interest. His first appearance in print was in 1784, when he published a valuable sermon on 'The Nature and Importance of Walking by Faith,' shortly after which he printed a treatise, which was written in 1781, entitled 'The Gospel worthy of all acceptation; or the duty of all sinners to believe in Jesus Christ,' a work which, from its alleged tendency to Arminianism, involved him in a warm controversy with the ultra or hyper-Calvinists. This work has been, like several of his other more important writings, repeatedly reprinted, and one of the replies to it, entitled 'Help for the Disciples of Immanuel,' by the Rev. John Stevens, originally published in 1803 and 1804, was reprinted in 1829. Another important controversy was raised by the publication, in 1793, of the first edition of his 'Calvinistic and Socinian systems examined and compared, as to their moral tendency.' The anti-Socinian views promulgated in this work were attacked by Dr. Joshua Toulmin and Mr. Kentish, to whom he replied in 1797 in his 'Socinianism Indefensible, on the ground of its moral tendency.' Toulmin's reply to the first of these works, entitled 'The Practical Efficacy of the Unitarian Doctrine considered,' which was first published in 1796, was reprinted in 1801. Fuller engaged in the Deistical controversy by the publication, in 1800, of 'The Gospel its own Witness; or the holy and divine harmony of the Christian Religion, contrasted with the immorality and absurdity of Deism.' In 1802 he collected into a small volume a series of 'Letters to Mr. Vidler, on the doctrine of Universal Salvation,' which had originally appeared in the 'Evangelical Magazine' and the 'Universalist's Miscellany,' and in 1810 he entered upon another theological controversy by publishing his 'Strictures on Sandemanianism.' About the year 1808 he wrote, in answer to numerous attacks by the enemies of Christian missions, his 'Apology for the late Christian Missions in India.' Among the less controversial works of Fuller were many single sermons and religious tracts, some of which are yet in high esteem, and the following larger works:—'Memoirs of the Rev. Samuel Pearce, of Birmingham,' 1800; 'The Backslider; or an inquiry into the nature, symptoms, and effects of Religious Declension, with the means of recovery,' 1801 'Expository Discourses on the Book of Genesis,' two vols., 1806; 'Dialogues, Letters, and Essays on various subjects,' 1806; a volume of 'Sermons on various subjects,' 1814; and 'Expository Discourses on the Apocalypse,' 1815, the latter being prepared for publication just before, but not issued till after his death. It is considered one of the least valuable of his works. Fuller also edited several works by other writers, among which was 'A View of all Religions,' by Hannah Adams, an American writer, to which he prefixed an original 'Essay on Truth.'

A memoir of Fuller appeared in 1816, in an octavo volume, compiled by John Ryland, D.D., chiefly from his own papers, which contains large extracts from his diary and correspondence, and a copious account of his writings, including his numerous contributions to religious periodicals, in which he wrote under various signatures; and another memoir of his life and writings appeared in the same year from the pen of J. W. Morris, of which a revised and extended edition was published in 1826, accompanied by a supplementary volume of his 'Miscellaneous Pieces on various religious subjects,' chiefly selected from his magazine papers.

Fuller's works have been repeatedly reprinted in America as well as in this country, and the college of New Jersey, about the year 1798, conferred upon him the degree of D.D., which, however, he declined to use. His 'Complete Works' have recently (1845) been collected and published in one very thick super-royal octavo volume, with a new memoir by his son, Andrew Gunton Fuller; and from the advertisement to this volume it appears that a 'first collected edition' was published in 1831, in several volumes, of which this is a reprint. Portraits of Fuller accompany both these editions and the memoirs of Ryland and Morris.

FUMA'RIA (from the Latin 'fumus,' smoke, in allusion to the unpleasant smell which it exhales: the French, with the same meaning, call it *fumeterre*, and hence our English word fumitory), a genus of plants the type of the natural order Fumariaceæ. It has 4 petals, the upper one spurred at the base, 2 sepals, diadelphous stamens, fruit indehiscent and 1-seeded. There are about twelve species of Fumaria, which are smooth slender herbs, with small racemose white or purplish flowers.

F. capreolata, Rampant Fumitory, has ovate acute sepals, toothed, as broad as the corolla, and half its length; globose emarginate fruit; bracts about a third shorter than the fruit-stalks. It is a climbing plant, and has cream-coloured flowers tipped with red or purple.

F. officinalis, Common Fumitory, has ovate lanceolate sepals, narrower and two-thirds shorter than the corolla, broader than the pedicel; fruit globose truncate, slightly emarginate; bracts two or three times shorter than the fruit-stalks. It grows in corn-fields and cultivated land throughout the world, and is plentiful in Britain. The flowers are of a pale red colour, deep red at the summit, with a green keel to the upper and under petals. The leaves are succulent, saline, and bitter, and the expressed juice is recommended as a remedy in cases of hypochondriasis and cachectic states of the body. It is said to correct acidity and strengthen the stomach. Boerhaave used to prescribe it in black jaundice and bilious affections. It has also gained some reputation as a cosmetic. Dr. Cullen recommends an infusion of the leaves in cutaneous disorders, and he also advises the use of it as a tonic whenever bitter remedies are desirable.

F. micrantha is distinguished by its sepals being orbicular dentate, broader than and nearly half as long as the corolla; fruit globose, slightly pointed; bracts longer than the fruit-stalks. This species is found both in England and Scotland, and has pale purple flowers in dense spikes.

F. parviflora has ovate sepals as broad as the corolla and about two-thirds shorter. It greatly resembles *F. officinalis*, but is smaller in all its parts. The flowers are of a pale red colour. It is found in Kent, and is also very common in the East Indies, where it is used as a medicine. The leaves have a bitter taste, and Dr. Whitlaw Ainslie mentions it in his 'Materia Medica of Hindostan.' The Mohammedans employ it as a diuretic, and in maniacal cases.

F. Vaillantii has its sepals narrower than the pedicels and many times shorter than the corolla. Globose fruit, scarcely pointed; bracts about as long as the pedicels. The flowers are mostly white with a purple tip. This is a British species, and is also found in sandy fields in the neighbourhood of Paris and Montpelier.

With the exception of one or two species, this genus seems hardly worth cultivation, having but a weedy and insignificant appearance. Such, however, as have a climbing tendency, look well if sown under a hedge and allowed to twine amongst the stems and branches.

(Don, *Gardener's Dict.*; Babington, *Man. Brit. Bot.*)

FUMITORY. [FUMARIA, P. C. S.]

FUNA'RIA, a genus of plants belonging to the natural order Musci, or Mosses. It has terminal fruit-stalks, with an oblique double peristome, both the outer and the inner having each 16 teeth, the inner ones opposite to those of the outer. There are three British species of this moss: *F. hygrometrica*, *F. muhlenbergii*, and *F. hibernica*.

F. hygrometrica has the leaves very concave, ovate, apiculate, entire, the nerves excurrent; the fruit-stalk curved flexuose. It is a native of Great Britain, and is found by waysides and under hedges, especially on spots where a wood-fire has been burning on the ground. It may be thus constantly found on the site of gipsies' encampments. It has obtained its specific name *hygrometrica* from its fruit-stalk having the property of twisting in different directions when moisture is applied to it. On taking a dry fruit-stalk into the hand and moistening the lower part with the finger, the capsule will turn itself from the right to the left by making two, three, or more turns; on moistening the upper part in the same manner, the capsule turns itself more rapidly in an opposite direction. Under the microscope the stalk exhibits an elongated cellular tissue twisted in a spiral form. The cellular tissue is not, however, turned uniformly, but at two-thirds of the length of the stalk it commences to assume a straighter form, and at the upper part it again turns itself, but more acutely, in an opposite direction to that of the lower part. The cause of the turning in two different directions depends on this structure of the cellular tissue. The capsule turns itself in an opposite direction to the spires which are moistened, and the circumstance of its turning more rapidly on the upper end being wetted, depends on the more acute angle made by the upper spires. The dryness of the fibres is not the cause of this phenomenon, as the green fruit-stalks, although perfectly dried, do not turn when moistened. The movements in this case are probably owing to the shortening of the vegetable fibre by the contact of moisture. In the green stalk the thick fluid contents of the cells leave a precipitate when they are dried, which fills them up and prevents the action of moisture upon them. In the ripened stalk this precipitate is dissolved and absorbed, and otherwise applied; and thus the cells, being empty, act like hollow tubes.

(Lankester, 'On the Structure of Funaria hygrometrica;' *Ann. of Nat. Hist.*, vol. iv.; Link, *Report on the Progress of Botany*, 1841, translated for the Ray Society, vol. i.; Hooker and Taylor, *Muscologia Britannica.*)

FUNCTION, ARBITRARY. In the integration of partial differential equations, arbitrary functions are introduced, that is, functions which may be of any form whatsoever. Thus, in the problem of the vibrations of a thin column of air, which leads to an equation of the form

$$\frac{d^2z}{dx^2} = a^2 \frac{d^2z}{dy^2}$$

the complete solution of the equation is

$$z = \phi\,(y + ax) + \psi\,(y - ax)$$

when ϕ and ψ stand for any functions whatever. The determination of these arbitrary functions must depend upon the data of the problem. Thus, if it were required so to determine ϕ and ψ as that z should become x when y is x, and x^2 when y is bx: we have then to determine the forms of ϕ and ψ from the two equations

$$\phi\,(x + ax) + \psi\,(x - ax) = x$$
$$\phi\,(bx + ax) + \psi\,(bx - ax) = x^2$$

These two functional equations might be solved without much difficulty, and forms of ϕx and ψx found. Theoretically, the determination of the arbitrary functions, so as to satisfy given conditions, resolves itself into the solution of functional equations.

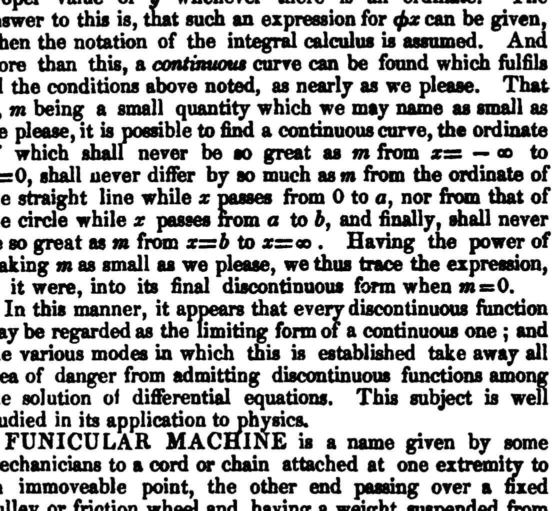
But when these questions were first considered, it was soon seen that the problems from which they are derived present very peculiar circumstances. For instance, when the problem is that of finding the manner in which a disturbance travels along a thin column of air, the preceding equation exists, when z represents the amount of compression or rarefaction which exists in the air at a distance y from a fixed origin at the end of the time x from the beginning of the motion. Now, in practice, there is no disturbance of the state of the air at the beginning of the motion, except in one small part of the column (as in a sound excited at one end of a cylindrical tube). Suppose, for example, that by introduction of external air, a certain amount of compression, c, is generated at the first moment ($x=0$) throughout the portion of the tube which extends from $y=0$ to $y=m$. When $x=0$, z is $\phi y + \psi y$, and the conditions of the problem require that $\phi y+\psi y$ should be equal to c when y lies between 0 and m, and always equal to nothing when y is greater than m. Hence, $\phi y+\psi y$ must be a discontinuous function; so that in this simple problem mathematical methods are insufficient to express a solution, unless discontinuous functions can be admitted among the solutions of partial differential equations.

There was, at one time, a spirited discussion between Euler, D'Alembert, and Lagrange, as to whether discontinuous functions could properly be admitted among the solutions of differential equations. We cannot enter into the details of this discussion, but we shall state the manner in which the question has been settled.

The considerations in Curve, P. C. S., give some approach to the notion that curves which are perfectly independent may be combined in one equation; and also that a continuous curve may be drawn, the arc of which runs as near as we please to two distinct branches of two independent curves. The power of expression given by means of definite integrals and periodic series [Integrals, Definite, P. C. S.] puts this result in a stronger light. Suppose, for example, that an axis of x being taken, we want to express mathematically the ordinate y, in such manner that it shall be nothing from $x=-\infty$ to $x=0$; that of a certain straight line from $x=0$ to $x=a$; that of a certain circle from $x=a$ to $x=b$, and nothing again from $x=b$ to $x=\infty$. In other words, we ask whether a line which is both limited and discontinuous, being a part of a straight line and a part of a circle, can be put upon the same sort of footing as an algebraic curve; so that a definite equation $y=\phi x$ shall always give $y=0$ when there is no ordinate, and shall give the proper value of y whenever there is an ordinate. The answer to this is, that such an expression for ϕx can be given, when the notation of the integral calculus is assumed. And more than this, a *continuous* curve can be found which fulfils all the conditions above noted, as nearly as we please. That is, m being a small quantity which we may name as small as we please, it is possible to find a continuous curve, the ordinate of which shall never be so great as m from $x=-\infty$ to $x=0$, shall never differ by so much as m from the ordinate of the straight line while x passes from 0 to a, nor from that of the circle while x passes from a to b, and finally, shall never be so great as m from $x=b$ to $x=\infty$. Having the power of making m as small as we please, we thus trace the expression, as it were, into its final discontinuous form when $m=0$.

In this manner, it appears that every discontinuous function may be regarded as the limiting form of a continuous one; and the various modes in which this is established take away all idea of danger from admitting discontinuous functions among the solution of differential equations. This subject is well studied in its application to physics.

FUNICULAR MACHINE is a name given by some mechanicians to a cord or chain attached at one extremity to an immoveable point, the other end passing over a fixed pulley or friction wheel and having a weight suspended from it; a weight being also suspended from the cord or chain in some part of its length between the fixed extremity and the pulley. The cord or chain becomes thus a mechanical agent, since unequal weights, applied as has been said, may be in equilibrio.



Let ACB in a vertical plane be the position of a cord suspended between two points A and B, but capable of moving freely on a pulley at each of those points, and let w be a given weight suspended from any point C; the weights p and q, which should be applied to the cord, at the extremities vertically below A and B, in order to produce equilibrium, may be thus determined. Through C draw the vertical line CZ to represent the weight w, and draw Zm, Zn parallel to BC, AC, respectively: then, by mechanics, the lines Cm, Cn will respectively represent the strains in the directions AC, BC, and consequently the weights p and q, which, in the case of equilibrium, must be equivalent to those strains. Now since the angles ACZ, BCZ are known, representing them by a and b, the sine of the angle CmZ may be expressed by sin. $(a+b)$; and by trigonometry,

$$p=w\frac{\sin.\ b}{\sin.\ a+b},\ q=w\frac{\sin.\ a}{\sin.\ a+b}:$$

therefore if the cord were attached to a fixed object at one end, as A or B, while capable of moving on a pulley at the other, and a weight w were applied at any point C in its length, a weight q or p, found as above, would hold w in equilibrio.

Again, let the weights p, q, w, and the position of the pullies at A and B be given, the cord moving freely on the pullies and the weight w being capable of sliding by means of a ring along the cord; then the positions of the parts AC, BC of the cord, when the system is in equilibrio, may be found in the following manner. Imagine mn to be the parallelogram of forces; then since CZ, Cm, Zm may be represented respectively by the known quantities w, p, q, the values of the angles ACZ and CZm or BCZ may be found by trigonometry. With these, by a geometrical construction, or otherwise, the required positions may be readily determined, since AC and BC make with horizontal lines, as Ad, Be passing through A and B angles equal to the complements of ACZ, BCZ.

A cord suspended in a vertical plane between two fixed points and acted on by weights placed at different points in its length, is called a funicular polygon; and the form of the suspended cord being given, with the weight to be applied at one angular point as C, the weights at all the other angular points, in the case of equilibrium, may be found thus. Let A and B be angular points on the left and right or C, and having determined the strains represented by Cm, Cn by the parallelogram of forces at C, construct a parallelogram at A and another at B, having vertical lines passing through A and B for the directions of their diagonals, and having two sides of each coincident in direction with the adjacent sides of the funicular polygon, also making the sides (Ar and Bs) on AC and BC equal to Cm and Cn respectively: then the diagonals will represent the weights to be suspended at A and C, in order to counteract the strains in AC and BC arising from the weight w at C. By forming parallelograms in a similar manner at the other angular points, the whole system may be in equilibrio. See 'Hutton's Tracts' (Tract 1, sect. 2, prop. i). In like manner may the equilibrium of the rafters in a curb-roof be determined. [Roof, P. C. page 145.]

FURNISHED LODGINGS. [Lodgings, P. C. S.]

FURRIERY, FUR DRESSING. The history of the Hudson's Bay Company and of the North American fur trade is briefly given in Furs and Fur-Trade, P. C., and the further history of the company is given under Oregon, P. C. S. The various kinds of furs mentioned in the first of those two articles, as well as some found in our own country, may be classed according to their use as *felted furs* and *dressed furs*.

Felted furs. These include all such as are employed in hat-making; and are principally the skins of the hare, the rabbit, the beaver, and the neutria. If the skin is taken off the animal in winter when the fur is full, soft, and fine, it is called 'seasoned,' and obtains the highest price; but if taken off at any other period of the year, it is comparatively short, coarse, hairy, and less valuable, and obtains the name of 'unseasoned skin.'

In the preparation of *hares' fur* for the hatter, the skin, after being opened and spread out flat, is rubbed with a kind of saw called a *rake*, for the purpose of clearing away the dirt and dried blood without detaching any of the fur itself. This done, the skin is damped on the *pelt* or inner side, and several are pressed one on another to remove creases and irregularities., Next ensues the separation of the furry covering from the felt beneath. This covering is of two kinds: an external coat of long hairs which possess no felting properties, and an internal coat of finc or true fur. These are removed separately. A pair of shears, something like those used in shearing sheep, are worked all over the surface of the skin so as to cut off the coarse hair without damaging the fine fur beneath; and to effect this properly is a difficult operation. The skin before this shearing was of a brownish colour, but when the external hair is removed the fur beneath appears as a beautiful black jet. To remove this fur is the next stage. The skin, extended smooth and even, is placed upon a square cutting-board made of willow, wetted occasionally to avoid blunting the edge of the knife employed in the cutting. This knife is about six inches long by three broad, and has a rough edge; it is shaped something like a cheese-cutter, so as to be used alike backwards and forwards. With such a knife the fur is cut gradually in every part of the pelt; the knife follows the direction which the fur naturally takes on the animal's skin: that is, from the head towards the tail. The whole of the fur from one skin is either collected together as a light fleecy mass, or is separated into parcels according to the different qualities of the different parts.

The preparation of *rabbits' fur* for the hatter is somewhat different from the above in its earlier stages, on account of the greater greasiness of the pelt, or inner surface of the skin. By the use of a knife in a peculiar way, the thin cuticle on which the grease or fat is deposited is stripped off, bringing the impurities away with it. The surface beneath is then rubbed with whiting. The rabbit skin, like that of the hare, has two kinds of hair or fur; but the coarser, instead of being removed by shearing, requires to be *pulled;* this is done by a short knife about three inches long, held against a leathern shield worn over the thumb: the hairs are grasped, a few at a time, between the knife and the thumb, and pulled out. A double care is here requisite: to avoid cutting the hair instead of pulling it, and to avoid pulling or cutting the fine fur beneath. When this is done, the fine fur is cut off in the same manner as hare's fur.

For the *neutria skins* (the commercial name of the skin obtained from the Coypou [Coypou, P. C.]), the processes are nearly the same. The skin has derived its name (variously written, *neutria*, *nutria*, *neutra*, *nuetra*) from the Spanish name for an otter, to whose skin it bears some resemblance. It is full of fat and grease, and requires a thorough washing with soap and boiling water before being 'pulled.' The outer or coarse hairs are treated like those of the rabbit, and not like those of the hare; being stronger, too, they require a sharper knife and a stronger pull for their extraction. Not only the pelt side, but also the fur-side is full of grease, and need a thorough purification before the removal of the hairs and fur. When the external hair has been pulled, the inner fur is cut in the same way as the others.

The skin of the *beaver* is, in many respects, the most serviceable of them all for the hatter's purpose. It is, however, so full of grease that the pelt requires to be scoured with fullers' earth and whiting before it attains a sufficient state of cleanness. The coarse hairs are pulled out by the knife and thumb, and being of no use to the hatter, they are sold as a stuffing for cushions. Then comes the cutting or cropping, which is, at the present day and in the largest establishments, effected by a very beautiful machine. There is a long broad and sharp blade, equalling in length the full width of the beaver-skin, and so adjusted as to fall rapidly with a chopping action against or near the edge of another blade beneath. The skin is placed between the two, and is attached to a piece of mechanism by which it is drawn gradually from end to end between them; as it passes, the sharp blade crops the fur from off the pelt, which it does so effectually that not a particle of fur is left behind, and yet the pelt is not cut through in any part. The fur falls down in a light flocculent layer on an endless apron beneath, from whence it is removed when the pelt is denuded. This fur is of three or four different qualities, that from the cheek being the finest and most valuable; and to separate them one from another a method at once simple and elegant is adopted. The fur is placed in a large chest or trough, where it comes within the action of a fan revolving two thousand times in a minute; the current excited by this fan is so violent that it whirls the fur along a hollow trunk or channel fifty feet in length. During the passage of the fur, the relative specific gravities of the filaments effect a separation without any farther interference: those which are largest and coarsest fall first, and are deposited on the bottom of the first compartment of the trough; those which are next heavier are deposited farther on; and lastly, the finest and best parts of the fur are blown to the extreme end of the trough, whence they can be taken without admixture with any of the others.

The cutting of the fur from the pelt by machinery has been attempted for various furs, but it has succeeded only in respect to beaver; this is said to be owing to the circumstance that the beaver-pelt is very regular in thickness and uniform in surface; whereas, most of the other pelts are irregular or unequable. If the blade of the machine by passing over an irregular part of the pelt should cut off a small bit of the latter, it would be the means of spoiling the mass of fur unless removed. Attempts have been made to detach the fur from the pelt by chemical instead of mechanical means. In tanning and leather-dressing, the hair and wool of the animal are often loosened by being exposed for some hours to the action of some acid or other chemical agent: and it has been supposed that the same result would be obtained in respect to fur for hatters' purposes; but it is found, that though separable by such means, the fur is injured in its felting properties—an objection fatal to the adoption of the plan.

Other kinds of fur besides the four above-named are employed in hat-making, but are not so generally serviceable. *Mole fur* is fine and regular, but is almost too short to be available. *Musquash*, or *musk-rat fur* is employed to some considerable extent. *Seal-fur* presents a dull appearance when worked up as a covering to a hat, being deficient in the delicate glossiness which distinguishes beaver. *Otter-fur* is finer than that of the seal, and is so far more serviceable, but it does not take a good black-dye. According to the price at which a hat is intended to be sold so is the selection of the fur employed. A good beaver hat contains in the foundation or body a mixture of fine wool with rabbit's fur, and in the covering beaver-fur alone; this is the standard, from which a departure takes place according to the price. [Hat, P. C.]

Some kinds of fur which are rather deficient in the felting property are made to undergo a process termed 'carrotting,' so called from the colour imparted thereby to the fur. This consists in wetting the skin (before the fur has been yet cropped from the pelt) with dilute sulphuric acid, and quickly drying it either near a strong fire or by means of a heated iron passed over it. The fur of the same species of animal often differs very much in felting quality, according to the district where the animal is found. Thus, the fur of the rabbit is said to possess a stronger felting quality when obtained from an animal reared near the sea-coast than from an inland animal: those of the eastern coast of England, from Lincolnshire to the Tweed, are considered the finest. The fur of the English hare, as a second example, is found to be both finer in quality and stronger in felting power than that of any other variety of the hare.

Dressed Furs.—By this term may be designated those furs which are retained on the original pelt, and in that state worn as garments or trimmings of garments, in the forms of cloaks, tippets, cuffs, collars, &c. Such an employment of furs was very much a matter of necessity among the rude tribes where the custom was first followed. At first the skins were worn almost in the state in which they were taken from the animals; but as luxuries advanced, the art of dressing the skins became established, and fur took rank as an adornment as well as a covering. We find that, by about the beginning of the fourteenth century in England, the custom of wearing costly furs had reached such a height, that Edward III., in one of his sumptuary laws (A.D. 1337) enacted, that all persons who could not spend a hundred pounds a year should be absolutely prohibited the use of furs.

The dressing of furs for this purpose, or 'furriery,' is much more simple than the preparation of felting-fur for the hatter, since it does not involve the separation of the filaments from the pelt beneath.

The fur-hunters of America, when they have captured a beaver or other fur-bearing animal, strip off the skin, and hang it up to dry, either in the open air, or in a dry and cool room where there is no fire. Great importance is attached both to the drying and to the careful packing of the skins; for if the slightest degree of putrefaction ensues, the fur loses its firm hold of the pelt, and is not fit for furriers' purposes. When the skins are brought to England, and placed in the hands of the furrier, he examines them minutely, to see that the drying has been properly effected, and the pelt in a firm state. He then proceeds to the two processes which constitute the main part of his business, viz. extracting the greasiness from the pelt, and also a kind of oil which is in the fur itself. The skin is put into a liquid containing bran, alum, and salt; and after sufficient steeping it is worked about and scoured, so as to remove the grease. The fur is cleansed from its oiliness by an application of soda and fine soap. The cleansed skin is finally washed thoroughly in cold water, and hung up to dry. The alum and other ingredients employed in scouring the pelt effect a kind of tanning or tawing process, by which the pelt is converted into a sort of thin leather, and thereby rendered more durable.

When thus far prepared, the skins are ready to be worked up into the form of garments, or materials for garments. In order to give the surface of the fur a uniform length and colour of fibre, it is often necessary to cut up a great many skins, and sew certain pieces of each edge to edge; for it is rarely if ever the case that every part of the same skin is of one uniform colour. The cutting up of a skin thus becomes an important affair; for unless considerable tact be exhibited, many of the smaller pieces would run to waste. The furs which are used for these purposes are in general different from those selected for felting; they comprise usually the grey, the silver, and the black fox, the sable, the bear, the lynx, the ermine, the mink, the chinchilla, the marten, the wolf, the fitchet, and a few others of less common character.

The preservation of furs, when kept in hand for manufacturing purposes, is a point of considerable importance, from the several sources of injury to which they are exposed. If kept too damp, they rot; if too dry, they diminish in weight. 'The great enemy to all furs,' says a practical writer on this subject in the 'Encyclopædia Britannica,' 'is the common moth. This destroys the felting principle. Whenever the slightest appearance in the fur indicates the secure lodgment of this little creature it ought immediately to be used; or, if this cannot be done, it should be taken out of the paper-bags, and broken all over with a small switch rod, or, what will answer the purpose still better, a hatter's bow. The same rules apply to the keeping of skins in good condition as to fur. The situation ought to be cool, dry, and well aired. They will seldom keep longer than twelve or eighteen months, without running great risk of suffering injury from the moth or black beetle. Too many ought not to be heaped together, and particularly if they be rabbit-skins, because the fat or grease about these skins will get heated, run amongst the fur, and become of such an acrid nature as to corrode the very pelt itself. Many persons are inclined to keep hare and rabbit skins a long time, from a notion that the fur upon them will increase in length from the moisture left in the pelt. This is an entirely erroneous opinion. Any one who will make the experiment will find that the amount of fur obtained off any given quantity of skins is much greater in weight when manufactured immediately after they are taken off the animal, than after having been kept for six or twelve months.'

FURZE. [Ulex, P. C.]

FUTURE. [Conjugation, P. C.]

INDEX TO THE LETTER F.

VOLUME I.

Fabbróni, A'ngelo, page 558.
Faba [Vicieæ, P.C.; Bean, P.C.]
Faboídea, 558
Fabriáno, Francesco di Gentile da, 558
Fabrot, or Fabrotus, Charles-Annibal, 558
Factorials, 558
Factories, 560
Fagopyrum, 563
Fahrenheit, Gabriel Daniel, 563
Faithorne, William, 563
Falconet, Etienne Morice, 563
Falkland, Lucius Cary, Viscount, 563
Falkland Islands, 564
False Imprisonment, 565
Families of Plants, 566
Fantuzzi [Trento, Antonio da, P. C. S.]
Farináti, Paolo, 566
Farriery [Horse, P. C.]
Fauna, 566
Favosítes, 566
Favulária, 566
Feathers, 567
Federíci, Camillo, 568
Fédia [Valerianella, P. C.]
Fee Farm Rent [Rent, P. C.]
Feigned Diseases, 568
Felt, Felting [Sheep, P. C., p. 356; Hat, P. C., p. 64; Woollen and Worsted Manufactures, P. C., p. 552.]
Feme Covert [Wife, P. C.]
Fenestélla, 570
Ferns [Filices, P. C. S.]
Ferónia, 570
Ferrári, Gaudenzio, 570
Ferri, Ciro, 570
Feti, Doménico, 570
Feuillea, 570
Fiammingo [Calvert, Denis, P. C. S.]
Ficaria [Ranunculus, P. C. S.]
Ficoidites [Stigmaria, P. C. S.]
Field, Nathaniel, 571
Fiêsole, Fra Giovánni da, 571
Filágo, 571
Filament, 571
File, 571
Filiation, Order of [Bastard, P. C. and P. C. S.]
Fílices and Filicáceæ, 574
Filipépi, Sandro or Alessandro, 575
Filter, Filtration, 575
Finiguerra [Engraving, P. C., p. 438]
Fiorillo, Johann Dominik, 576
Fire-Bote [Estovers, P. C.; Common, Right of, P. C.]
Fire-proof Buildings, 576
Fire-Ship, 577
Firenzuóla, Agnolo, 578
Firestone, 578
Fischer von Erlach, Johann Bernhard, 578
Fischer, Karl von, 579
Fishes, Fossil, 579
Fishes, Geographical Distribution of [Ichthyology, Recent, P. C. S.]
Fistulária, 581
Fixtures, 581
Flabellária, 583
Flacourtiáceæ, or Flacourtiáneæ, 583
Flagstone, 584
Fleet Prison, 584
Flexibility, 584
Flexure of Columns, 584
Flindersia [Cedrelaceæ, P. C. S.]
Flink, Govert, 585
Flint, 585
Floor [House, P. C. S.]
Floor-cloth, 586
Florentínus, 587
Floris, Frans, or Frans de Vriend, 587
Flowers, Artificial, 588
Fluids, Elastic, 588
Fly Fly-Wheel [Wheels, P.C., p. 316]
Flying Bridge, 589
Fog [Mist, P. C.]
Fohr, Carl Philipp, 590
Fontána, Prospero, 590
Fontevrault [Maine et Loire, P. C.]
Foot [Skeleton, P. C.]
Foot-prints, 590
Foraminífera, Fossil, 590
Forbes, Patrick, 591
Forbes, William, 591
Forbes, John, 591
Forcing-engine [Fire-engine, P. C.]
Forest Marble, 591
Forli, Melozzo da, 591
Formation, 592
Fortebracci [Braccio Fortebracci, P. C. S.]
Fosbroke, Rev. Thomas Dudley, 592
Foscaríni, Marco, 592
Foschíni, Antonio, 593
Fossáti, Doménico, 593
Fossombróni, Vittório, 594
Foster, Rev. John, 594
Foulston, John, 595
Fouquieráceæ, 596
Fourier, Charles, 596
Fractions, Decomposition of, 600
Frambæsia [Skin, Diseases of, P. C. S.]
Francésca, Piéro della, 601
Francia, Francesco, 601
Francia, Doctor José Gaspar Rodriguez, 601
Francklin, Thomas, D.D., 602
Franco, Battista, 602
Francucci [Imola, Innocenzio da, P. C. S.]
Frankpledge [Leet, P. C.]
Frankalmoigne, 602
Frankenia, 603
Fraser, Simon [Lovat, Lord, P. C. S.]
Frauds, Statute of [Statute of Frauds, P. C. S.]
Fraudulent Conveyance [Consideration, P. C. S.]
Frauenreuth, 603
Fraunhofer, Joseph, 603
Fraxinella, 604
Fraxinin [Chemistry, P. C. S.]
Frazéra, 604
Frederic William III., 604
Free Church of Scotland, 613
Free Town [Sierra Leone, P.C.]
Free Trade [Agriculture, P. C. S.; Capital, P. C. S.; Corn Trade, P. C.; Corn Trade, Ancient, P. C. S.; Demand and Supply, P. C. S.; Leases, P. C. S.; Monopoly, P.C.]
Freeman [Boroughs of England and Wales, P. C.]
Freezing Apparatus, 615
Freight [Ships, P. C.]
Fresco, 615
Fresnel, Augustin Jean, 618
Frey, Jacob, 619
Friction Wheels [Wheels, P.C.]
Frisi, Páolo, 619
Fritillária, 620
Fuchsia, 620
Fucoídes, 621
Fuente Rabia, 621
Fuerteventura, 621
Füger, Friedrich Heinrich, 622
Fulgora, 622
Fuller, Rev. Andrew, 622
Fumária, 623
Fumitory [Fumaria, P. C. S.]
Funária, 623
Function, Arbitrary, 623
Funicular Machine, 624
Furnished Lodgings [Lodgings, P. C. S.]
Furriery, Fur-Dressing, 624
Furze [Ulex, P. C.]
Future [Conjugation, P. C.]

G.

GADDI. The name of a celebrated old Florentine family of artists of the thirteenth and fourteenth centuries.

Gaddo Gaddi, the contemporary and friend of Andrea Tafi, and Cimabue, was born at Florence in 1249, according to Vasari. Gaddo was a painter and mosaic-worker, and assisted Tafi in the Mosaics of San Giovanni. He executed alone the mosaic of the 'Coronation of the Madonna,' in Santa Maria del Fiore, which is still extant. This work obtained him a reputation all over Italy, and he was ordered in 1308 by Clement V. to Rome, to execute some mosaics in the new church and palace of San Giovanni in Laterano, which was rebuilt after the fire of 1307. He executed other works in St. Peter's, and in Santa Maria Maggiore, which last still exist. There is also a Madonna by him in mosaic in the cathedral of Pisa. He executed some paintings in *tempera*, but they have all perished. He died in 1312, and was buried in Santa Croce, where his son Taddeo painted his portrait beside that of Andrea Tafi, in a Marriage of the Virgin in the Capella Baroncelli.

Taddeo Gaddi was a much more able man than his father, after whose death he lived twenty-four years with Giotto, who was his godfather. He was the most distinguished of Giotto's scholars and imitators.

Vasari mentions the paintings of the sacristy of Santa Croce in Florence, as Taddeo's first works; the altar-piece, however, of this chapel, is altogether similar to the other paintings, and it bears the date of 1378, which was some years after the death of Taddeo: the portion which Vasari attributes to Taddeo are the five subjects from the life of the Magdalen. The frescoes of the Baroncelli (now Giugni) chapel in the same church, representing the life of the Virgin, also by Taddeo, according to Vasari, are in a different style, and in one which assimilates more with the characteristic style of the period. Taddeo enlarged somewhat upon the style of Giotto; he gave more bulk and motion to his figures. The frescoes of this chapel are perhaps the best of his works that remain; they have been engraved by Lasinio. Taddeo painted also in Santa Maria Novella, and other churches at Florence, and at Arezzo, and in 1342 at Pisa; but little remains of his works besides those mentioned above, and a few small altar-pieces in *tempera*, in the gallery of the academy a Florence and at Berlin.

In Santa Maria Novella Taddeo painted, in fresco, a wall and the ceiling of the Capella degli Spagnuoli, formerly the chapter-house. The ceiling represents the Resurrection and the Ascension of Christ, the Descent of the Holy Ghost, and Peter saved from Shipwreck: in the Resurrection light proceeds from the body of Christ. The painting of the wall is apparently an allegory to the glory of St. Thomas Aquinas, commemorating his extensive knowledge and his great services to the church. The other walls of the chapel were painted by Memmi at the same time as the works of Taddeo were executed, but are much inferior to them; on one of the walls are the reputed portraits of Petrarch and Laura. Taddeo's works in this chapel are the most considerable efforts in painting of the fourteenth century; but they are not in a sufficient state of preservation to judge adequately of their merits, yet sufficient to justify his reputation of the best draftsman of his age or century. In composition he was symmetrical and crude; in character natural, and in expression not superior but equal to Giotto. Taddeo was likewise a distinguished architect; he built the present Ponte Vecchio in 1345, and the Ponte della Trinità, which was destroyed by the flood of 1557, and was replaced by the present bridge by Ammanati.

Taddeo Gaddi amassed great wealth, by means of which he established his family, and the Gaddi have been for many centuries one of the most distinguished families of Florence. It is not known when Taddeo died, but Rumohr has shown that he was still living in 1366, when, according to Vasari, he must have been in his sixty-sixth year. He was buried near his father in Santa Croce.

His most distinguished scholars were Giovanni da Milano and Jacopo da Casentino, to whom he entrusted the care of his sons Giovanni and Angelo: the former died young, after giving great promise as a painter.

Angelo Gaddi excelled in colour, and generally in the technical practice of the period, which appears to have been thoroughly established in his time. He, however, executed several great works, especially in Santa Croce, where he painted the history of the Discovery of the Cross; but they are all in imitation of Giotto and his father, though he was inferior to both in expression and to his father in design.

He executed many works in Florence in various churches, and he visited Venice not only in the capacity of a painter but as a merchant also. He established a commercial house there, together with his sons, and realized a great fortune: his sons devoted themselves exclusively to mercantile pursuits. He died, according to Vasari, aged 63, and according to Baldinocci, in 1389; but if he died at that age the date can scarcely be correct, if the fact, as implied above, is true, that he was young when his father died.

Angelo left two distinguished scholars, Stefano da Verona, and Cennino Cennini, who is the author of the earliest known treatise on painting—'Trattato della Pittura,' Rome, 1821: it was written in 1437.

(Vasari, *Vite de' Pittori*, &c.; Speth, *Kunst in Italien*; Rumohr, *Italienische Forschungen*.)

GAERTNER, JOHANN ANDREAS. Descended himself from a family of architects, this Gaertner claims notice both on account of his own professional talents, and as being the father of the present celebrated **Friedrich von Gaertner** (born at Coblenz in 1792), now (1845) chief architect to the king of Bavaria, and who has adorned Munich with some of its noblest and most monumental structures.

Though we speak of this architect (Friedrich) merely incidentally, not biographically, yet as the opportunity offers itself we give a list of his principal buildings down to 1844, viz.:— The Ludwigs-kirche, Bibliothek or Public Library, University, Damenstift, Priester-Seminar, Blinden-Institut, Salzamt, the Ludwig Gate, and Feldhernnshalle, all at Munich; the Residenz, or new palace, at Athens; the Befreiungshalle at Kelheim, a colossal monument of rotunda form, intended to commemorate the liberation of Germany; the Palace at Wittelsbach; the magnificent Pump-room at Kissingen, and the Pompeian House at Aschaffenburg. Contrary to either Schinkel or Klenze, this architect chiefly affects the Byzantine or round-arch style. He has just begun to publish the designs of his buildings in large folio size, but as yet only some of the plates have appeared without any letter-press, and without even so much as a notice to say whether there will be any at all, or what will be the probable extent of the work.

Johann Andreas was the son of a former Andreas, a Dresden architect and artist of considerable reputation in the early part of the last century; and was the nephew of Johann Gaertner, a clever architect of the same period and the same place. He was born at Dresden in 1743, and was at first more inclined towards the military profession; but going to Poland he was induced by Count Minitszek not to give up architecture entirely, but rather to apply himself to engineering also, and he was employed by that nobleman to erect various buildings upon his estates. After that he visited Vienna, Berlin, and Paris, in which last capital he remained nine years, when he was invited to Coblenz, to finish the Residenz or electoral palace there. He next entered the service of the Prince-bishop of Würzburg, being glad to quit Coblenz (where his son Friedrich was born), the disturbances arising out of the French Revolution having both rendered that city an insecure place of abode, and cut off all prospect of professional employment. He erected several buildings at Würzburg, and in its neighbourhood, all of which display superior talent and taste; among others the theatre, and restorations of the Church of St. Michael at Würzburg, and Count Schönborn's château at Gaibach; and he continued to reside at Würzburg after political changes had annexed it to Bavaria, and after he himself had been nominated as a Bavarian architect, for he did not remove to Munich till 1804, when he had been appointed Hofbauintendant there. He did not however find opened to him in that capital the enlarged scope for the display of his abilities which he had promised himself, for of the various designs which he produced, scarcely any—none of the more important ones—were adopted for execution. Towards the close of his life he felt the disappointment so bitterly, that instead of selecting his best designs and publishing them as a memorial of his talents, he destroyed them with his own hands, as if to prevent others from availing themselves of the ideas which he had been able to work out only upon paper. From this circumstance it may be inferred that he felt protracted life—and he did not die till 1826, when he was in his eighty-third year—to be attended with other penalties than those annexed to old age. Could he have foreseen how much more prosperous a career was reserved for his son, he would probably have borne his own disappointments with less impatience of temper.

GA'GEA, a genus of plants belonging the natural order Liliaceæ, and the tribe Asphodeleæ. It has a perianth of 6 patent leaves, the stamen adhering to the base of the perianth; the anthers erect, attached by their bases. The flowers of the species are corymbose or umbellate.

G. lutea (the Ornithogalum luteum of many botanists) has the radical leaves usually solitary, linear-lanceolate, flat; the bracts 2, opposite; the peduncles umbellate, simple, glabrous; the segments of the perianth oblong, obtuse; the bulb ovate, solitary. The stem of this plant is about six inches high, and shorter than the leaves. Its flowers are yellow. It is a native of England and Scotland in woods, but is a rare plant. It is a native of Europe, and is found on the Alps in Switzerland. Koch describes ten species of this genus as natives of Germany and Switzerland.

(Babington, *Manual of British Botany*; Koch, *Flora Germanica.*)

GAILLONI'LLA, one of the abundant infusorial fossils of Franzenbad in Bohemia.

GALANI'NO, the name by which Baldassare Aloisi is generally known. He was born at Bologna in 1578, was educated in the school of the Carracci, and became one of the most distinguished of the Italian portrait painters: he is sometimes called the Italian Vandyck. He practised chiefly at Rome. Galanino was also a very able historical painter and a skilful etcher: he died in 1638.

(Baglione, *Vite de' Pittori*, &c.; Malvasia, *Felsina Pittrice;* Bartsch, *Peintre Graveur.*)

GALASHIELS. [Selkirkshire, P. C.]

GALEOPSIS, from γαλῆ, a 'weasel,' and ὄψις, 'sight,' 'aspect,' the mouth of the corolla gaping like that of a weasel, a genus of plants belonging to the natural order Labiatæ or Lamiaceæ. It has the anthers approaching in pairs, opposite cells bursting by two valves transversely; the upper lip of the corolla arched, and the lower lip three lobed, unequal, with two teeth on its upper side; a tubular 5-toothed calyx, with equal teeth, or the two upper ones longest. The nuts are rounded at the end. The species of this genus are annual, divaricately branched, erect herbs and rarely decumbent at the base. The flowers are red or cream-coloured, or varied with both these colours. This genus may be easily recognized by the peculiar formation of its anthers, which differs from any other of the Labiatæ.

G. ochroleuca, the cream-coloured Hemp Nettle, has a softly pubescent stem with deflexed hairs, not thickened below the joints, oblong or oblong-lanceolate leaves, clothed with soft villi on both surfaces. The calyx is shaggy and glandular, and the upper lip of the corolla deeply cut. This species is found in the sandy corn-fields of Middle Europe, and also in England and Wales. The flowers are of a pale yellow or cream colour, and bloom during the months of July and August.

G. ladanum, the red Hemp Nettle, is distinguished by having the upper lip of the corolla slightly notched. It is a native throughout Europe, and is found plentifully in the sandy corn-fields of Great Britain. The flowers are of a purple colour, variegated with crimson and white. A variety of this species, with flowers half the usual size, is the *G. intermedia* of Reichenbach, and the *G. parviflora* of Lambert.

G. tetrahit, the common Hemp Nettle, has a hispid stem, thickened below the joints, with oblong, ovate, acuminate, serrate leaves. The calyx has tubular teeth, and a tube nearly equal. The tube of the corolla is as long as the calyx, and has an ovate upper lip. It is of a purple colour, and is a native of cultivated ground throughout Europe and Middle Asia, and is plentiful in Great Britain.

G. versicolor has the tube of the corolla much longer than the calyx. The flowers are very large, yellow, and have a broad purple spot on the lower lip. It is not easily distinguished by description from *G. tetrahit*, of which it is regarded as a variety by many botanists.

(Don, *Gardener's Dictionary*; Babington, *Manual of British Botany.*)

GALILEO. A short time after the article Galileo, P. C., was published, there appeared in a leading Roman Catholic publication, the 'Dublin Review' (July, 1838, vol. v. pp. 72-116), a controversial article upon the celebrated interference of the Inquisition. This article has been much cited, and seems to be considered by some, at least, of the English and Irish Roman Catholics as a triumphant reply to the account usually given. We shall here briefly examine the main assertions, and the question which arises out of them.

We have already [Motion of the Earth, P. C.] expressed our opinion of the use which is made of Galileo's trial by Protestants: and we repeat that Catholics have a good right to consider the manner in which this case is harped upon as a high compliment to the authority which through so many centuries possessed the power of doing as much or more on every day of every year. That the whole proceeding was disgraceful to the parties concerned is generally admitted even by Catholics; but the question, and one which has not been fairly handled by Protestants, is, how far those parties can claim to be the representatives of the church which declares itself infallible in matters of faith. The importance of Galileo's trial depends upon its connexion with this question; and party zeal has mixed up with it all manner of discussion upon the character of the proceeding itself, and the motives of those who originated it. Englishmen would do well to remember, with regard to the latter points, their own Star-Chamber and the astronomy* of the Act of Uniformity.

Even in Italy the defence of the Inquisition has been long and openly given up by many. Witness the expressive silence of the account of Galileo, in the 'Elogi degli Uomini illustri Toscani,' Lucca, 1772, taken from a contemporary Milan periodical; the declaration of Frisi (Milan, 1775) that 'the imagination is horrified, and the virtuous and feeling mind shudders,' at the language applied to Galileo in the sentence passed upon him; and that of Fabbroni (Pisa, 1784), that 'it is better to be silent upon the details than by recalling them to increase the horror which every virtuous mind ought to feel against the injustice of that time.' And the article in the Dublin Review styles the Inquisition 'superlatively cruel in Spain, more mild and sparing of human life in Rome'—only more mild than superlatively cruel.

That the Roman Church decided against the earth's motion has been generally affirmed by Protestants, and denied by Catholics, we believe with justice. But that the church which claims infallibility in essential matters suffered two local tribunals, the office of which was the suppression of heresy, to pronounce, and, as it turns out, to pronounce wrongly, upon a question of astronomical fact, is all but universally admitted. Nevertheless, even this is denied altogether by the author of the article before us, whose account of the matter is as follows—That Galileo, in 1615, not content with supporting the Copernican doctrine as a truth, which it was open to him to do, persisted in invading what himself admitted to be the prerogative of the church, by declaring that the sacred Scriptures could be interpreted against Ptolemy and for Copernicus; and this, in spite of many friendly warnings, that he must confine himself to 'demonstrating his system,' and writing 'as a mathematician, and by way of hypothesis.' That when the first attempt was made upon him in 1615 (which was rejected by the Inquisition for informality), as much licence as the above was distinctly mentioned as given to all. That the prohibition of 1616, to teach or write in favour of the Copernican doctrine, was a prohibition to Galileo only, not to others, and was brought about partly by Galileo's persisting in forcing the theological question upon the court, and partly by the imprudence of his advocate, Cardinal Orsini, in pressing the subject upon the pope. That before this prohibition was given, on the occasion of Galileo's first personal appearance, the qualificators of the Inquisition, whose office it is to put the propositions bearing on the points at issue before the court, drew up the two famous theses, in which the doctrine of the earth's motion was called false and heretical. That when Galileo, in 1632, brought on the proceeding of 1633, not only by a breach of the prohibition, but by a sarcastic reference to it, and a caricature of the arguments of his friend and benefactor, the reigning pope, these theses were merely cited in the preamble of the sentence, and are not there to be taken as anything but recapitulation. That the word heretical, in the proceedings of the Inquisition, is the *stylus curiæ*, and that even offences against morals or the public peace, apart from all doctrine, must be styled heretical, before that court can assume jurisdiction.

---

* The poor nonconformists (see Calamy's 'Life of Baxter') pleaded in vain that they were required 'unfeignedly to assent and consent' to declarations which distinctly implied that it was full moon at times when any one could see that it was little more than half moon. And to make this more remarkable, it should be remembered, that in the year following it was proposed to insert into the act for relief of those who had not subscribed on account of sickness, a clause declaring the assent and consent to be nothing more than a declaration of obedience. This clause passed the Lords was rejected by the Commons

In the above are the following assertions. 1, That any one (except Galileo, restrained for his own misconduct) was at liberty to teach the earth's motion as true, provided he confined himself to philosophy, and let theology alone. 2, That the Inquisition pronounced no opinion upon the truth of the doctrine. 3, That it pronounced no opinion upon the orthodoxy of the same. We deny each of these positions, upon the clearest reasons, which we shall bring forward. But we do not deny that much has been stated which, when closely examined (for articles in reviews do not deal in references), would probably establish the fact that the prohibition of 1616 was mainly due to the injudicious ardour with which Galileo pressed the theological question. Nor do we deny that the conduct of the philosopher was weak and ungrateful in putting into the mouth of the wrongheaded personage of his dialogue the arguments urged to him in personal conference by his benefactor Urban, with a hint that they came from a high quarter. All parties admit that it was the irritation of the pope at this conduct which led to the final proceeding.

As to the first of the preceding assertions. There were, at the time in question, three distinct modes of maintaining a theory. First, as a mathematical hypothesis, assuming it not as true, but as sufficient to explain phenomena, and leaving its truth or falsehood aside, or even implying the latter. Secondly, as a truth, but without any reference to the Scriptures: maintaining it by arguments, and implying that if the Scriptures really assert the contrary, there must be something wrong in those arguments, but that if the latter really amount to demonstration, then the interpretation of the Scriptures, which makes them assert the contrary, must be wrong. Thirdly, as an absolute truth, confirmed by reason and Scripture both. In the article we are examining, the first and second of these modes are confounded: and it is thought that when Galileo was warned off the third mode, and told to write 'as a mathematician and by way of hypothesis,' and to confine himself to 'demonstration,' he was left with permission to use the second mode. This is not correct, but the mistake is a natural one. We have already seen [Demonstration, P. C.] that demonstration, as applied to physical hypothesis, meant only explanation: and that it could be said that a false hypothesis might give true demonstration; that is, might be shown to be capable of accounting for phenomena. To learn how matters stood in the present case, we must look to the words of the authorities. Of these there were two, the Inquisition, which took cognizance of the acts of heretics, and the Congregation of the Index, which examined and censured their books. In one and the same year (1616) the former silenced Galileo, the latter condemned the great work of Copernicus, and the writings of his followers. The decree which condemns them calls the doctrine of the earth's motion 'false, and altogether contrary to Scripture.' And this decree prohibits not only the work of Foscarini, which endeavours to show that the doctrine is not contrary to Scripture, but also that of Copernicus, which does not touch the question of theology. This is plain enough, but we can make it still plainer. Four years after (1620), the same Cardinals of the Index, finding that the work of Copernicus could by slight alterations be made to speak the language of hypothesis, published the corrections under which they would allow it to be read. We put a few sentences of the work side by side with the alterations dictated by authority:—

Copernicus.	*Correction required.*
This question (of the motion of the earth) is not yet settled, and is not to be despised by any means.	It matters nothing whether the earth be taken as the centre [remember that the word centre in those days implied immoveability] or not, as far as solving the phenomena of celestial motions is concerned.
Since then there is *nothing to hinder* the motion of the earth	Since then *we assume* the motion of the earth
On the triple motion of the earth (heading of a chapter).	On *the hypothesis* of the triple motion of the earth.
These three stars (the earth being one)	Omit these words, because the earth is not a star, as Copernicus makes it to be.

This surely will settle, in reasonable minds of all persuasions, the question how much is permitted to a person speaking as a mathematician, and by way of hypothesis. If Copernicus say the earth is a star [a word implying motion], the cardinals strike it out: if that it may be so, they alter it into a professed assumption for purposes of calculation. How indeed could they allow *nihil prohibet* on an opinion described by themselves as *Divinæ Scripturæ omnino adversantem?* For the documents cited see Riccioli, *Almag. Nov.*, lib. ix. sect. iv.

Next, as to the assertion that the Inquisition pronounced no opinion on the truth of the doctrine. The two propositions, affirming both its falsehood and heresy, were drawn up, it is said, by the qualificators or qualifiers, inferior officers of the court, and not the court itself. This is a strange argument, and to make it relevant it must be shown that the declaratory power of the Inquisition was lodged in its inferior officers, and not in its judges. If the tribunal were so constituted, it matters nothing to the point in question; for the qualifiers did declare against the doctrine, that is, the court did pronounce a decision in its usual form and manner, and we assert nothing more. All that was done in any other case was done in this one. But in point of fact, it will be found that the qualifiers are only the assistants of the judges; and the voluntary adoption of their conclusions by the cardinals makes those cardinals themselves the responsible parties. But further: it is not true that the final sentence of 1633 did no more than state the theses of the qualifiers as recapitulation of the proceedings of 1616. The defence before us asserts that the Inquisitors 'did not at all trouble themselves with considering the truth or falsehood, the innocence or poison, of the opinion asserted.' To this let the sentence itself reply:—'And that this pernicious doctrine might be altogether removed, and might not further creep in, to the great injury of Catholic truth, a decree emanated from the Sacred Congregation of the Index, by which the books which treat of this doctrine were prohibited, and the doctrine itself was declared false, and altogether contrary to Scripture. But since a book has appeared at Florence in the past year (1632), of which the inscription shows that you [Galileo] were its author, the title being *Dialogo* &c., and whereas the sacred Congregation has come to know that since the printing of that work the false opinion of the motion of the earth has increased more and more from day to day, the said book was diligently considered,' &c. And in the recantation Galileo is made to say that the opinion of the earth's motion is false and heretical, and that he abjures and detests that error and heresy. It thus appears that there are four parties who declare the doctrine false and heretical—the qualifiers, the Inquisitors, the Congregation of the Index, and (perforce) Galileo himself.

Next, as to the question whether the Inquisition declared the doctrine heretical. That, as far as its authority extended, and in its own usual sense and meaning of the word, it did do so, is clear enough from what precedes. But, as may be supposed, a general word which belongs to an extensive system of law has many uses. The argument about the *stylus curiæ* seems to us unanswerable. In our Court of King's Bench, peaceful persons are adjudged to have done many things by force and arms, because the court, originally instituted for matters connected with the King's peace, had no other way of widening its jurisdiction for the relief of the subject, except by interpreting one class of injuries after another as acts of violence. The Inquisition, instituted for the suppression of heresy, and having no choice but to determine all causes sent before it by the Pope (as was that of Galileo), was as much compelled by its forms to consider every point with nominal reference to heresy and orthodoxy, as the Court of King's Bench to decide actions for breach of contract, on a supposition of money detained by force. Whether the maxim of our law—*in fictione juris semper subsistit æquitas*—can be applied to the Office called Holy; whether the high authority which Catholics reckon to be infallible when it *does* pronounce a decision was not culpably negligent in withholding its power from the scene of action, and in allowing an inferior tribunal to assume the function of interpretation which it asserts to belong peculiarly to itself—are questions on which Catholics themselves are likely enough to be divided in opinion. But however this may be, to require them to admit that their church has decided against the motion of the earth, as a matter of faith, and in its asserted infallible character, is to ask them to yield more than the opponents of the disputed doctrine ever thought they could claim as having been done for them. On this point we can cite a most unwilling contemporary witness, Fromond of Louvain, whose 'Antaristar chus,' written against the motion of the earth, was published at Antwerp in 1631. Fromond was a very zealous Catholic, an ardent opponent of the Copernican doctrine, and a firm believer in the fact of the sacred writers having intended to declare the stability of the earth. One of his chapters is thus headed, 'Is the Copernican opinion now to be held heretical?' This of itself is something, for it is to be remembered that the work had passed through the hands of the united censure of Philip IV. of Spain and the ecclesiastical authorities. What would these examiners have said to a work on the Nicene Council with a chapter headed 'Are the followers of Arius to be considered as heretics?' But to proceed:—Fromond, who wants to get all the condemnation that he can for his opponents, begins by citing Catholics who have expressed opinions on the subject: and it is remarkable how mild the censure is, even of those who wrote after the decree of the cardinals. Tanner says the opinion is 'condemned, and cannot any longer be safely held;' Mersenne, that 'any one may justly think it rash,[*] particularly after the manner in which the cardinals have expressed themselves.' The author goes on to state, with a slight, but very slight, tone of reproach, that there are men, both learned and Catholic, in Italy, France, Germany, and Belgium, who care little for the opinion of the cardinals, and who say that the power of these dignitaries is not supreme and pontifical, and that until this last-named power is exerted, they are safe and not within the limits of heresy. But Fromond doubts whether they are 'safe enough.' He points out that the books which are in the Index are condemned (according to the bull of Sextus V., which modelled both the Index and the Inquisition into the form which they had when Galileo was silenced) by the authority of the pope, expressly delegated for that purpose; and he then feels justified in drawing the following inference. 'If' says he, 'the general opinion of the Catholics of our time be correct, namely, that the pope speaking è *cathedra* cannot err, though not supported by a general council, then it is all up with Copernicus, and his paradox (to use a gentle word) appears rash, and next thing to heresy, ay, even more.' Having thus, as it were, made his utmost point, and still not got quite as far as heresy infallibly pronounced, he checks himself thus: 'This is what a severe judge might think. But when I consider how circumspect and free from haste pontiffs generally are in their decrees on matters of faith è *cathedra*, and also their practice of making those decrees in their own names and not in those of others, and since Sextus V., in the diploma which established the fifteen congregations of cardinals, expressly says, "Of those decrees which relate to the dogmas of the faith, we reserve the interpretation to ourselves"—it seems necessary to mitigate the censure a little, and right to suppose that the authority of the congregation of the Index is not equal, but inferior, to that of the pope.' He ends by saying that though the Copernican has (unless the pope should otherwise decide) one foot inside the door of heresy, yet he would not dare to pronounce him an open heretic, without something more express from the head of the church. The bull of Sextus V., as we see, contains an express limitation of the power of the several congregations; and the language and arguments of Fromond (to whom we might join other writers, but not of so satisfactory a character, as being themselves Copernicans) prove that this renunciation of the charge of heresy, this declaration that the asserted infallible power never showed itself, is no subterfuge of modern Romanists, but was the argument of the time when Galileo was under the ban; was held, among others, by a distinguished opponent of the Copernican doctrine, the very last person who was likely to have had any bias towards such reasoning; and was allowed to pass a strict censorship of the press.

But not only do Catholic writers thus express themselves, but contemporary Protestants, the most staunch opponents of Rome, accept the interpretation. Thus Bishop Wilkins, a decided Puritan, writing in 1640, after stating that some individuals, as Serrarius, expressly condemn the Copernican doctrine as a heresy, proceeds as follows: 'And since him, it hath bin called in [question?] by two Sessions of the Cardinals as being an opinion both absurd and dangerous. And therefore likewise doe they punish it, by casting the Defenders of it into the Pope's truest Purgatorie, the Inquisition: by yet neither these Councels, nor any (that I know of) since them, have proceeded to such a peremptorie censure of it, as to conclude it a heresie; fearing, perhaps, lest a more exact examination, and the discoverie of future times, finding it to bee an undeniable Truth, it might redound to the prejudice of their church, and its infallibilitie.'

It is moreover to be remembered that the Inquisition, and even the Congregation of the Index, was a local authority, incompetent to legislate for the faith of all Roman Christians. There was nothing in what was done by the Italian to hinder the Spanish Inquisitors from declaring in favour of Copernicus, if such had been their pleasure: and, in fact, we have searched the Spanish Index of 1667 in vain for the name of Copernicus, though some of his followers are in the list.

Lastly, if we remember the controversy which has always existed in the Roman world as to the character of decrees emanating from the Roman See alone, without a general council, we shall see that it would have been very unlikely that a pope should have raised this question in France, Spain, and Germany, upon a matter which might any day be settled against him by absolute demonstration. Tiraboschi looks upon it as a special Providence that the Church was not allowed to commit itself; and we apprehend that most Roman Catholics will be of his opinion. But they must admit, as they have had to do in many other cases, that their earthly head used his power in a most unworthy manner, and found agents who were the subservient creatures of his irritated feelings. Protestants, on the other hand, should beware how they weaken the general argument against the infallibility of the Roman church, by practically owning that it cannot be successfully attacked except by denying to those who maintain it the right to be the interpreters of the sense in which they use their own words.

Though we differ entirely from the article in the 'Dublin Review,' the substance of which we have quoted, yet it is right to say that we find in it a large quantity of collateral information, put together in a manner which strikingly exhibits the under current of favour which was setting towards the doctrines of Copernicus, when its imprudent advocates began to mix theological with their physical arguments. Had we intended this comment to be a biographical one, we should have had to make use of its details; and we should be very glad to see the numerous interesting citations which it contains worked into truer history, supported by fuller reference, and dignified by milder language towards opponents.

GA'LIUM (from γάλα, 'milk'), a genus of plants belonging to the natural order Galiaceæ or Rubiaceæ. The corolla is rotate, 4-parted; the fruit dry, not crowned with the calyx, and composed of 2 indehiscent 1-seeded mericarps. The species are branched herbs with variable inflorescence.

G. cruciatum, Crosswort, has elliptic oblong hairy leaves, four in a whorl; the flower-stalks lateral, corymbose, bracteated; terminal fertile flowers, mostly staminiferous; the fruit-stalks deflexed, and the fruit smooth. It is a native of Europe, and is commonly found in Great Britain.

G. mollugo, Great Hedge-bedstraw, or Wild Madder, has about 8 leaves in a whorl, they are lanceolate-obovate or obovate-oblong; the margins rough with prickles pointing forwards; the branches of the panicle many-flowered, the lower ones spreading horizontally; the fruit glabrous. This species is a native almost throughout Europe and the Caucasus, and is found in Britain. The flowers are white, and sometimes yellowish. The roots are creeping, and yield a red dye like the true madder, but of a brighter colour; they also have the property of colouring the bones of animals red that feed upon them. This plant has been extolled by M. Jourdan, the director of the hospital at Tain in Dauphiny, as an effectual cure for epilepsy. It is however to be feared that the cases he details, which are certainly very marvellous, will not justify his reliance on this remedy.

G. tinctorium, the Dyer's Bedstraw, has smooth decumbent stems; linear obtuse leaves, scabrous on the margin and keels; elongated, axillary, terminal, and many-flowered peduncles. The corolla has 4 obtuse lobes, and the fruit is smooth and glabrous. This species is a native of North America, in low marshy places, especially in Canada and Newfoundland; it is also found in the Straits of De Fuca. It is very nearly allied to *G. trifidum*, but is distinguished by the stems being smooth and the flowers always 4-parted.

G. palustre, a native of Great Britain, nearly resembles

---

[*] This word rash, *temerarius*, is of great force. It had a technical meaning, and was constantly used at the time of which we write, as for aught we know it may be now, as an epithet distinctive of an offence minor to heresy. Accordingly when a priest styles the opinion *rash*, it is to be inferred that he would refuse to say it was *heretical*: just as, hearing a lawyer call an offence manslaughter, we should suppose him to deny that it amounted to murder. So that, when Mersenne qualifies as only *temerarium* that which the court of which he is speaking had pronounced *falsum et formaliter hæreticum*, he limits the power of that court in the same manner as Fromond did, though more briefly.

G. tinctorium when the leaves are more numerous than usual. It is said that from the roots of this plant the Indians extract the red dye with which they colour their feathers and the ornaments of their dress.

G. septentrionale, the Northern Bedstraw, has erect tetragonal smooth stems; oblong lanceolate leaves, 4 in a whorl. The fruit is beset with hooked bristles; the flowers are numerous and of a milk-white colour. The Cree women use the roots of this plant to dye red. It is a native of North America, about the lakes of Canada and the United States.

G. verum, Ladies' Bedstraw, or Cheese-rennet, is distinguished by having its leaves about 8 in a whorl, linear-setaceous with revolute margins, channelled above, downy beneath. The flowers in numerous small dense panicles of a golden yellow colour. On loose sandy soils the flowers are sometimes solitary and the stems much more branched, but agreeing in other respects with this species. It is a native of Europe and Siberia, in meadows, woods, and among bushes, and is found in Britain very commonly in dry soils. The stalks and flowers of this plant have been used in the cheese counties for the purpose of curdling milk, and also for colouring it. Mathiolus says it produces an agreeable flavour and makes the cheese 'eat sweeter.' The French formerly used to prescribe the flowers in hysteria and epilepsy. The roots affords a rich red dye, superior in colour to madder. It was grown at one time as a substitute for the true madder, *Rubia tinctorum*, but the roots are too small to render its culture profitable. This plant seems to be the *γάλιον* of Dioscorides.

G. aparine, the common Goose-grass, or Cleavers, has from six to eight leaves in a whorl; they are linear-lanceolate with marginal prickles pointing backwards; axillary 3-flowered peduncles; reflexed granulated fruit. It is a native throughout the whole of Europe, north of Asia, and North America, in hedges, fields, and most cultivated places; it is plentiful in Great Britain. This plant, according to Burnett, was fancifully called by the Greeks *Philanthropos*, as they attributed the readiness with which it cleaves to our habiliments to a love of the human species. A mechanical cause will however fully account for this tendency. It is thus it has acquired the names of Cleavers, Catch-weed, &c., and from being a favourite food or medicine of geese, that of Goose-grass. Dioscorides relates that this plant was used by the shepherds of his time as a sieve to strain milk, and Linnæus tells us it is still made use of in Sweden for the same purpose. It is the *ἀπαρίνη* of Theophrastus. The expressed juice of this herb taken in doses of four ounces or a quarter of a pint night and morning, during several weeks, is said to be a very beneficial remedy in cutaneous disorders, and is believed by the country-people to be a purifier of the blood and an antiscorbutic. The seeds have a corneous albumen, and when roasted have been used instead of coffee. We are not aware that they have been analysed, but it is not improbable that they contain a principle similar to caffeine, and if this be the case, they would form a valuable substitute for coffee. The roots of this species, like most of the genus, afford a rich red dye, and birds that feed on them have their bones tinged with the colour. The roots of G. tuberosum are farinaceous, and in China are cultivated as a dietetic vegetable. Loureiro says that, when boiled, they are both wholesome and nutritious. Don enumerates 164 species of Galium, which are distributed in every quarter of the world. The common name Bedstraw given to all the species, is from the verb to *strew*, antiently written *straw*. Before the introduction of modern luxuries beds were made by strewing with various herbs, and doubtless this was one used for that purpose, and has thence acquired its common name. These plants are very easily cultivated and propagated; they will grow in any common soil, care being paid to the situations in which they are placed, which should as much resemble their natural positions as possible; those brought from marshes and bogs should have a moist soil, and the natives of warmer climates should be protected during the winter. None of them however are worth cultivation unless in botanical gardens.

(Fraas, *Synopsis Plant. Floræ Classicæ*; Don, *Gardener's Dictionary*; Burnett's *Outlines of Botany*; Babington's *Manual of British Botany*.)

GALLA. [Abyssinia, P. C. S., p. 23.]

GALLERY, a name of distinction given to a room either on account of its extent and proportions, or to one or more rooms especially appropriated to pictures and other works of art, whence the term 'Gallery' is extended to the collection itself, without any reference to the building. Thus what answers to the term in one sense may not in the other; or it may do so in both. In architectural language a room can hardly be called a gallery unless its length be three times its width, for else, though as a room it might be considered long, as a gallery it would be short; therefore if a spacious apartment, it would answer to the character of a hall, as is the case with the Waterloo Gallery in Windsor Castle, whereas the adjoining St. George's Hall, might more appropriately be termed a gallery, its proportions being those of one [Windsor Castle, P. C.]; on the contrary, the Victoria Gallery, in the new Palace of Westminster, will, according to the architect's own admission, be 'avowedly a hall, and not a gallery,' its dimensions being 100 feet by 45, consequently an architectural misnomer has been intentionally given to it. But though the length of a gallery as compared with its breadth ought not to be less than what has been stated, it may be increased to any extent without danger of excess, unless the gallery should thereby be rendered far too pompous and spacious to be at all in keeping with the other apartments, as was generally the case in Elizabethan mansions. The proportion as to height in galleries is regulated solely by width, which may be nearly equal to each other, the height being a little more or less than the breadth, according as the ceiling is arched or flat, because the height being the same, the walls will be lower in the former case than in the other. It is to be observed, however, that a very long gallery will bear to be somewhat loftier than one of moderate length; at the same time it must be borne in mind that the height must not be such as to occasion the effect of narrowness and produce the proportions of a mere corridor. Very low proportions, on the contrary, rather than height, are one characteristic of galleries of the Elizabethan period, so much so that some of them look quite depressed by their heavy flat ceilings, whereas halls in the same buildings are frequently disproportionally high, owing to their occupying two storeys of the building, and being, besides, sometimes not twice their width in length.

There is hardly anything in the interior of a building which lends itself so readily to architectural effect as a gallery, since, if it at all answers to its name, there will at any rate be that of lengthened perspective and vista. In fact the very name itself excites expectations of superior design and taste, because rooms of the kind belong to the luxuries of architecture and are rather intended for state and display than for any actual use as rooms, except on extraordinary occasions. Hence galleries are by no means common even in spacious and sumptuous mansions; consequently it very rarely happens that an architect has an opportunity of exercising his talent for interior design upon what holds out so much scope for the display of it; and this, no doubt, is one chief reason why the subject itself is so slurred over in professional treatises; for it certainly does lie quite out of the track of everyday practice. Still, in itself it is one of such very great interest, that it is rather surprising that no one should ever have thought of giving us a 'Recueil et Parallèle' exhibiting the principal varieties of galleries.

All that can be done here is to indicate some of the principal varieties with regard to mere matters of plan, section, and lighting, independently of style and decoration, and we hardly need say that the value of these latter is greatly enhanced by the effect arising out of the first-mentioned circumstances, for great taste may be shown in the embellishments of such an apartment, and yet its general design may be exceedingly common-place, so that though it may say very much for those who are employed to give the finishing touches to the architect's work, it may say nothing at all for the architect himself. As far as plan alone is concerned, there is nothing calling for remark further than what has already been touched upon with respect to proportions, when a gallery forms a single uniform space from end to end. It is only when we come to *compound plans* that we can obtain *combinations of plan*; and the very first step towards these is the usual mode of merely dividing the room into three compartments by means of columns, but which is practised with scarcely any variety, the number of columns between the centre and the end spaces of the plan very rarely exceeding two, and there being as rarely a decided expression given of division, by boldly projecting *antæ-piers* so as to contract the openings between the several compartments of the plan, and thereby define these latter the more distinctly. Almost the only variation which this very simple sort of division of plan into compartments admits of arises from the proportions of the respective spaces, and the ratio which they bear to other; that is, accordingly as the end compartments are shallower or deeper in themselves, or are either deep or shallow in comparison with the principal division of the room.

The next step approaching to combination of plan in the simplest form of it, is the making the end compartments curvilinear, that is, either semicircular or segmental but otherwise of the same width as the rest of the room. In regard to the mode of merely dividing off the ends of the gallery by columns, almost the only other matter of plan calling for observation, is that the door leading into the room is almost invariably placed in one of the end compartments, but it should also, if at all practicable, be not on one of the sides, but at the end of the room, and occupy a central position there, the entering any room of the kind at one angle of it, being attended with a disagreeable awkward effect, for we ought to advance directly forward into a gallery, and behold it before us in its full expanse instead of *sidling* into it.

We now come to those combinations where the plan is divided into distinct compartments, all opening into each other, instead of forming a suite of separate rooms. In galleries of this class the arrangement is usually a *triple* one, and the middle division or body of the gallery is almost always considerably larger—that is, longer than the two end ones, besides being distinguished in other respects, whether by greater plainness or greater richness of architecture, or by any other circumstance. Accordingly, an almost inexhaustible fund of combinations and contrasts thus opens itself to the architect: first, as regards *Plan*, there may be more or less of difference and contrast between one portion of it and another in respect to shape, size, and proportions; and the variety hence obtainable will be greatly increased, if, instead of the entire plan being of the same width throughout, some parts of it are wider or narrower than others. Neither is this all, for similar contrasts and combinations hold themselves out with regard to *Section;* since, instead of being of uniform height throughout, some parts of a gallery may be considerably loftier than the rest, whether the increased height be given to the body or the extremities; neither is difference of height the only difference connected with section, because, the height being the same or nearly the same throughout, some of the compartments of the plan may have flat ceilings, others vaulted ones. And again, in respect to *lighting*, the body of a gallery may be lighted entirely from above through a lantern or other skylight, &c., while the extremities are lighted either from one side, or by a window at each end of the gallery; or else the opposite mode may be adopted;—matters of this kind depending upon local circumstances and necessities of the general plan of a building.

In order to illustrate what has just been said with reference to varieties of Plan and Section, by positive instances of them, we will take merely three examples of galleries, which all agree in consisting of three divisions, yet in every other respect are of totally different character. The first of them, the Statue-gallery at Holkham (the seat of the Earl of Leicester) is a singularly beautiful though by no means a particularly splendid interior, or one remarkable for its size, the entire length being only 108 feet. It consists altogether of two octagons (21 feet in diameter) and a centre (50 feet by 21), connected together only by an open arch at each end, so that the body is almost shut up from the other two divisions, more especially as although open those arches are set back within *tribunes*, or large semicircular recesses, whereby the full length of the body is increased to 60 feet. Were it not, therefore, that the whole is thrown open from end to end without any separation by doors, the centre would of itself hardly constitute a gallery in the strict architectural meaning of the term, nor would it be a particularly large, though still a very elegant and characteristic room. In this example the centre one is the lowest of the three divisions, its height being 23 feet, while that of the octagons is 32 feet, the ceilings of the latter forming domes, while that of the centre is flat.

The gallery at Castle Howard (the designs of which were published by its architect, the late C. H. Tatham, together with those of the Picture-gallery at Brockelsby) is of quite different character from the Holkham one, for the centre division of it is, though much shorter, of greater diameter than the other two, and also much loftier, it being an octagon of 38 feet, and of the same height, while the other two divisions are each 60 by 24 feet, and 24 in height. The three compartments of the plan are connected into one gallery by two spacious open arches. The effect would, no doubt, have been greatly enhanced had the central octagon been lighted from above instead of from one of its sides. Our third example is the Gallery at Shelburne or Lansdowne House, Berkeley Square, as shown in Adam's designs, where, however, it is far from being satisfactorily explained, there being not so much as a single section of it. Here the three divisions of the plan are very nearly equal in size, the two end ones being rotundas 30 feet in diameter, and the middle one 30 feet in breadth by only 8 feet more in length. The whole, however, is thrown more into a single apartment than is the case in the two preceding instances, the openings between the respective portions being wider, each consisting of three open intercolumns. It may be presumed that the two rotundas are lighted from above, yet whether they are also domed, and if so, in what way, is not shown, although some express information would certainly not have been at all superfluous; on the contrary, far more to the purpose than those trivial matters which occupy so many of the plates in Adam's work.

These few instances must suffice, and they will at least serve to make manifest how many combinations of form (those of both plans and sections put together), and what infinite variety of proportions may be produced. To bring forward other examples would not be difficult; we cannot however forbear adverting to Soane's 'Royal Gallery,' at the House of Lords (which will now shortly disappear), for although of no great size—only 100 feet in its fullest extent, or 75 by 20 feet, exclusive of the portion cut off by columns at one end as a vestibule between it and the staircase—it is of exceedingly scenic design and impressive character, replete with perspective and picturesque effect, though it must be admitted that much of the detail is in very poor, not to say very bad taste. For much of its character and effect it is indebted almost entirely to the mode of lighting it, to the arrangement of the windows and lanterns, and to the use of coloured glass in the lanterns, of a uniform warm tint, so as to shed a sunny hue over the architecture. There is, besides, very great play of outline in the section, the average height of the gallery being only 21 feet, while that of the centre compartment is 28, which is further increased to 45 feet by a tambour dome with eight Ionic columns, forming an open peristyle within that lantern; of the smaller lanterns over the two other compartments of the plan the height from the floor is 31 feet. The plan also is marked by a somewhat similar degree of play and variety, for each of the end compartments has an arched recess on each side of it, and likewise two columns on each side; and this variety and complexity of both plan and section render it impossible to show this gallery in a perspective drawing otherwise than partially and imperfectly, since it requires to be looked at from so many and such different points of view, affording as it does a succession of effects which drawings, even when they are perfectly understood, leave it to the imagination to shape out for itself.

Differ as they may in all other respects, galleries agree in one, namely in forming an extended line; or if they branch out in any direction, the separate parts are still so many straight lines. We are aware of but one instance of a *circle* being employed for the plan of a gallery, and it is one so remarkable for its beauty as well as singularity of effect as to claim particular notice here, more especially as, besides being quite a new idea in itself, it is capable of being further applied under a variety of circumstances. We allude to the *Glyptotheca* of the Colosseum in the Regent's Park, which, as now fitted up for the exhibition of sculpture (1845), forms a complete circle, with a peristyle of twenty columns of the Ionic order, and as many recesses within the colonnade, answering to the number of inter-columns, except that two of those spaces, one on the east, the other on the west side, are made use of for entrances. The whole is lighted from above, through the compartments (filled in with cut-glass) between the ribs of the roof, which last, instead of expanding itself into a dome, becomes merely a cove in consequence of the cylindrical mass in the centre of the plan, and which may be considered the *core* of the structure, rising up through what would else be a dome covering the entire space; and in like manner, were it not for that cylinder within it, this interior would be merely a rotunda of the usual kind, whereas now it is converted into one of altogether different character; though no doubt not with any view at all in the first instance to architectural character or effect of any kind, but solely in consequence of the indispensable necessity of carrying up a staircase in the very centre of the building to the platform which the Panorama is viewed from. It was accordingly sheer necessity which originally compelled the architect to adopt a peculiarity of plan that has since been so admirably turned to account; and besides being unusually attractive for its architectural beauty, this gallery is excellently well contrived for the exhibition of either sculpture or pictures; because, though the peristyle is circular, the wall behind it may be a polygon of as many planes as there are intercolumns—in this instance twenty: and by being so divided into separate compartments or groups, pictures may be arranged better with regard to some sort of classification than when hung up on the side of a long wall without division of any kind from end to end. The convex part of such a double cylindrical plan might in like manner be rendered available for hanging pictures—were such the purpose of the gallery—by making that also a circle of columns; the columns being in this case *engaged* or attached to the wall, which last would consist of as many separate planes or flat surfaces as intercolumns; and in order to keep up perfect symmetry in regard to intercolumniation the two circles might be so proportioned to each other that the larger or outer circle would have just twice the number of the columns on the circumference of the smaller circle or cylinder, the intercolumns being of the same width in both circles. This would of course very greatly increase the diameter of the cylinder, to somewhat more than half that of the larger circle; consequently, supposing the breadth of the gallery, or space between the two concentric circles of the plan, to be the same as in the Glyptotheca of the Colosseum, the whole plan would be greatly enlarged, and there might be a rotunda fifty feet in diameter in the centre of it; so that in a gallery thus planned the *ring* or outer portion might be appropriated to pictures, and the inner one form a circular hall for sculpture. Thus the arrangement of plan being just the same as at the Colosseum, the architectural character of the structure would become different, inasmuch as by being increased in circumference the *ring* would acquire more of the appearance of a gallery, and in some degree lose that of a rotunda with another structure built up in the centre of it. Though it has hitherto been quite overlooked, the same general disposition of plan—and it is one that plainly enough shows itself in the concentric circles of Druidical pillars in such monuments as Avebury [AVEBURY, P. C.] and Stonehenge—is applicable to a very great variety of cases.

Other circumstances being the same, the character of a gallery is greatly modified by the manner in which it is fitted up in accordance with either some specific destination or a general one; for it may be only a superior kind of corridor uniting the principal apartments, or intended exclusively as a picture-gallery, statue-gallery, or library, or partake of the character of all; and that, again, either by a miscellaneous distribution of its contents, or by one division of the room being assigned to pictures, another to statues, a third to books. There is a great difference between a long room of the kind that is merely hung with pictures, as is the case with galleries in Elizabethan mansions, and one which is built expressly as a picture gallery, for the purpose of displaying both the entire collection and the individual works to the best advantage. We subjoin a list of some galleries, in addition to those noticed, in order that their respective dimensions and proportions may be compared.

	Length. feet.	Breadth. feet.	Height. feet.
British Museum, King's Library. Three compartments	300	41; 58 in centre	30
All Souls', Oxford, Library	198	32	40
Arundel Castle	195	12	
Trinity College, Cambridge, Library	190	40	38
Montacute	189	21	
Blenheim Library. Five compartments	183	32	20
Wentworth Castle	180	24	30
Hardwicke	166	22	22
Hatfield. In three compartments; ends 22 feet square	163½	19½	15
Buckingham Palace	157	27	
Woburn Abbey, Statue Gallery	136	25	
Stafford House	132	24	32
Sion House, Library	136	14	14
Chatsworth	103	30	22

GALLUS, C. AQUILIUS, was a Roman eques and a friend of Cicero. He was praetor B.C. 66. Gallus was a pupil of Q. Mucius Scaevola, the Pontifex, and obtained a great reputation as a jurist. He was both a skilful advocate and a learned expounder of the law. The distinguished jurist Servius Sulpicius was a pupil of Gallus; and either edited his works or incorporated them in his own writings. Gallus was praetor in the same year that Cicero was, and presided on the trials on Ambitus (bribery at elections); and accordingly Cicero calls him his colleague (*Topica*, 7), and in another passage he has preserved the legal definition of Littus which Gallus on some occasion gave (*Topica*, 12). Gallus was the author of an edictal rule or formula as to dolus malus (fraud) in matters of buying and selling, which he promulgated as praetor (Cic. *De Officiis*, iii. 14; Dig. 9, tit. 2). The Lex Aquilia, which gave the actio damni injuria (Dig 9, tit. 2; Gaius, iii. 210), was not proposed by this Aquilius, but by a tribune Aquilius. The high opinion which Cicero entertained of his friend Gallus is expressed in his oration Pro A. Caecina (c. 27), where he pronounces upon him a eulogium which few lawyers have merited: 'The authority of such a man can never have too much weight, whose judgment the Roman people have seen tried in providing security against fraud, not in showing how fraud may be practised; a man who never separated the principles of law (jus civile) from those of equity, who for so many years dedicated his genius, his industry, and his integrity to the Roman people, which integrity was ever ready and ever at command; who is so great and good a man that he seems to have been formed a lawyer by nature, and not by education; so skilful and so learned that not knowledge only but goodness too appears to be the product of the law; whose genius is so powerful, whose integrity so manifest, that whatever you draw from that source you will find to be pure and clear.' Cicero's oration Pro P. Quintio was made before Gallus as judex. Gallus is cited several times in the Digest (50, tit. 16, s. 77; 46, tit. 4, s. 18, &c.), but there is no excerpt from his writings. Gallus devised or expounded some clauses of the formula of Accepitalio (Dig. 46, tit. 4, s. 18). Valerius Maximus (viii. c. 2) relates a case in which Gallus refused to allow a woman with whom C. Visellius Varro had cohabited, to sue on a security which Varro in his illness had given her, and which the woman attempted to enforce when he recovered.

(Grotius, *Vitae Jurisconsultorum*; Orelli, *Onomasticum Tullianum.*)

GALLUS, AELIUS, a contemporary of Cicero, and a learned jurist, wrote a treatise on the signification of terms (Gellius, x. 22), from which a single excerpt is given in the Digest (50, tit. 16, s. 157).

GALLUS, AELIUS. [ARABIA, P. C., p. 215.]

GALLUS, JULIUS AQUILA, or Julius Gallus Aquila, a jurist under the empire, of uncertain date. There are two excerpts in the Digest from his Liber Responsorum (26, tit. 7, s. 34, and 26, tit. 10, s. 12).

GALT, JOHN, was born at Irvine in Ayrshire, on the 2nd of May, 1779. His father was a sea-captain in the West India trade. About the eleventh year of his age his parents removed to Greenock; and in that busy town he received an education for commercial pursuits, any literary cultivation beyond this point being the fruit of his exertions in hours of leisure. In conformity to his mercantile destination, he spent some time as a clerk in the Greenock custom-house; whence he was transferred, in the same character, to the counting-house of a mercantile firm in the place. When he was between twenty and twenty-five years of age he left Scotland for London, where he intended to establish himself as a merchant. His literary propensities, however, which had previously led him into frequent compositions, were further nourished by a few months of inaction in the metropolis. The result was, the production of a poem in octo-syllabic verse called 'The Battle of Largs,' portions of which were printed in the 'Scots' Magazine' in the course of the years 1803 and 1804, and on the originality of which (as having preceded Sir Walter Scott's metrical romances) he prided himself not a little in after-life. Other studies, chiefly in history and political economy, were prosecuted occasionally after he had embarked in commerce. He did so in partnership with another young Scotchman; but the partners disagreed, their affairs became entangled, and in about three years the firm was bankrupt. After a short attempt to re-establish himself in business along with a brother, Mr. Galt entered himself at Lincoln's Inn; but determining (partly for the sake of his health) to spend abroad some part of the time before his being called to the bar, he left England in 1809.

His travels lasted for nearly three years. He afterwards described them in two works: 'Voyages and Travels in the years 1809, 1810, and 1811, containing Statistical, Commercial, and Miscellaneous Observations on Gibraltar, Sardinia, Sicily, Malta, and Turkey,' 1812, 4to.; and 'Letters from the Levant, containing Views of the State of Society, Manners, Opinions, and Commerce, in Greece and several of the Principal Islands of the Archipelago,' 1813, 8vo. Soon after his return he married Elizabeth, daughter of Dr. Tilloch, the editor of the 'Philosophical Magazine,' and also proprietor of the 'Star' newspaper, on which Mr. Galt was for some time employed. By this lady he left two sons. He now wrote the following works:—'The Life and Administration of Cardinal Wolsey,' 1812, 4to., 1818, 8vo.; 'Reflections on Political and Commercial Subjects,' 1812, 8vo.; a volume of 'Tragedies' (Maddalen, Agamemnon, Lady Macbeth, Antonia, and Clytemnestra), 1812, 4to.; 'The Life and Studies of Benjamin West, Esq.,' 1816, 8vo., 1818, 8vo. He edited also, during its short career, 'The New British Theatre,' which was at first intended to contain a series of dramas rejected by the managers; and in which, besides other contributions of the editor, was printed a vigorous tragedy called 'The Witness.' These productions however were composed in the intervals left by undertakings of other kinds, chiefly commercial. In the course of his travels he had devised a scheme for importing British goods into the Continent by way of Turkey, notwithstanding Napoleon's decrees of exclusion; and he spent some time in vain endeavours to obtain support for this plan. On another occasion he acted as a parliamentary agent for a Scottish canal bill. In short, although he soon gave up the design of studying the law, he was resolutely desirous to obtain a footing in some department of active business, and entertained a strong reluctance to considering literature as the main employment of his life.

Down to this time, indeed, his literary success had by no means been great. His works had not generally obtained credit even for the shrewdness and comprehensiveness of thinking, and the acute observation of life, which they really evinced: while his tendency to paradox in opinion, his oddity and clumsiness of language, and the coarseness with which his vigour of feeling was alloyed, had furnished topics of ridicule to some who thought his works worth criticising. It was particularly provoking to him, that not only his poetical efforts, but also his speculations on politics and society, should have been handled most severely in the 'Quarterly Review,' the literary organ of the party to which, although too independent and eccentric to be relied upon as a partisan, he always professed to belong.

He was hardly more successful in his next literary attempt, 'The Earthquake,' 3 vols. 12mo., 1820, a serious novel, marked by that clumsy and gloomy strength of feeling which pervaded his dramas. But he now hit upon the ground in which lay his strength, the delineation of familiar Scottish life, in his own inimitable vein of quaint, shrewd, homely, observant humour. In 1820 and 1821 his 'Ayrshire Legatees' appeared in successive numbers of 'Blackwood's Magazine;' and the work was immediately published separately. Its popularity encouraged him to a series of sketches similar in character. The next of these was 'The Annals of the Parish,' 1821; which, by the way, had been written several years before, and offered for publication to the bookseller Constable, who refused to venture on it. Then came the 'Provost,' 'The Steamboat,' and Sir Andrew Wyllie' (3 vols.), all in 1822; and 'The Gathering of the West,' 1823. After this he was tempted to desert his own peculiar path, by his incessant hankering after more ambitious themes and more elevated trains of feeling. This tendency was half yielded to in his novel of 'The Entail,' 3 vols. 1823; and it led him quite away in his two historical novels 'Ringhan Gilhaize' and 'The Spae-wife,' both published in 1823.

The reputation which Mr. Galt had acquired for shrewdness and activity in business, and for acquaintance with the principles and practice of commerce, now opened up for him the most brilliant prospects of his life. Inhabitants of Canada gave him a commission as their agent, to prosecute their claims on the home government for losses which they had suffered during the occupation of the province by the forces of the United States. The negotiations arising out of this affair issued in the adoption by the government of a proposal made by Mr. Galt, to sell crown lands in Upper Canada, for the purpose of defraying the claims of his constituents. The Canada Company, incorporated in 1826, undertook to purchase those lands and to colonise them. Before the company obtained its charter, Mr. Galt had gone out as one of the government commissioners for valuing the lands, and had returned to England in the summer of 1825. In the autumn of 1826, when the sales had taken place, he was sent out by the Company, being at first employed in making inquiries for them and in arranging their system of management; but being afterwards appointed the superintendent of their operations. Under his direction were founded the earliest of those settlements which are now acquiring so much importance: Guelph was entirely a place of his making; and the village of Galt received its name from him. In his last days of sickness and sorrow, he was wont to declare that the consciousness of having benefited his country materially, by his services in the colony, was almost his only consolation in looking back upon a life full of bitterness and disappointment. But even these services were not so performed as to earn a reward. His conduct, although distinguished by great intelligence, energy, and enterprise, appears to have been deficient not only in commercial caution, but in deference both to the provincial government and to his employers at home; and he himself always maintained that the colonial authorities were prejudiced against him as a democrat, by misrepresentations of the tenor of his books of travels. The governor, Sir Peregrine Maitland, sent home complaints against him; alarm was excited about the Company's affairs; and the directors superseded him. He returned to England in the spring of 1829, after a residence of about two years and a half. Soon afterwards, being pressed by some of his creditors, he took the benefit of the Insolvent Debtors' Act.

After this unfortunate catastrophe, Mr. Galt, now fifty years old, did not again make any sustained attempt at obtaining mercantile occupation. The embarrassment of his affairs forced him upon authorship for the subsistence of himself and his family; and, although he was not able to produce any work comparable to the few which had gained for him his literary celebrity, the circumstances in which his exertions were made were such as to render his active industry at once meritorious and touching. His earliest works in this period were his novels of 'Lawrie Todd' and 'Southennan,' and the caustic 'Life of Lord Byron,' 1830. While writing the last of these he undertook the editorship of the 'Courier' newspaper, which however he very speedily resigned. His health now broke up rapidly. He had already had a slight shock of paralysis; a second occurred soon after his withdrawal from the newspaper. But his literary exertions were never relaxed, unless for a short time, when he attempted the formation of a new American Land Company.

About midsummer, 1832, paralysis recurred with increased violence; and from that time he was a confirmed invalid. He retired to Scotland, where repeated attacks of palsy made his body an utter wreck, but with surprisingly little effect on his courage or on the vigour of his intellect. His memory failed much, but his invention was active to the last. He continued to dictate his compositions to a young amanuensis or to any friend who happened to visit him, long after he had lost the use of every limb. Volume after volume, so composed, and committed to the press, as he himself said, 'to wrench life from famine,' ought to receive, not the unfavourable judgment merited by unavoidable defects, but the compassionate forbearance due to the manly fortitude of the ill-fated author. Among these fruits of decay, there were, besides several novels and tales, and contributions to periodicals, two works which give, in a very incomplete and disjointed state, much information about his life and writings: 'The Autobiography of John Galt,' 2 vols. 8vo., 1833; and 'The Literary Life and Miscellanies of John Galt,' 3 vols. 12mo., 1834.

Mr. Galt died at Greenock, on the 11th of April, 1839, when he had almost completed his sixtieth year, and a few days after he had suffered his fourteenth stroke of palsy. The list of his writings, as given by himself (perhaps incompletely, and omitting many papers furnished to periodicals), is very large. His novels alone are twenty-four in number, making about fifty volumes; his dramas are hardly less numerous; his biographical and miscellaneous works are even more so.

GAME LAWS. [Game Laws, P. C.] Some portion of the history of the game-laws in England will be found under Forest-Laws, P. C., and Warren, Free, P. C. Game has constantly been a subject of legislation from the Conquest to the present time. The last general statute which relates to game (2 Wm. IV. c. 32) was enacted in 1831, and it repealed twenty-four acts, eight of which had been passed in the reign of George III. It is doubtful whether the evils of the game-laws have been much diminished by the act of 1831. Some of them are beyond the reach of legislative enactments.

Game is declared to include hares, pheasants, partridges, grouse, heath or moor game, black game, and bustards. Snipe, quail, landrail, woodcock, and conies are not game, but they can only be taken or killed by certificated persons.

Woodcocks and snipes may be taken with nets or snares, and also rabbits, by the proprietor, in an enclosed ground, or by a tenant and his servant.

A penalty not exceeding 2*l.* over and above the value of the bird is incurred for killing, wounding, or taking any house-dove or pigeon when the offence does not amount to a larceny (7 & 8 Geo. IV. c. 29).

Any person who purchases a certificate or licence may kill game upon his own land, or on the land of any other person with his permission. This important alteration of the law was effected by 2 Wm. IV. c. 32, before which time a person was required to be possessed of a qualification by estate or birth to entitle him to kill game. The statute 13 Richard II. c. 13, the title of which was, 'None shall hunt but they who have a sufficient living,' was the first introduction of a qualification to kill game. This statute prohibited laymen who had not lands or tenement of 40*s.* a year, and priests who had not 10*l.* a year, from taking or destroying deer, hares, or conies, upon pain of one year's imprisonment. By 3 Jac. I. c. 13, the qualification to kill game was increased to 40*l.* a year in land and 200*l.* in personal property. By 22 & 23 Car. II. c. 25, the qualification was limited to persons who had an estate of inheritance of 100*l.* per annum or an estate for term of life or 99 years, or upwards of 150*l.* annual value. On this Blackstone remarks, there was 'fifty times the property required to enable a man to kill a partridge, as to vote for a knight of the shire.' Qualifications were also of a personal nature, as being the son and heir apparent of an esquire. Persons who had not these qualifications were not allowed to have or keep game dogs.

Certificates were first required to be taken out by persons qualified to kill game by the act 25 Geo. III. c. 50. The certificate itself, which costs 3*l.* 13*s.* 6*d.*, now gives a qualification. It must be taken out annually, and expires in July. A sportsman who refuses to show his certificate when demanded by collectors of taxes, gamekeepers, landlords, occupiers, and lessees, is liable to a penalty of 20*l.* Uncertificated persons who kill or take any game, or who use any dog, gun, &c. for the purpose of searching for or killing or taking game, are liable, on conviction before two justices, to a penalty not exceeding 5*l.* for each offence, with additional penalties under the Certificate Act of 23*l.* 13*s.* 6*d.* Penalties under 1 & 2 Wm. IV. c. 32 are given to the parish, to be applied in aid of the county-rate, and in some cases a portion of the penalty goes to the informer.

The right which a certificate gives to kill game is subject to a number of restrictions. A certificated person is liable to a penalty of 5*l.*, with costs, for taking or killing game on Sunday or Christmas-day, and to a penalty not exceeding 20*s.* for each head of game taken or killed at the season when the pursuit of each kind of game is prohibited. He is subject to the general law of trespass for going upon another person's land. The right to the game is vested by 1 & 2 Wm. IV. c. 32, in the tenant in all cases where it is not reserved to the landlord in his agreement with the tenant; but the game is generally coveted by the landlord, and few tenants are in a situation to oppose their landlord. The consequence is that the game is reserved by the landlord when he lets his land, and when this is the case, the occupier can neither kill game nor give permission to another person to do so. He is liable under 1 & 2 Wm. IV. c. 32, to a penalty of 20*s.*, with costs, for every head of game killed by him or other persons authorized by him. When the landlord reserves the game, he may kill it on the tenant's land, or authorize any certificated person to enter on the land and kill the game. The tenant may kill woodcocks, snipes, quails, landrails, or rabbits, on the land which he occupies, but he cannot authorize other persons to kill them. The person who has the right of killing the game, or the occupier of the land, or gamekeepers, or any person authorized by either of them, may require a person found trespassing in pursuit of game to quit the land, and to give his name and place of abode; and in case of refusal, the trespasser may be taken instantly before a magistrate, who may fine him 5*l.*; but if not brought before a magistrate within twelve hours, proceedings must be taken by summons or warrant. If five or more persons together trespass in pursuit of game, and any one of them be armed with a gun, and if threats or violence are used to prevent any authorized person from approaching them for the purpose of requiring them to quit the land, or to tell their names and abodes, every person so offending is liable to a penalty not exceeding 5*l.*, in addition to any other penalty with costs.

The law is very severe against persons not authorized, who take or destroy game by night. By 1 & 2 Wm. IV. c. 32, 'day-time' is to be deemed from one hour before sun-rise to one hour after sun-set. The 9 Geo. IV. c. 69, enacts, that if any person by night shall take or kill game or rabbits on any land, or shall enter therein with gun, net, engine, or other instrument, for the purpose, he shall, on conviction before two justices, be committed to hard labour in the house of correction for a term not exceeding three months, and, at the expiration of that period, find securities for twelve months, himself in 10*l.* and two others in 5*l.* each, or one security in 10*l.* In case of not finding sureties (and it is not a likely case that night-poachers should be able to find them), the offender may be further imprisoned six months. For a second offence the term of imprisonment is extended to six months, the sureties are doubled, and required for a period of two years. If the offender cannot find sureties, he may be further imprisoned for twelve months. The third offence is punishable with transportation for seven years, or imprisonment with hard labour in the house of correction for a term not exceeding two years. Offenders under this act may be apprehended on the spot by owners and occupiers of lands, their servants and assistants; and if they assault or offer violence with gun, club, stick, or otherwise, they are liable to be transported for seven years, or to be imprisoned with hard labour for two years. The punishment for night-poaching is still more severe when three or more persons enter any land for the purpose of taking or destroying game or rabbits, armed with a gun, bludgeon, or other offensive weapon, and they are subject to transportation for a period not exceeding fourteen years, or to imprisonment with hard labour for not exceeding three years. In 1844 an act was passed (7 & 8 Vict. c. 29) which extended the provisions of 9 Geo. IV. c. 69, against night-poaching to persons who take or kill game or rabbits upon public roads or highways, and other roads and paths leading to enclosed gates, and also at the gates, outlets, and openings between such lands and roads or paths.

By s. 36 of 1 & 2 Wm. IV. c. 32, it is enacted, that if any unauthorized person be found by day or night on any land in search of game, and have in his possession any game which 'appears to have been recently killed,' any authorized persons, as gamekeepers, occupiers, or others who have the right of killing the game, may demand such game and seize it if not immediately delivered.

A penalty not exceeding 10*l.* is incurred for laying poison with intent to destroy game (1 & 2 Wm. IV. c. 32).

If any person who is not authorized to kill game himself, or who has not permission from a person who has such right, shall take out of the nest or destroy the eggs of any bird of game, or of any swan, wild duck, teal, or widgeon, or shall knowingly have in his possession any such eggs so taken, he shall be liable on conviction to a penalty not exceeding 5*s.*, with costs, for each egg (1 & 2 Wm. IV. c. 32, § 24).

By the act 7 & 8 Geo. IV. c. 29, it is felony to course, hunt, snare, carry away, kill or wound, or attempt to kill of wound, any deer kept in any inclosed land, whether forest, chace, or purlieu, or other place wherein deer is usually kept. The punishment is transportation for seven years, or imprisonment for two years. If the offence be committed in the uninclosed part of a forest, chace, &c., the penalty for the first offence is a sum not exceeding 50*l.*; and for a second offence, transportation or imprisonment.

Such are the principal legal provisions respecting game which exist at the present day. This right of appointing persons called gamekeepers, who are, properly speaking, a game police, does not belong to all owners of lands. Gamekeepers were first allowed to be appointed by 22 & 23 Car. II. c. 25. Before the act 1 & 2 Wm. IV. c. 32 was passed, a person could only appoint one gamekeeper. By this act lords of manors may appoint one or more gamekeepers to preserve or kill game within the manor for their own use. Lords of manors may depute any person to be a gamekeeper to a manor, with authority to kill game for his own use or that of any other person named in the deputation. The gamekeepers are authorized to seize all dogs, nets, and other engines used for killing game by uncertificated persons.

Until the passing of the act 1 & 2 Wm. IV. c. 32, no person was allowed to sell game; but it was made saleable by this act, as the law was systematically evaded. A dealer in game must obtain an annual licence from the justices, who hold a special session in July for the purpose of granting such licences. Innkeepers, victuallers, retail beer-sellers, guards, coachmen, carriers or higglers, or persons in the employ of any of these classes of persons, are prohibited from dealing in game. Licensed dealers who buy game of any person not authorized to sell it are liable to a penalty of 10*l.* with costs. A person not being licensed, who buys game of an unlicensed person, subjects himself to a penalty not exceeding 5*l.* for each head of game, with costs.

The preservation of game is an object of constant solicitude to nearly all those who belong to the landed gentry in this country. The pursuit of game is not only followed for the sport which it affords, but because ideas derived from the feudal times still attach a social distinction to the right of killing birds and beasts of game. It is only fifteen years since this privilege was acquired only by property or birth. It is still sufficiently restricted to confer upon those who enjoy it a petty importance. Within the last fifty years game has been preserved to an excess which was previously unknown. Most of the laws relating to game which have been passed within this period have been made to enable game-preservers to indulge in this taste, and to visit with greater severity those who are tempted by the abundance of game to become poachers. The accumulation of game in preserves, watched and guarded by numerous keepers, has led to changes in the modes of sporting. The sportsman of the old school was contented with a little spoil, but found enjoyment in healthful recreation and exercise, and was aided by the sagacity of his dogs. In the modern system of battue-shooting, the woods and plantations are beaten by men and boys; attendants load the sportsman's guns, and the game is driven within reach of gun-shot, and many hundred heads of game are slaughtered in a few hours. The true sportsman would as soon think of spoiling a poultry-yard. Battue-shooting is the end of excessive game-preserving; and in this so-called sport, members of the royal family, ministers of state, and many of the aristocracy eagerly participate. In an ordinary day's sport of this description, seven or eight hundred head of game may be killed by three or four sportsmen in about four hours, and perhaps fifty or sixty wounded may be picked up on the following day. A couple of gentlemen may kill nine hundred hares in one day. On a great field-day, when the sportsmen are more numerous, the slaughter is immense. Whole waggon-loads of hares are sent off to the London and other great markets for sale, as the result of one day's sport.

The effect of protecting game by oppressive laws is, perhaps, more injurious to the morals of the rural population than any other single cause. With a densely crowded population, thousands of whom are often pressed by hunger, and frequently in a state of the most lamentable poverty, the temptation to kill game is irresistible. It swarms before the labourer as he returns home in the evening from his long day of hard toil. *He* does not recognise property in game. No man can claim an individual hare or partridge like an ox or a sheep. The latter must be fed at the expense of their owners; but game is fed by no one in particular. This man, then, who probably would not, for all his poverty, violate the laws of property in the case of poultry, and who at the bottom recognises no greater right of property in a partridge than in a sparrow, sets a snare in the haunts frequented by game near his cottage, and is pounced upon by the keeper. When he comes out of the gaol, the farmers perhaps dare not employ him lest they should offend the game-preservers their landlords. The justice and the rural police look upon the gaol-bird with suspicion; and only at the beer-shop, with men of his own stamp and character, does he feel at home. It is hardly necessary to sketch his further progress. In nine cases out of ten, it is from bad to worse; and this because for objects of selfish gratification men have given to a bird or beast of little worth in itself an arbitrary value, and protected it by statutory regulations stricter than are applied to many other things which are recognised as objects of property by all mankind.

The number of persons convicted at assizes and sessions in 1843, for infractions of the game-laws in England and Wales, was 4529, of whom 40 were transported. Between 1833 and 1844 there were 41 inquests on gamekeepers found dead, and in 26 cases verdicts of wilful murder were returned. In 1843, out of 201 persons summarily convicted in Bedfordshire, 143 were committed for poaching, and sentenced to prison for an average period of seven weeks each. In the same year, out of 539 persons committed to the county gaol for Buckinghamshire, 169 were for offences against the game-laws. The wives and families of these men must be maintained during the husbands' imprisonment; and hence the poor-rates and the county-rates are at the same time increased. Gaols require to be enlarged; and as poaching leads to other crimes, a more extensive police is required for the protection of property. The time of this force is not a little taken up in preventing, detecting, and apprehending poachers. The game-laws are in this way a heavy burden on the occupiers of land.

The total public expenditure which the preservation of game occasions is probably more onerous than that which is required for the support of pauperism in this country. Game, and the game-laws, are among the greatest hindrances to the improvement of agriculture. They not only prevent a gain, but they occasion a loss to the actual aggregate of agricultural products.

Many landowners in their enthusiasm respecting game take means to ensure its preservation which none but tenants in a wretched state of dependence would submit to. The tenant is not allowed to use his best skill in the application of his own capital to the land, but is interfered with on account of the game. This game devours the produce of the land, is fattened at the tenant's expense (compensation for the destructiveness of game being generally futile and deceptive), and the landlord pockets the money which the game thus fed produces in the market. The effect would be far less injurious if the landlord turned a certain proportion of his oxen and sheep to feed with those which belong to his tenants. There are instances where the landlord lets the game on the tenant's land to a third person, and thus gets two rents, one for the land, and another rent for the game after it has been fed by the farmer.

It has often been stated that from three to five hares eat and destroy as much as would keep one sheep. On many farms the number of hares averages at least two per acre; and the destruction by hares alone is often equal to an additional rental of 10*s.* per acre on the whole of the farm: there is, besides, the waste and destruction caused by rabbits, pheasants, and partridges. On some farms of 500 acres where the game is strictly preserved, but not excessively, the loss caused by hares will often amount to above 200*l.* The landlord sells the hares at perhaps 1*s.* 6*d.* each, and pockets 75*l.* This is short-sighted enough, setting aside the bad moral effect of the practice. The operations of the poacher, if he escape detection, are in one sense beneficial to the tenant-farmer, for the destruction of the game adds to the farmer's profit; but if the poacher be convicted and sent to gaol, then the support of the man and his family adds to the loss which the game occasions.

Many of the reservations and covenants in leases in relation to game are fit only for the copyholders of a manor four or five centuries ago. There are many farms on which the tenants are forbidden either to mow wheat or drill turnips. Mowing costs less than reaping, and the tenant has besides the advantage of an extra quantity of straw for the stock and for manure; but then the ground is left too bare to shelter the partridges, and therefore the scythe must not be used, nor any other instrument which cuts lower than twelve inches. Drilling turnips is now an essential operation in all good systems of farming; but though it gives a much greater weight of roots per acre, it encourages the birds to run, and spoils sport. In some districts, where game is preserved with great strictness, a farmer is not allowed to sow winter tares. To drain land where rabbits are kept would be a waste of property. Legislation cannot produce any improvement in this state of things. It arises from the dependent condition of the great majority of the tenant-farmers; and if a law were passed which gave them the right to kill the game on their lands, it would be of no advantage to them. The gamekeepers and other retainers of the great and small game-preservers are spies on the tenant, and in the intense competition for farms he dare not contravene the wishes of his landlord. Public opinion may and does produce some effect on the landlord's exercise of his power, but this is confined to isolated cases.

The administration of the game-laws in England is in the hands of persons who are either game-preservers themselves, or who, generally speaking, are not unfavourable to the system, and hence the rigour with which offences against the law are visited. Before the act 1 & 2 Wm. IV. c. 32 was passed, penalties for infractions of the game-laws could be recovered before one justice; but now conviction can only take place before two justices, and an appeal lies to the quarter-sessions, but a certiorari is not allowed. There was no appeal formerly, and great obstacles were thrown in the way of obtaining a certiorari. The expenses of appeal are heavy.

On the 27th of February, 1845, on the motion of Mr.

Bright, M.P. for Durham, a select committee was appointed to inquire into the operation of the game-laws. At the close of the session the committee reported that they had not concluded their inquiry, and it is to be resumed in the session of 1846. Certain members of the committee voted against printing the evidence already taken, and when Mr. Bright, who had given notice of his intention, was about to bring the question before the House, the House was counted out. The evidence cannot therefore be printed before 1846.

The number of certificates taken out annually to kill game is about 40,000 in Great Britain, and the number of licences to sell game about 800.

In other countries, as well as in England, game-laws have been an instrument of oppression. In France before the first Revolution there were edicts for preserving game which 'prohibited weeding and hoeing, lest the young partridges should be disturbed; steeping seed, lest it should injure the game; manuring with night-soil, lest the flavour of the partridges should be injured by feeding on the corn so produced; mowing hay, &c. before a certain time, so late as to spoil many crops, and taking away the stubble which would deprive the birds of shelter.' (Arthur Young's *Travels in France in* 1787-88-89.) The tyranny of the manorial courts rendered it hopeless to escape from this oppressive system. The Constituent Assembly abolished this exclusive 'droit de la chasse' which the seigneurs arrogated to themselves. A stringent game-law has recently been enacted in France, which is giving great offence.

GAMING. [Gaming or Gambling, P. C.] In England, before the passing of 8 & 9 Vict. c. 109, the law considered wagers in general as legal contracts, and the winner of a wager could enforce his claim in a court of law. The exceptions to this rule were, where the wager was an incitement to a breach of the peace or to immorality; where it affected the feelings or interests of third persons, or exposed them to ridicule or inconvenience; or where it was against sound policy or prohibited by statutory enactment. In cases not comprehended within the above exceptions the judges frequently refused to try actions respecting wagers when they considered the matter to be of a frivolous or of an improper nature.

In Scotland the courts followed an opposite rule to that which prevailed in England. They held that 'they were instituted to try adverse rights, and not to determine silly or impertinent doubts or inquiries of persons not interested in the matters in question;' and they decided 'that their proper functions are to enforce the rights of parties arising out of serious transactions, and not to pay regard to *Sponsiones ludicrae.*'

In 1844 a select committee of the House of Commons on gaming recommended that 'wagering in general should be free and subject to no penalty;' and they also expressed an opinion in favour of the law of England being assimilated to that of Scotland.

In the session of 1845 the act 8 & 9 Vict. c. 109 was passed, which enacts 'That all contracts or agreements, whether by parole or in writing, by way of gaming or wagering, shall be null and void; and that no suit shall be brought or maintained in any court of law or equity for recovering any sum of money or valuable thing alleged to be won upon any wager, or which shall have been deposited in the hands of any person to abide the event on which any wager shall have been made: provided always, that this enactment shall not be deemed to apply to any subscription or contribution, or agreement to subscribe or contribute, for or toward any plate, prize, or sum of money to be awarded to the winner or winners of any lawful game, sport, pastime, or exercise.'

By 16 Charles II. c. 7, any person who won any sum of money by fraud, cosenage, or deceit was to forfeit treble the value won. Under 8 & 9 Vict. c. 109, cheating at play is to be punished as obtaining money under false pretences.

The act 16 Charles II. c. 7, which was designed to repress excessive gaming by restraining it to playing for ready money, is repealed by 8 & 9 Vict. c. 109.

The clause in 13 Geo. II. c. 19, which enacted that no horse-race shall be run for any prize less than 50*l.* in value, was repealed by 3 & 4 Vict. c. 5.

The provision of the statute of Anne against bets exceeding 10*l.* was so much a dead letter, that its existence appears to have been almost forgotten, until in 1843 a number of actions were brought by common informers against several noblemen and gentlemen who had violated the law by betting sums of more than 10*l.* on horse-races. A bill was brought in early in the session of 1844, for the relief of these persons, and was rapidly passed through its several stages. The act is 7 Vict. c. 3, and it was entitled 'An Act to stay proceedings for three calendar months, and till the end of the present session of Parliament, in certain actions under the provisions of several statutes for the prevention of excessive gaming, and to prevent any proceedings being taken under those statutes during such limited time.' Select committees were appointed in both Houses of Parliament to inquire into the laws respecting gaming, and another act (7 Vict. c. 7) was passed to indemnify witnesses implicated in gaming transactions who should give evidence before these committees. Before the session was over, and to prevent the consequences of the act 7 Vict. c. 3 being allowed to expire, another act was passed (7 & 8 Vict. c. 58) which further stayed proceedings in the actions for gaming.

The act 8 & 9 Vict. c. 109 repeals those parts of 9 Anne c. 14, and 18 Geo. II. c. 34, which rendered it illegal to win or lose any sum exceeding 10*l.* at play or by betting; and there is a clause under which all actions and informations commenced previous to this act under former statutes against gaming are to be discontinued on payment of costs.

The act 7 Geo. II. c. 8, which was made perpetual by 10 Geo. II. c. 8, entitled 'An Act to prevent the infamous practice of stock-jobbing,' is violated hourly on the London Stock-Exchange by the practice of time-bargains.

The acts 19 Geo. II. c. 37, and 14 Geo. III. c. 48, are intended to prevent transactions of the nature of gaming or wagering on policies of marine and life insurance.

The act 8 & 9 Vict. c. 109 greatly facilitates proceedings against any common gaming-house, by enacting that in default of other evidence it shall be sufficient to prove that such house or place is kept or used for playing therein at any unlawful game, and that a bank is kept there by one or more of the players exclusively of the others, or that the chances of any game played therein are not alike favourable to all the players, including among the players the banker or other person by whom the game is managed, or against whom the other players stake, play, or bet; and every such house or place shall be deemed a common gaming-house. It is not necessary under this act to prove that any person found playing at any game was playing for any money, wager, or stake. The act dispenses with the necessity of obtaining the allegation of two householders that any house is a common gaming-house; and provides, that on the report of a superintendent of metropolitan police, it shall be lawful for either of the commissioners of police to authorize the superintendent by a written order to enter any house or room with constables, and, if necessary, to use force for the purpose of effecting such entry, whether by breaking open doors or otherwise, and to take into custody all persons who shall be found therein, and to seize and destroy all tables and instruments of gaming found in such house or premises, and also to seize all money and securities for money found therein. If any cards, dice, balls, counters, tables, or other instruments of gaming used in playing any unlawful game be found in any house or room which the police have entered as a suspected gaming-house, or about the person of any of those who shall be found therein, it shall be evidence, until the contrary be made to appear, that such house or room is used as a common gaming-house, and that the persons found in the room where such instruments of gaming shall have been found, were playing therein, although no playing was actually going on in the presence of those who made the entry. Before this act was passed, persons found in a gaming-house could not be searched; and proof of play was necessary before entry. In all other places out of the metropolitan police district the justices may by warrant empower constables to enter gaming-houses. Persons who have been concerned in unlawful gaming and who give evidence on the trial of any owner or keeper or person who has had the management of a common gaming-house, may obtain a certificate from the magistrate or judge of the court, which frees them from all criminal prosecutions, penalties, &c.

The punishment which may be inflicted on gaming-house keepers under 8 & 9 Vict. c. 109, in addition to the penalties mentioned in 33 Hen. VIII. c. 9, is, a penalty not exceeding 100*l.*, or imprisonment with or without hard labour for a term not exceeding six months.

By 8 & 9 Vict. c. 109, public billiard and bagatelle boards are not to be kept without a licence, and the places where they are kept may be visited at any time by constables and officers of police; and such places are to be closed entirely on

Sundays, and on other days at midnight, except Saturday, when the hour of closing is fixed at eleven o'clock.

On the night of the 8th of May, 1844, a simultaneous entry was made by the police into all the common gambling-houses, seventeen in number, which were then known to exist in the metropolitan police district. Gambling is also carried on in the metropolis at places where billiard-tables are kept, at public-houses, and also at cigar-shops. The evidence taken before the select committees on gaming in 1844 contains a mass of information on the subject of gaming and gambling both in London and elsewhere.

Gaming (alea) among the Romans was played with dice. The earliest enactment against it is referred to by Plautus and Cicero; but it is not certain what the penalty was. Under the later republic and the empire gaming was a common vice, but it was considered to be disreputable. The little that is known of the penalties against gaming is contained in the Digest (11, tit. 5) and the code of Justinian (iii. tit. 43). The praetor in this, as in many like cases, placed the encourager of gaming under disabilities. If a man lent his house for gaming, and, while the gaming was going on there, was beaten or had anything stolen from his house, the praetor refused him all remedy. A senatusconsultum, the name and time of which are not mentioned, prohibited all playing for money, except the stake was made upon the five athletic exercises enumerated, and, as we must infer, by the persons who joined in the exercises. If a slave, or a son in the power of his father, lost money at gaming, the father or owner of the slave might recover it. If a slave won money, there might be an action for it against the master; but the demand against the master could not exceed the amount of the slave's peculium, that is, the property which the slave held as his own, according to Roman custom, with the permission of his master. The praetor's edict also allowed an action against parents and patrons in respect of money lost (to children or the patrons' freedmen, as we must understand it). Justinian made several constitutions against gaming. A man who lost money at gaming was not bound to pay it; and if he did pay, it could be recovered by him or his successors (in the Roman sense) from the winner or his heredes any time within thirty years. If they did not choose to recover it, the father or defender (defensor) of the town in which the money was lost might recover it, or any other person might. The money, when recovered, was laid out for public purposes. Gamblers were also liable to a fine. Spiritual persons who violated the gaming laws, or were present at gambling, were suspended for three years and confined in a monastery (*Novell.* 123, c. 10).

The following abstracts of the laws relating to gaming in different countries were prepared by J. M. Ludlow, Esq., and were laid before the Select Committee of the House of Commons on gaming, by H. Bellenden Ker, Esq.:—

By the French law, as it stood before the Revolution, minors alone could recover their losses at play; but no winnings could be sued for except in the case of warlike sports; when not excessive, games of strength and skill were permitted, games of mere chance absolutely forbidden.

The Code Français allows an action for money won at games of strength and skill, when the amount is not excessive; but money paid can never be recovered, unless on the ground of fraud. The keepers of gaming-houses, their managers or agents, are punishable with fine (100 to 6000 francs), and imprisonment (two to six months), and may be deprived of most of their civil rights. A trifling fine is imposed on those who set up lotteries, or games of chance in public places; the furniture, implements, &c. are in all cases to be seized.

By the Prussian Code all games of chance, except when licensed by the state, are prohibited. Gaming debts are not the subject of action; but money paid cannot be sued for by the loser. Wagers give a right of action when the stakes are constituted in cash in the hands of a third person; they are void when the winner had a knowledge of the event, and concealed it. Money lent for gambling or betting purposes, or to pay gambling or betting debts, cannot be sued for. Gaming-house keepers are punishable with fine, professed gamblers with banishment; and if they break the ban, by imprisonment. Occasional cheating at play obliges to compensation; professed swindlers at play are punishable as for theft, and banished afterwards. Money won from a drunken man, if to a considerable amount must be returned, and a fine paid of equal value.

In Austria no right of action is given either to winner or loser. All games of chance are prohibited, except when licensed by the state. Cheating at play is punishable with imprisonment, according to the amount of fraudulent gain. Playing at unlawful games, or allowing such to take place in one's house, subjects the party to a heavy fine, or in default to imprisonment.

The provisions of the Sardinian civil code are similar to those of the French, giving an action for money won at games of strength or skill, when not excessive in amount; but not allowing the recovery of money lost, except on the ground of fraud or minority (a provision taken from the old French law).

The Bavarian code is somewhat special in its provisions; it distinguishes between games of pure skill, and mixed skill and chance on the one hand, and games of mere chance on the other. In the two former, money honestly won, and not excessive in amount, may be lawfully claimed, and money lost cannot be recovered; but with respect to fraudulent or excessive gaming, and also as to all games of mere chance, the winner may be called upon to repay his gains, and is liable, together with the loser (except as to the latter, in the case of fraud), to a penalty of varying amount. Gaming-house keepers and professed gamblers are subjected to various penalties. Distinctions are also taken as to wagers, which are only void for fraud or immorality, but the amount of which is liable to be reduced, if excessive. When money lost at play is proved to have been the property of some other person than the player, the true owner may recover it.

Wagers also appear to be lawful in Spain, when not in themselves fraudulent, or relating to anything unlawful or immoral. (Johnson's *Institutes of the Civil Law of Spain*, p. 242.)

GANDON, JAMES. Of this eminent architect (who has escaped the notice of the industrious Nagler) nothing is known as to either his parentage or the place or year of his birth, and we can only infer from the date of his death at the age of eighty-two, that he must have been born about 1741-2. He studied under Sir William Chambers, and was the first who obtained the gold medal for architecture at the Royal Academy, on which occasion Reynolds is said to have complimented him, and to have predicted his future fame. He began to make himself known in his profession by undertaking a continuation of Campbell's 'Vitruvius Britannicus,' the first volume of which, or fourth of the series, appeared in 1767, and the second in 1771. Though he had Woolfe for his coadjutor in the work, Gandon appears to have taken the chief share of the management and editorship upon himself; and in fact the name of John Woolfe would not now be known but for its association with that of Gandon, and but for a strange mistake which has attributed to him a building that appears to have been by some other architect. Though Dallaway, and others after him, say that Woolfe built 'Lord Shrewsbury's, at Heythrop,' the 'Vitruvius Britannicus' itself contradicts this, for there Woolfe's name appears only as that of the draftsman of the two plates of the mansion at Heythrop, as do both his and Gandon's to many other subjects whose authors are expressly mentioned. If Woolfe really built Heythrop, it is most singular, especially as he was one of the editors of the 'Vitruvius,' that that fact should not have been distinctly stated in the letter-press account of that subject; besides which the building itself (destroyed by fire in 1831) by no means favours the supposition of its having been erected even in Woolfe's time, since it is in a style that savours far more of the commencement than the middle of the eighteenth century; and at any rate the taste displayed in it would hardly entitle Woolfe to the epithet of a 'classical' architect, even were his claims to the authorship of the design undeniable. That he was not the architect of Heythrop may further be presumed from there being merely a single plan and elevation of that building, although a section of it—which, had he been the actual architect of it, he could easily have furnished—was almost indispensable for explaining some parts of the internal plan, in which there is more variety than usual. In fact, the 'Vitruvius' is sadly deficient in regard to sections, only a very few of the subjects being so illustrated; and although the continuation exhibits a decided improvement upon the original volumes by Campbell, it leaves great room for further improvement: while many buildings of considerable interest are omitted, several are given which possess very little interest or merit; neither does the letter-press afford that information —easily given at the time—as to dates, architects, and other particulars, which would now be valuable. So far from being descriptive and explanatory of the respective buildings, the letter-press, which appears to have been written by Gandon himself, and which certainly does not say much for his literary abilities, tells us very little more than what may be made out from the plates themselves. Even as an architect Gandon does not appear to any particular advantage in the 'Vitruvius,' his 'Court-hall' at Nottingham (vol. v.) being of rather negative merit, though Dallaway calls it 'a most correct and elegant design of the Ionic order,' whereas, so far from being a correct specimen, the entablature would accord with Tuscan columns, just as well as or better than with Ionic ones. Gandon himself however tells us that he made five different designs for that building, and that he was obliged to pare down his ideas to suit the notions and the frugality of his employers; yet the plan and section of the original design, which he has given along with the other plates, do not display any extraordinary talent. Still his building at Nottingham obtained for him the notice of Sir George Saville, Mason the poet, and other persons of distinction, and probably brought him professional employment, as he discontinued the 'Vitruvius,' after the second supplementary volume; nor has the work since been resumed by other editors. G. Richardson's 'New Vitruvius Britannicus' is a mere collection of plans and elevations, for the greater part of no architectural interest or merit, and unaccompanied by any letterpress: and F. P. Robinson's work, which has a similar title, was begun upon such a scale as was more suitable for a series of distinct publications on the respective buildings than for a collective one.

For saying so much on the subject of the 'Vitruvius' we may be excused, since it is with that work that Gandon's name is most familiarly associated in this country; whereas his architectural talents found a field opened to them in Ireland. On premiums being offered by advertisement for the best design for a Royal Exchange at Dublin, Gandon's obtained the second and those by Cooley [COOLEY, P. C. S.] and Thomas Sandby the first and second prizes. What Gandon's design was is not known, but its merits attracted the attention of the Earl of Charlemont, Colonel Burton Conyngham, and other admirers and patrons of art. Nor was it long before an opportunity presented itself in the Irish capital very far exceeding the Exchange both in magnitude and importance. The Custom-house of Dublin, a magnificent pile of 375 by 209 feet (begun in 1781 and finished 1791), is one of the noblest structures of the kind in the world—perhaps the noblest of all—and would of itself alone suffice for the fame of any architect. Dublin is also indebted to him for several others of its finest buildings,—the eastern front and Corinthian portico of the House of Lords, now the Bank of Ireland; the Four Courts (begun by Cooley, but completed by him, with great alterations from the original design), and the King's Inns. He also built the Court-house at Waterford, and probably many other things besides, although they have not obtained distinct notice. It is to be regretted that Gandon did not perform for himself and his own works the same office as he had in the earlier part of his life done for those of other architects; and that he did not bequeath us such an autobiography of his professional career. But architects neither care to be autobiographers nor are they hardly ever made subjects of biography. Gandon died at Cannonbrook, near Lucan, Ireland, at the beginning of 1824.

GA'NODUS, a genus of fossil Ganoid Fishes, from the oolite of Stonesfield; seven species (Egerton), referred to Chimera by Agassiz.

GANOID, a grand division of fossil fishes in the classification of M. Agassiz. [FISHES, FOSSIL, P. C. S.]

GANS, EDWARD, was born at Berlin on the 22nd of March, 1798, and descended from Jewish parents of great respectability. His father was a wealthy man, noted for his sarcastic wit, and highly esteemed for his patriotism: he enjoyed the particular confidence of the Prussian state chancellor, the Baron (afterwards Prince) Hardenberg. After having been educated at the gymnasium called 'das Graue Kloster' (the Grey Cloister), in his native town, Gans entered the University of Berlin, in 1816, as a student of law. In the following year he went to Göttingen, and there, at the age of nineteen, obtained the prize for the best answer to the question proposed by the faculty of law on the history and the civil and political laws of the island of Rhodes: the dissertation which he wrote on the subject was printed at the expense of the faculty. In 1818 he left Göttingen, and went to Heidelberg, where he enjoyed the friendship and esteem of Thibaut, the jurist, and Hegel, the philosopher, and his intercourse with these celebrated men had a lasting influence on his literary pursuits. At Heidelberg he wrote several articles for the 'Civilistisches Archiv,' edited by Gensler, Thibaut, and Mittermaier; and the 'Zeitschrift für die Wissenschaft des Judenthums,' in which he gave eminent proofs of his talents and learning. He took the degree of doctor in law in 1819, in the same university, and there also published a little work 'Ueber Römisches Obligationen-Recht.'

In 1820 Gans returned to Berlin, was admitted by the university as public lecturer on law (privatim docens, rather a strange name for a public lecturer), and in the same year published a work which created general sensation, namely, 'Scholien zum Gajus.' The first complete edition of Gaius, by Göschen, came only out in the following year, 1821, but the printing was begun as early as 1819: the printed sheets were distributed among the friends of the editor, and parts of the Institutes of Gaius had already appeared, and were commented upon in several learned Reviews in Germany. The first in rank among the earlier commentators were Savigny and Göschen, and it was principally against their opinions that Gans took the field in his 'Scholien.' He was rather rash in publishing his 'Observations' at so early a period, and on the whole the work is superficial; but it contains some profound remarks, and shows the solid knowledge which the youthful author had acquired of the historical part of the Roman Law. The learned public in general considered it a most valuable work, and they were certainly not wrong in judging it favourably. Until the discovery of the Institutes of Gaius, our knowledge of the history of the Roman law was very imperfect; and it is the merit of Gans that he was remarkably free from old errors, while he explained many new facts with extraordinary judgment: many comments on Gaius, however, which appeared after the Scholia, prove that it is easier to learn new truths than to forget old errors. Gans met, of course, with many distinguished opponents; and those who could not defeat him on the field of science traduced his character by styling his work the attempt of an insolent and self-conceited youth to overthrow the authority of his masters. Gans was not discouraged: he entered into a closer alliance with Hegel and Thibaut, who, with Feuerbach, Grollmann, and other distinguished jurists, were the originators of the school of philosophical jurisprudence, of which young Gans soon became one of the most eminent leaders. Their principal aim was, and still is, to explain the nature of law and its bearing upon the past as well as the future, through the medium of philosophical ideas, and to show its connexion with the moral, social, and political progress of mankind; and it cannot be denied that they exercised a beneficial influence upon legislation, the bar, and the judicature. Many of their followers however were misled by the influence of some favourite system of metaphysics; forgetting that every law is, or at least ought to be, the product of some national want, they published legal commentaries fit to puzzle at once the most plain and straight-forward judge and the most sophistical advocate; and it was apprehended that if they should ever obtain a complete ascendency over legislation, Germany would be blessed with a new edition of Plato's Republic, rather than with a new code and a constitution answering the wishes and the wants of the people. The historical school, on the contrary, cared little for the political or social progress of the people. Their attention was chiefly directed to the past; and, satisfied with having discovered the historical development of laws, they were prouder of having added to the knowledge of obsolete, forgotten, or obscure things than to the knowledge of modern law, however great might be its practical importance. Accustomed in their minute historical researches to see things grow gradually, they were puzzled whenever they met with great legislative revolutions, and they looked upon the present French code—that master-piece of modern legislation—as an 'unhistorical' product, and the same epithet they bestowed upon the modern constitutions of France, Spain, and Belgium. The philosophical school advocated the introduction into Germany of trial by jury in criminal cases, and publicity of proceeding in all cases: the historical school opposed them on the ground that such legal institutions had no connection with the present state of things; they proposed to introduce them first in trifling matters, in order that the people might accustom themselves to the novelty, and then to wait till the people would be 'ripe' for their general introduction. It was apprehended that, if the historical school should become the director of legislation, they would reduce Germany to slavery, since the feudal system, though oppressive, and the Justinian law, though the result of absolutism, were both regarded with favour by them as being completely developed 'historical' productions. On the whole, the philosophical school found more adherents among practical lawyers, and the historical school among learned lawyers, scholars, and antiquarians. Gans says, in the preface to his 'Das Erbrecht,' mentioned below, that the chief merit of the historical school consisted in having published excellent editions of the works of Roman jurists, and commentaries on obsolete laws.

Between the philosophical and the historical schools stood and still stands the school of positive jurisprudence, which comprehends all such jurists, mostly practical lawyers, as write on law with a practical view, the labours of the other two schools being rather of a theoretical character. One of the most distinguished positive jurists is Solomon Philip Gans, an advocate of the supreme court at Celle, in Hanover, who is still living, and the author of several excellent works and treatises on law, and who ought not to be confounded with his late kinsman Edward Gans. In the scientific struggle between the philosophical and the historical school Edward Gans was better enabled to take a leading part, as he had a profound knowledge of the history of the Roman Law, combined the qualities of a scholar with those of an eloquent and acute advocate, and could consequently attack his opponents with success on the very field where they thought themselves invincible. His first attack, as already said, was contained in the Scholia to Gaius. The second was 'Das Erbrecht in weltgeschichtlicher Entwickelung,' Berlin, Stuttgart, and Tübingen, 4 vols. in 8vo., 1824—35 (The Law of Succession, its historical development, and its importance for the history of the world), by which he placed himself among the first jurists of Germany. In this splendid work the author treats on the law of succession of the most eminent nations of the world, antient and modern, European, American, and Asiatic, even those of the Chinese, and shows how the alterations which the law has gradually undergone are combined with the history of the nations and their advance towards social and political perfection. A translation of this work would be a valuable addition to English literature; but the task is not easy, as it requires more than a superficial knowledge of the philosophy of Hegel, and the difficult art of rendering into English the technical terms of the most obscure of all German philosophers. In 1825 Gans was appointed professor extraordinarius, and some years afterwards professor ordinarius at the university of Berlin. The latter dignity is not bestowed upon Jews in Prussia, but Gans had adopted the Christian religion, at Hamburg, some time previous to his appointment. In 1826 he published 'System des Römischen Civil-Rechts' (System of the Roman Civil Law), and founded a new Review of which Berlin stood in great need, the 'Jahrbücher für wissenschaftliche Critik' (Year-Books for Scientific Criticism). After the outbreak of the French Revolution, in 1830, he went to France, a country which he had already visited previously, as well as England; and his fame being already established in France, he was well received by the most eminent men in Paris, among whom he preferred those who stood at the head of the great political movement. From France he went to England. The Prussian government now became suspicious, and set spies upon him, who reported every word they could catch. On his return to Berlin he began a course of lectures on modern history in the university, and his learning, eloquence, wit, and liberal principles attracted an immense crowd not only of students, who alone are entitled by law to attend the lectures delivered in the German universities, but of public functionaries, advocates, officers in the army, and others who endeavoured to get and actually got admission. He lectured in the largest room of the university, which was not only full to suffocation, but hundreds of gentlemen were seen standing outside, in the hall, and in the great court, in spite of a very severe winter (1832-33), and all eager to learn from their friends inside the subject of the lecture, or the spirited observations of the lecturer. This was a capital opportunity for the enemies of Gans to denounce him to the Prussian government as a demagogue; and after some time the government compelled him to give up his lectures, on the pretext that he being a professor of law had no right to deliver lectures on history. Little discouraged by this check, Gans introduced subjects connected with modern history into his lectures on law; and the Prussian government, dreading his sharp tongue as well as his principles, now commenced a system of annoyance and petty persecution against him, in which it was well assisted by the numerous enemies of the professor, and which embittered his life, and undoubtedly contributed to his untimely death. In the following years Gans published 'Vorlesungen über die Geschichte der letzten fünfzig Jahre' (Lectures on the history of the last fifty years), in Raumer's 'Historisches Taschenbuch' for 1833 and 1834; 'Vermischte Schriften juristischen, historischen, staatswissenschaftlichen und ästhetischen Inhalts' (Miscellaneous writings on jurisprudence, history, &c.), Berlin, 1834, 2 vols. 8vo.; 'Rückblicke auf Personen und Zustände' (Retrospective view of individuals and events), Berlin, 1836; 'Grundlage des Besitzes' (The Basis of Possession), Berlin, 1839, an attack upon Savigny's celebrated work on the Law of Possession among the Romans. Most of his time he devoted to a complete edition of the works of Hegel, those that were published already, and those which Hegel left partly unfinished in MS., especially on Hegel's Philosophy of History; and without Gans the world would perhaps never have seen a complete edition of Hegel, he being, according to Hegel's own words, the only man who thoroughly understood his great but obscure master. On the 1st of May, 1839, while dining with a friend, Gans fell suddenly speechless from his chair, being struck by apoplexy; after lingering a few days, he died on the 5th of the same month.

Gans was one of the most learned, most witty, and most eloquent men of Germany; distinguished as an author, and unsurpassed as a lecturer. His fame would have been still greater had he had an opportunity of displaying his talents on the political stage. No man was his equal in controversy: he confounded the most skilful of his adversaries by his sarcastic replies. Those whom he wounded deepest and spared least were men of acknowledged authority, or of high rank or birth, and among them he had his bitterest enemies. He belonged to those highly gifted Jews, his contemporaries, who held, or still hold, such an eminent rank among the learned, the poets, and the artists of Germany, as Heine the poet, Börne the political writer, Mendelsohn the composer, Michael Behr the poet, his brother Meier Behr, commonly called Meierbeer the composer, and many more. Gans's successor as professor of law in the university of Berlin was Dr. Stahl, a man of ultramonarchical principles, and a disciple of the notorious Haller, the author of the 'Restoration of Political Science.'

(*Neuer Nekrolog der Deutschen*, *Allgemeine Zeitung (Supplement)* of 1839, No. 132; *Conversations-Lexicon der Gegenwart.*)

GAOL. [TRANSPORTATION, P. C.]

GARDE'NIA (named after Dr. Alexander Garden of Charlestown, South Carolina, a correspondent of Linnæus), a genus of plants belonging to the natural order Cinchonaceæ. It has the calyx usually ribbed, with a tubular truncate limb divided into several lobes or teeth; the corolla funnel-shaped, or approaching salver-shaped, with a tube much larger than the calyx, and a contorted spreading 5-9-parted limb; the anthers 5-9 linear sessile in the throat; the stigma clavate, bifid, or 2-toothed, with thick erect lobes; the dissepiments of the ovary 2-5, incompletely dividing it into cells; the berry fleshy, crowned with the calyx, with a papery or bony lining, incompletely 2-5-celled; the seeds immersed in fleshy parietal placentæ. The species are armed or unarmed trees or shrubs, with axillary or terminal, usually solitary, white and fragrant flowers.

G. campanulata is a shrubby plant with short branches spiny at the apex, the spines solitary; the leaves lanceolate, smooth, acuminated at both ends; the flowers on short pedicels in terminal and lateral fascicles; the limb of the calyx campanulate, with a short acutely 5-toothed border; the corolla sub-campanulate, 5-lobed; the berry roundish, ovate. This plant is a shrub 5 to 10 feet in height, and is a native of the East Indies, in the forests of Chittagong. The berry is about the size of a golden pippin apple, and is employed by the natives of India as a cathartic and anthelmintic.

G. arborea is an unarmed tree with ovate-oblong leaves, terminal, almost sessile flowers, usually arranged in threes; the corolla with a filiform tube and a 5-parted limb; the berry drupaceous, smooth, containing a 4-5-valved shell. It is a native of the East Indies. The fruit is eaten by the natives of India. It is one of the most beautiful species of the genus, and deserves a place in every collection.

There are about fifty species of Gardenia, which all bear elegant sweet-scented flowers. They thrive best in a mixture of loam, peat, and sand. Under the name of Cape Jasmines, double-flowered varieties of *G. florida* and *G. radicans* are extensively cultivated. Their flowers are very fragrant and the best way of getting them to bloom freely is to set them in a close frame with a gentle bottom heat in the spring. In the winter they may be placed in the greenhouse. They may be increased by cuttings.

(Lindley, *Flora Medica;* Don, *Gardener's Dictionary.*)

GARNISHEE. [ATTACHMENT, P. C.]

GARO'FALO, the name by which Benvenuto Tisio is commonly known, apparently from his adoption of a gilliflower (garofalo) for his monogram. Garofalo is the most distinguished of the Ferrarese painters; he belongs however to the Roman school. He was born in the Ferrarese in 1481, and was first instructed in design by Domenico Pannetti, from whom he went to his uncle Niccolo Soriani at Cremona. After the death of his uncle in 1499, he left Cremona and repaired in 1500 to Rome, where he remained fifteen months with Giovanni Baldini, and after visiting several other cities, he spent two years with Lorenzo Costa at Mantua; he then dwelt for a period of four years in Ferrara, and finally engaged himself with Raphael in Rome, in 1508 (1505 in Vasari is a mere misprint, as the stated intervals evidently show).

Raphael's great powers and personal qualities excited in Garofalo, as in other painters, a species of enthusiastic veneration for him; and Garofalo ever afterwards was a studious imitator of his style, even in his small works. He remained some years with Raphael in Rome, when he was called by domestic affairs to Ferrara. He intended to return to Raphael, but circumstances kept him in Ferrara. He was employed at Belriguardo and elsewhere on extensive works, together with the two Dossi, by the Duke Alfonso I. He executed many excellent frescoes in Ferrara—the principal of which were those of San Francesco, the Slaughter of the Innocents, the Resurrection of Lazarus, and others, painted about 1519—24: they still exist. There are also some excellent frescoes by him still preserved in the Palazzo del Magistrato. Garofalo's oil paintings are frequent in picture galleries: there are many at Rome, in the Borghese gallery, and in the Ghigi and Doria palaces; and there are also some good specimens of his style in the galleries of Dresden and St. Petersburg, and there are two small pictures of average merit in the National Gallery. His small pictures are very numerous: he appears to have had a predilection for small proportions; and with regard to these works, what Ælian (*Var. Hist.* iv. 3) says of Dionysius of Colophon respecting Polygnotus, may be said of Garofalo respecting Raphael—he imitated his art in every respect except size. Garofalo however, though he imitated, did not equal Raphael even in technical practice, except perhaps in colour. He is more intense and more true in local tints than Raphael—his red and green draperies are remarkably pure, and are quite fresh even to this day—but in execution generally he is dry; his works are crude in effect, and have much of the *quattrocentismo*, or that crudity and dryness of design which characterise the majority of the works of the fifteenth century. Though he was very successful in the execution of the distinct objects or features of his works independently, he failed in uniting the parts, in harmonizing the whole: he wants aerial perspective and tone. He died in 1559, having been for the last few years of his life quite blind.

(Vasari, *Vite de' Pittori*, &c.; Lanzi, *Storia Pittorica*, &c.)

GARRYA, the only genus and type of the natural order of incomplete plants Garryaceæ. It was named by Mr. Douglas in compliment to Nicholas Garry, Esq., secretary to the Hudson's Bay Company. The flowers of this genus are unisexual, the staminiferous and pistiliferous flowers being upon distinct plants. The staminiferous flowers are in pendulous catkin-like racemes, within connate bracteæ. They have a 4-leaved calyx and 4 stamens. The pistiliferous flowers are in pendulous racemes like the others, but with a 2-toothed calyx, connate with the ovary, which is 1-celled. They have two setaceous styles, two pendulous ovules, with funiculi as long as themselves. The fruit is a berried pericarp, not opening, and containing two seeds. The embryo is very minute in the base of a great mass of fleshy pulp. The leaves are simple, opposite, exstipulate, evergreen, serrated or entire. The species are shrubs, natives of California and Mexico. Only two species of this genus have been introduced into Great Britain; they are very ornamental and grow best in a loamy soil, and may be propagated by layers.

G. elliptica, the Elliptic-leaved Garrya, has, when young, soft, pubescent, purplish branches; when older, they become smooth and greyish. The leaves are dark-green, shining above, hoary beneath, with simple, twisted, interwoven hairs. The flowers are of a greenish or yellowish white, and are in bloom from November to February. Only the stamen-bearing plant is in this country. During the season of blossoming this shrub presents a striking and beautiful appearance, with its delicate pendulous catkins, which are from eight inches to a foot in length. It is easily cultivated in our gardens and is as hardy as the common laurustinus.

G. laurifolia has elliptic oblong leaves either entire or very minutely dentate. Both the staminiferous and pistiliferous flowers are solitary, sessile, and opposite, having one in every bract. This species, like the former, is an evergreen shrub or low tree, and grows on the mountains of Mexico. According to Loudon there is but one specimen of this very beautiful and desirable shrub preserved in the garden of the Horticultural Society. It was brought over in the year 1839. There are some other species of Garrya recognised by various botanists: *G. Lindleyi*, considered by Mr. Bentham as a variety of *G. laurifolia*; *G. macrophylla*, *G. oblonga*, and *G. ovata*, are described in Bentham's 'Plantæ Hartwegianæ' from specimens collected by Mr. Hartweg in different parts of Mexico.

(Loudon, *Encyclopædia of Trees and Shrubs.*)

GASCOIGNE, GEORGE, was the son of Sir John Gascoigne, the head of an antient family in Essex. The date of his birth is uncertain; but it was not later, and may have been earlier, than the year 1537. He was educated at Cambridge, and afterwards entered at Gray's Inn as a student of law: but his youthful prodigality caused his father to disinherit him, as far as it was possible to do so. Upon this he sold all his property that was at his disposal, and endeavoured in vain to obtain employment at home. He embarked for Holland, and took service as a soldier of fortune under William, Prince of Orange, whose favour he gained in two years of hard and bloody warfare. At the end of this time he was one of five hundred Englishmen who, being left to garrison the indefensible fort of Falkenburg, fought their way to the walls of Leyden during its siege, but, being refused admittance, were compelled to surrender to the Spaniards. Their lives were spared; and they were sent home to England after being kept four months as prisoners. Here Gascoigne resumed the study of the law, but never prosecuted the profession seriously or with success; and he appears to have possessed means sufficient for his subsistence, although we read of his having been at one time, towards the close of his life, a prisoner in the Compter. He married (it is said) a Scottish lady whom he met in France; and usually resided at Walthamstow in his native county, where gardening and literary composition were his chief employments. In 1575, having been introduced to Queen Elizabeth, he attended one of her progresses; and at Kenilworth, on that occasion, he recited verses before her, and wrote an account of the pageantries. It will be recollected what use Sir Walter Scott has made of this incident. He died of some slow disease, at Stamford, on the 7th of October, 1577, commending his wife and child to the bounty of the queen. The earliest of Gascoigne's printed volumes bears date 1572; and his works were collected ten years after his death, in a volume bearing this title: 'The whole Woorkes of George Gascoigne, Esquyre: newly compyled into one volume: that is to say, His Flowers, Hearbes, Weedes; the Fruites of Warre; the Comedie called Supposes; the Tragedie of Iocasta; the Steel Glasse; the Complaynt of Phylomene; the Storie of Ferdinando Ieronimi; and the Princelye Pleasures of Kenelworth Castle,' London, 1587, 4to. black letter. The chief among his non-dramatic poems is the satire called 'The Steel Glasse,' written in blank verse, and first printed in 1576. This poem, with the 'Fruites of Warre' (which gives many particulars of the author's life), and several other specimens of his poetry, are reprinted in Southey's 'Select Works of the British Poets, from Chaucer to Jonson,' 1831; and either from those, or from pieces given by Campbell and others, a notion may be formed of the serious ethical tone of feeling, the frequency of familiar illustration, and the antique and half-allegoric cast of imagery, which distinguish the works of this interesting old poet. His prose 'Notes of Instruction concerning the makynge of verse' have been reprinted by Mr. Haslewood, in his 'Ancient Critical Essays upon English Poets and Poesy,' 1815. Gascoigne holds likewise a place in the history of the English drama. His comedy of 'The Supposes,' a free translation from 'Gli Suppositi,' of Ariosto, was first performed by the gentlemen of Gray's Inn in 1566; and is the earliest prose play existing in the language. It is reprinted by Sir John Hawkins in the third volume of his 'Origin of the English Drama;' and its chief importance arises from the use supposed to have been made of it in 'The Taming of the Shrew.' The 'Iocasta,' first played at the same place and in the same year as 'The

Supposes,' is founded upon the 'Phœnissæ' of Euripides, of which however it is an alteration rather than a translation. Three authors had part in it, Gascoigne, Francis Kinwelmarsh, and Christopher Yelverton, Gascoigne working on the second, third, and fifth acts. Some specimens of it, with a short critical estimate, will be found in Collier's 'History of English Dramatic Poetry.' It is mainly curious as having been the second drama in blank verse which was composed in our language. Mr. Collier gives also an account of another dramatic piece of Gascoigne, 'The Glasse of Government,' first printed in 1575; which possesses very little merit.

GASCOYGNE, WILLIAM, an astronomer of the seventeenth century, who is distinguished by having been the first inventor of the micrometer (about 1641). The instrument appears to have originally consisted either of two parallel wires, or of two plates of metal, placed in the focus of the eye-glass of a telescope: the nearest edges of the plates, which were ground fine, were parallel to one another; and the plates or the wires were capable of being moved, so that the image of an object could be exactly comprehended between them: a scale served for the measurement of the angle subtended by the interval, and Gascoygne is said to have used this instrument for the purpose of measuring the diameters of the moon and planets, and also for determining the magnitudes or distances of terrestrial objects.

The few circumstances which are known concerning this ingenious person, and the manner of his death, are given under Horrocks, Jeremiah, P. C.

GASES, LIQUIFICATION OF. [Chemistry, P.C.S.]

GASSE, STEFANO and LUIGI, twin brothers, and both architects, were born at Naples, August 8th, 1778, but were of French origin. When not above seven years of age they were sent to Paris, and there confided to the care and instruction of their maternal uncle the Abbate Minotti. On their education being sufficiently advanced, they made choice of architecture as their profession; and they not only obtained many premiums at the Institute of France, but were sent to complete their studies at Rome. After remaining five years at Rome, they were recalled by their parents to Naples in 1802, where they settled and practised together. The strong attachment between the two brothers was interrupted only by the death of Luigi (November 11th, 1833); and they appear to have been well suited to aid each other, no less by the difference of their talents than by the similarity of their dispositions—Luigi possessing greater fertility of ideas and readiness in design, while Stefano had more practical skill and knowledge of construction. Thus, the works executed by Stefano during the life-time of Luigi, belong to both brothers in common; and Naples owes to them many of its best modern edifices. Among the more important of them, and which appear to have been erected after the death of Luigi, as they are ascribed to Stefano in particular, are, the Astronomical Observatory; the additions to the Villa Reale; the Reale Edifizio di San Giacomo, an immense pile of building, erected at the cost of 1,500,000 ducats, and containing the bank, exchange, prefecture, and a great number of other public offices; and the Dogana, or new custom-house. Besides these public works he built not a few mansions for private individuals: the Palazzo Montemiletto; that of the Duca di Terranova, the Casino Cacace at Sorrento; the Casino Dupont, and that called 'di Sofia,' in the Strada Nuova di Posilipo. He also designed the new streets Santa Lucia and Mergellina, and the entrance to the new Campo Santo or public cemetery, but he did not live to complete any of these last-mentioned improvements. After a short illness the Cavaliere Stefano Gasse—for he had been complimented with the cross of the order of Francesco Primo—died at Naples, February 21st, 1840.

GASTEROMYCETES, a suborder or cohort of the natural order of Fungi. [Fungi, P. C.] It is distinguished from the higher forms of fungi [Hymenomycetes, P. C. S.] by the reproductive organs being included in a case of some kind or another. Many of the genera and subsections of Fungi belonging to this suborder, and the suborders Hyphomycetes and Coniomycetes, have been described in the 'Penny Cyclopædia,' so that those only which have been omitted will be mentioned here, in order that a connected view of the family, more especially as it exists in Great Britain, may be given.

The first tribe of the Gasteromycetes is *Angiogastres*. Of this tribe there are four sub-tribes or sections. The first, *Phalloidei*, has a distinct receptacle at length bursting through the excipulum. Of this section the genus *Phallus* is the type: it has a stipitate pileiform receptacle, with an entire border. There are several species of this genus known in Great Britain, where they are called Stinkhorns on account of their disgusting smell. *P. impudicus*, the common Stinkhorn, is found in woods and thickets in summer and autumn. It grows under sticks and leaves, and frequently, when not to be seen, may be detected by the disagreeable metallic odour which it exhales. The stem is from one to six inches in height, and the uterus is about as large as a hen's egg, consisting of two coats distended with jelly and a delicate membrane surrounding the pileus. *P. caninus* is a rarer species. It grows in woods and hedges in the south of England. From the colour of its pileus, by which it may be distinguished, it is called Red-headed Stinkhorn. Mr. Curtis, in his 'British Entomology,' has described a third species, *P. iosmos*, which was found at Lowestoft in Suffolk. At first it has a scent somewhat like that of violets, but it becomes very offensive when dried.

The second section is *Tuberaceæ*. [Tuberaceæ, P. C.] The third section, *Nidulariacei*, has a receptacle filled with free or elastically pedicellate sporangia. The type of this section is *Nidularia*, or Bird's-nest Peziza. There are three species of this genus found in Great Britain. The most common is *N. campanulata*, which is found on the ground, decaying dung, sticks, &c. They are pretty little fungi, resembling birds' nests, not only in their shape, but also in their sporangia, which lie at the bottom of the receptacle like little eggs.

The fourth section, *Carpoboli*, have a solitary sporangium protruding from the receptacle. The genera belonging to it are *Carpobolus*, *Sphærobolus*, *Thelebolus*, *Pilobolus*, *Atractobolus*.

A species of the last named, *A. ubiquitarius*, is found on wood, stones, and other things, after rain, appearing like scattered meal. The Rev. M. J. Berkeley, says, however, that he is convinced that it is of insect origin. *Sphærobolus stellatus*, is found on rotten wood and sticks, in the autumn. In its early state it is covered by a fine woolly or cottony web which is very fugacious. When the young plants have pushed through this web, they have the appearance of mustard-seeds. Each plant consists of an outer and an inner membrane. At the time of the opening of the outer membrane, the inner one, which is then concave and with its mouth uppermost, projects the ball of sporules which it contains, like a bomb from a mortar, to a distance of several inches. The cracking noise occasioned by this phenomenon is so great as to be distinctly audible at some distance. 'This is unquestionably,' says Dr. Greville, 'the most wonderfully constructed plant which it has fallen to my lot to describe. That so great a degree of force should exist in a body not larger than a pin's head, and that force exerted in defiance of considerable resistance, seems to surpass the power of anything to account for it satisfactorily.'

The tribe *Pyrenomycetes* is frequently regarded as a suborder or cohort. [Fungi, P. C.] It consists of genera having more or less the characters of *Sphæria*. [Sphæria, P. C.] Most of the species are found on the decaying leaves of other plants, and vary with the species of the plant on which they grow. The genera in which the greatest number of species have been described by British botanists are *Cytispora*, *Phoma*, *Dothidea*, *Asteroma*, *Rhytisma*, *Phacidium*, *Hysterium*, and *Leptostroma*.

The third tribe is *Trichospermi* [Trichospermi, P. C.]; the fifth, *Trichodermacei* [Trichodermaceæ, P. C.]

The fifth tribe, *Perisporiacei*, has a peridium scarcely distinct from the nucleus, and the sporidia immersed in pulp, free or included in peridiola. The genera in this tribe are not numerous. *Racodium*, the Mouse-skin Byssus, is placed here by some authors; by Fries, in Byssaceæ. [Byssaceæ, P. C. S.]

The most extensive genus is *Erysiphe*, the species of which produce various forms of mildew. It has a fleshy peridium opening at the collapsing apex, subgelatinous within; the sporidia included in one or more peridiola, often including sporidiola; the thallus floccose, effused, free.

E. pannosa, the Rose Mildew, is found on the leaves of the various species of rose. It is easily known by its shining clothy aspect, which is very different from the rest of the genus. On this account it is referred by Fries to *Eurotium*.

E. communis is an extremely common fungus, and is found on various kinds of herbaceous plants. It is not improbable that the various forms of Erysiphe, which have been described according to the species of plant on which they grow, have a common origin. The same may be said of the forms of *Uredo*, *Æcidium*, and *Puccinia*. [Mildew, P. C.; Uredo, P. C.]

The suborder *Hyphomycetes* of Berkeley and others includes many of the genera that are referred by Fries to the fourth order, *Coniomycetes*. The first tribe, *Cephalotrichei*, includes the genera *Isaria*, *Anthina*, and *Ceratium*. The species of the two first are not numerous or common. *Ceratium hydnoides* is not uncommon on rotten wood.

The tribes *Mucori*, *Dematiei*, and *Mucedines* consist of various genera of plants forming moulds, mildews, blights, brands, &c. [Mildew, P. C.; Mouldiness, P. C.; Sporendonema, P. C.] Some of the species placed in these tribes by Berkeley are described under Byssaceæ, P. C. S.

The tribe *Sepidoniei* includes the genera *Sepidonium*, *Epochnum*, *Psilonia*, and *Fusisporium*. They have all a floccose mycelium, without any distinct sporidiferous filaments; and the sporidia, heaped together, lying upon and in general springing from the matrix. The species of Fusisporium are found in decaying fruits and vegetables. Von Martius has described one under the name of *F. Solani*, which attacks the tubers of the potato, and produces a kind of rot. This occurred epidemically among potatoes in Germany in 1831, and at the present moment (October, 1845) a similar epidemic has' attacked the potato-crop of Great Britain. That the fungus is the cause of the disease may however be doubted, and it is probable that the fungus is only the result of a diseased state of the plant.

The last suborder, *Coniomycetes*, embraces those fungi whose sporidia are produced beneath the epidermis of plants, and which in many instances appear to be rather diseases of the tissue than independent existences. The first subsection or tribe is *Tubercularini*. [Tubercularini, P. C.] The second tribe, *Stilbosporei*, consists of sporidia glued together into a nucleus, without any covering, under the cuticle of plants, at length bursting forth together with the gelatine or free. The genera of this tribe are *Nemaspora*, *Septoria*, *Stilbospora*, *Didymasporium* and *Melancorium*.

The third tribe, *Sporidesmiei*, have their sporidia chained together into flocci. The genera are *Aregma*, *Torula*, and *Spilocæa*.

The fourth tribe, *Hypodermii*, includes those species of fungi which are found underneath the cuticle of living plants. They are said by Fries to have 'no proper vegetation, their sporidia arising from an anamorphosis of the cells of living vegetables.' To this definition Berkeley objects, and regards the species as distinct plants. The principal genera are *Puccinia*, *Æcidium*, and *Uredo*. [Uredo, P. C.]

(Smith, *English Flora*, vol. v. part ii.; Burnett, *Outlines of Botany*; Lindley, *Natural System*.)

GASTROBRANCHUS. [Myxine, P. C. S.]

GATTI, BERNARDINO, called il Soiaro from the occupation of his father, was born at Cremona about 1495. He is one of the most distinguished of Correggio's pupils and imitators: there are several admirable works by him in Parma, Piacenza, and Cremona. The Miracle of the Loaves in the refectory of the Padri Lateranensi at Cremona, painted in 1552, is a masterpiece, as is also the Ascension of Christ in the church of San Sigismondo. He died in 1575. Il Soiaro is claimed by other cities, but Cremona appears to have the best title to him.

(Zaist, *Notizie Istoriche dei Pittori, &c. Cremonesi*; Lanzi, *Storia Pittorica*, &c.)

GAUDEN, JOHN, was born in 1605 at Mayland in Essex, his father being vicar of that parish. His school-education was received at Bury Saint Edmunds; whence he removed to Saint John's College, Cambridge, and took his degree in arts in the ordinary course. About 1630 he removed to Oxford, and became a tutor in Wadham College; and at a later period he took the degrees of bachelor and doctor in divinity. In 1630 he was appointed chaplain to the Earl of Warwick, through whose patronage he received two ecclesiastical preferments, a rectory in Berkshire, and a vicarage in the county of Cambridge. In the earlier part of his history, led perhaps by the turn of his patron's politics, he inclined strongly to the popular side; and a sermon which he preached before the House of Commons, in 1640, was rewarded by a public present of a silver tankard. Next year the parliament presented him to the lucrative deanery of Bocking in Essex; to which however the cautious doctor thought it right to have his title confirmed by Archbishop Laud, then a prisoner in the Tower. After the breaking out of the civil war, Gauden submitted to the Presbyterian government, but with a hesitation which was suspicious, and which appears to have been punished by his exclusion from the Westminster Assembly of Divines after he had been named a member of that board. He gave up the use of the liturgy in the service of the church, but not till the last moment when it was possible to preserve it: and he subscribed the covenant, but not till he had written a treatise against it. He thus retained his preferments, but gradually approached nearer to the royalist church-party, and contracted with some members of it relations which, by his own account, led to important consequences. Upon the Restoration, Dr. Gauden was appointed chaplain to Charles II.; and before the close of the same year he was created bishop of Exeter, whence in 1664 he was translated to the see of Worcester. Shortly afterwards, on the 20th of September in that year, he died, of a disease which was either caused or aggravated by his disappointment in being obliged to put up with the bishopric of Worcester in place of the more valuable one of Winchester, which he had very eagerly solicited.

In the course of this solicitation the assertion was made which gives interest to Bishop Gauden's history and character. He alleged that he was the real and sole author of the famous work called 'Eikon Basilike, the Portraicture of his Sacred Majesty in his Solitudes and Sufferings,' which, purporting to contain meditations and prayers composed by King Charles I. in his captivity, had been published in 1648, a few days after his decapitation, and had excited a very lively sympathy towards the supposed author. The bishop's claim, urged privately in letters to Lord Clarendon and the Earl of Bristol, did not at once become the subject of open discussion; but the controversy was commenced in 1692, by an assertion of Gauden's authorship, published by a clergyman who had resided in his family. The curious question thus raised has been discussed again and again by our historical writers. An elaborate history of the controversy is given by Dr. Wordsworth in his two works upon it: 'Who wrote Icôn Basilikè? Considered and Answered,' 8vo., 1824; and 'King Charles the First the Author of Icôn Basilikè, further proved,' 8vo., 1828. Upon the merits of the controversy, it is here enough to say, that Warburton, in pronouncing doubtfully in favour of the genuineness of the work, had reason to declare the matter to be 'the most uncertain he ever took pains to examine;' and that, in our own day, and since Dr. Wordsworth entered the field, the claim of Gauden has been strenuously supported by Mr. Hallam and by other writers of authority.

Gauden was the acknowledged author of a large number of sermons and tracts, chiefly bearing upon questions of ecclesiastical polity. A list of these, containing nineteen or twenty pieces, is given in the article under his name in the 'Biographia Britannica.'

GEARING, or GEERING, in machinery, is a term somewhat indefinitely applied to a train of toothed wheels, or other similar contrivance, for transmitting motion. Couplings [Coupling, P. C. S., p. 483] may in some cases be considered a kind of gearing; and the expression 'to throw machinery *into* or *out of gear*' is commonly applied to the act of engaging or disengaging such connections.

The subject of gearing generally is treated of under Wheels, and Wheels, Teeth of, P. C., pp. 310, 318, where the principal varieties of toothed wheels are described. We may here further notice two ingenious contrivances for multiplying rotatory motion in a train of gearing, with greater rapidity than by any ordinary arrangement of wheels and pinions. The first of these was invented simultaneously by Mr. Dyer, in America, and by Messrs. M'Dougall, of Ferry-Bridge, in Yorkshire, and communicated by the former gentleman to Mr. H. Burnett, who obtained an English patent for it. The object of this invention, according to Hebert's account of it in the 'Engineer's and Mechanic's Encyclopædia,' vol i. pp. 621, 622, is to obtain a great difference in the relative velocities of the wheel and pinion, by a contrivance which in some respects resembles what is called a *worm-wheel*, or a wheel driven by an endless screw, while it is free from the objections attending the ordinary form of such an apparatus. As usually applied, the endless screw [Wheels, P. C., p. 314] forms a tangent, or nearly so, to the periphery of the wheel, the axis of the screw being at right angles with that of the wheel. The force applied by the screw in turning the wheel is therefore exerted in the direction of its axis, and not of its radius; and the communication of motion is attended by much rubbing friction, and by considerable strain or longitudinal pressure upon the pivot or resisting point of the screw. Owing to these disadvantages the screw is rarely, if ever, driven by the wheel, so that the use of the apparatus is limited to the conversion of a quick into a slow motion. In the improved gearing, of which Hebert gives illustrative cuts, the axis of the spiral or endless screw lies parallel to that of the wheel, and the power is applied in the direction of its radius, while the rubbing is converted into simple rolling friction. The resistance is thus so greatly diminished that the screw may be driven with facility by the wheel, so that the apparatus may be employed to convert a slow into a quick motion, as well as, like the common endless screw, for converting quick motion into slow. The simplicity of this kind of gearing constitutes one very important advantage, for as by its use every tooth of the wheel produces a complete revolution of the screw or spiral pinion, a wheel of only ten teeth may be used to produce the same effect as, in ordinary gearing, would be produced by a wheel of a hundred teeth working into a pinion of ten leaves.

The other apparatus referred to is the contrivance of Mr. W. Franks, to whom the Society of Arts awarded their large silver medal in 1833. In it the periphery of the wheel is cut with two sets of teeth, alternating with one another, so that the wheel may be described as resembling two thin wheels, cut precisely similar, and mounted upon the same axis in such a way that the teeth of one shall be opposite to the intervals of the other. Into this wheel works a pinion of peculiar shape, having four teeth or leaves, two of which work into one set of teeth on the wheel, and two into the other set. By this curious arrangement a complete revolution of the pinion is effected by the passage of only two teeth of the wheel; or rather, by the passage of a portion of the periphery of the wheel equal to two teeth; although, owing to the employment of duplicate gearing, four teeth, two of each set, are called into action to produce the revolution. Cuts of the apparatus are given in the forty-ninth volume of the Society's 'Transactions,' part ii. p. 116.

GEE, JOSHUA, was an eminent London merchant of the earlier part of the eighteenth century, but we have not been able to discover any particulars of his personal history. He was one of the authors of the work called 'The British Merchant,' originally published in numbers twice a week in 1713, and afterwards collected and reprinted in 3 vols. 8vo., 1721, and again in 1743. It was set up in opposition to the commercial treaty with France which was proposed by ministers after the peace of Utrecht, and to Defoe's thrice a week paper, entitled 'Mercator, or Commerce Retrieved,' in which the treaty was defended. 'The British Merchant' contains perhaps the most complete exposition that has been given of what is called the Mercantile or Balance of Trade theory; but, independently of their systematic notions, many of the facts collected by the writers are curious and valuable, and their publication forms a record of the state of many branches of our commerce at the period when it appeared. (See a full account of it in the 'Pictorial History of England,' vol. iv. pp. 207—213.) In the preface to the republication it is stated by the editor, Mr. Charles King, that 'Mr. Joshua Gee, merchant, was a very great assistant, and laboured with much industry in these papers.' Gee however is best known by his separate work, entitled 'The Trade and Navigation of Great Britain considered,' which originally appeared at London in 8vo. in 1729 or 1730 (for copies of the first edition seem to have sometimes one, sometimes the other of these dates). It was reprinted at London in 8vo. in 1731, and in 12mo. in 1738; and there is a Glasgow edition of 1760, called on the title-page the sixth, and another in 12mo. of 1767, professing to contain 'many interesting Notes and Additions, by a Merchant.' Mr. M'Culloch, in his 'Literature of Political Economy' (1845), makes a sixth edition to have appeared at Glasgow in 1735; but this must be a mistake. The advertisement prefixed to the Glasgow edition of 1768 speaks of the book as having for many years been very scarce. Gee himself, in an address 'To the Reader,' states that his treatise had been written, and even printed for the first time, without any design of publication, and only that a few copies might be put into the hands of the ministers of state and other great men. But he adds, 'After I had delivered a few of them, I understood, by some great persons, that a discourse upon trade would be very acceptable to the king, who was pleased with every opportunity of demonstrating his care and affection for his people; and that it would also be acceptable to the queen and prince.' He thereupon sent copies to these royal personages. Finally, when it got abroad that he had written the 'Discourse,' he was informed that if he did not permit it to be published, it would fall into the hands of such as might print it and alter the sense; so he determined to publish it himself. In a 'Preface,' which follows, he further attributes the origin of the work to his having been desired by some persons of distinction in the late reigns to give them his thoughts on naval stores, and divers other subjects in trade. The book is divided into thirty-four chapters, and, besides the general principles of trade, discusses the particular commerce carried on by England with every part of the world. The two main propositions which the author attempts to make out are, 'That the surest way for a nation to increase in riches is to prevent the importation of such foreign commodities as may be raised at home,' and 'That this kingdom is capable of raising within itself and its colonies materials for employing all our poor in those manufactures which we now import from such of our neighbours who refuse the admission of ours.' In his advertisement Gee informs us that the poverty and necessity in which he had seen the poor in several parts of the kingdom had touched him very sensibly, and he had spent a great deal of time from the service of his family 'to find out methods for promoting so public a blessing as turning the employment we give the poor of foreign nations to our own.' His scheme however is merely to put down begging in the streets, and to employ the poor in workhouses. On the whole, the book, though it was formerly popular, is not one of any remarkable ability or value, except as giving a clear account in small space of what the trade of the country then was.

GELL, SIR WILLIAM, was born in 1777, and was a younger son of Philip Gell, Esq., of Hopton, in the county of Derby. The original family name was Eyre, which had been changed by his grandfather to Gell, after his mother, who was of the family of the Gells of Hopton, Baronets. Sir William was educated at Jesus College, Cambridge; and took his degree of B.A. in 1798, and of M.A. in 1804. He was for some time a Fellow of Emanuel College. He is stated in the account to which we are indebted for the particulars of his biography, to have received his knighthood, 14th May, 1803, on his return from a mission to the Ionian Islands; but what was the nature of this mission, if it ever took place, we do not know, and he certainly was not knighted at so early a date. He had already spent much of his time abroad, as his publications show, when on the Princess of Wales leaving England in 1814, she appointed him one of her chamberlains. He attended the princess in various parts of Italy, especially at Naples and Rome; as appears from the evidence he gave at the bar of the House of Lords in the course of the proceedings taken against her after she became queen and had returned to England in 1820. After this Gell returned to Italy, and he resided mostly at Naples till his death, which took place there on the 4th of February, 1836. He had also however a house at Rome, in which he occasionally resided. He had long suffered severely from gout and rheumatism; and for some years before his death he had nearly altogether lost the use of his limbs.

He first appeared as an author in 1804, when he published his work entitled 'The Topography of Troy and its Vicinity, illustrated and explained by Drawings and Descriptions,' folio. This was followed by 'The Geography and Antiquities of Ithaca,' 4to., 1808; 'The Itinerary of Greece, with a Commentary on Pausanias and Strabo, and an account of the Monuments of Antiquity at present existing in that Country,' 4to., 1810; 'The Itinerary of the Morea, being a particular description of that peninsula, with a map of the routes,' 8vo., 1817; 'Pompeiana, or Observations upon the Topography, Edifices, and Ornaments of Pompeii' (in conjunction with J. P. Gandy, Esq.), 2 vols. 8vo., 1817-19; 'Attica,' folio, 1817; 'Narrative of a Journey in the Morea,' 8vo. 1823 (the journey having been performed in 1804); 'The Topography of Rome and its Vicinity,' 2 vols. 8vo., 1834 (an important work in reference to the cities antiently existing in the Campagna di Roma); 'Rome and its Environs' (a map), 1834. Gell was a good draftsman, and he has the merit of having carefully examined and delineated many monuments of antiquity. Some of his works are hurried performances; but they have all a certain value as being the results of actual observation. The one that brought the author most into notice was his 'Pompeiana;' of this a continuation, or second series, in 2 vols. 8vo., was published in 1835.

(Notice in *Gentleman's Magazine* for June, 1836, p. 665; and Gell's *Works*.)

GENERAL ISSUE. [Pleading, P. C.]

GENE'VRE, MONT, a mountain of the Alpine range [Alps, P. C.], which gives name to one of the principal cols or passes communicating between France and Piedmont. It is in that part of the Alpine range known to the Romans as Alpes Cottiae (the Cottian Alps), and still frequently called by that name, or its equivalents in the various languages of modern Europe. The peak of Mont Genèvre is on the S. side of the pass, and rises to the height of 3592 mètres, or 11,777 feet, above the level of the sea. The springs which are commonly regarded as the sources of the Dora (an affluent of the Po) and of the Durance are on the sides of Mont Genèvre. The pass forms the principal communication between the south of France and Piedmont. Though possessing several advantages over Mont Cenis, the next pass to the northward, it is less convenient for travellers coming from Paris and Lyon, as it involves the necessity of traversing another mountain-pass, the Col du Lautaret (the summit of which is 2091 mètres, or 6856 feet, above the level of the sea), by which the traveller crosses a branch of the Alps between Grenoble and Briançon. A third pass, that of the Col de Sestrières, on the Sardinian side, increases the difficulties of the passage by the pass of Mont Genèvre. The road from the south of France passes through Gap and Embrun to Briançon, and is practicable for carriages; that from Grenoble to Briançon (by Vizille, Bourg d'Oysans [Bourg, P. C.], the wild and sombre valley of the Romanche, the Col du Lautaret, and the valley of the Guisanne) is practicable only for foot-passengers or mules.

From Briançon the road runs for a league through the narrow gorge which affords a passage to the Durance, to the hamlet of La Vachette, at the foot of Mont Genèvre; here it crosses the Clarée, which, though considered only an affluent of the Durance, ought, from its greater length and volume of of water, to be regarded as the main stream. The ascent from La Vachette to the summit has been formed through a forest of firs, larches, and pines, now for the most part destroyed; it has numerous short steep ascents and sharp turns, and offers to the traveller looking back a fine view of Briançon [Briançon, P. C.], with its numerous forts, picturesquely situated, and lofty mountains. The summit of the pass is the lowest of all the passes of the Alps except the Col de Tende, being 1974 mètres, or 6472 feet, above the level of the sea, according to Malte-Brun: Brockedon's statement, 5850 feet, is, we believe, too low. The summit is a plain two miles long, extending E. and W., and sheltered by the mountains on either side. It is cultivated, and the cultivation extends up the slope on each side to an elevation of perhaps 60 or 80 mètres (180 to 240 feet) above the plain. The surrounding heights are crowned with larch-forests. Barley, oats, and rye are grown on this plain; and though the cold renders the amount of the harvest very precarious, the crop rarely fails entirely. The gardens are more productive than on the summit of the pass of Mont Cenis, and the spring is earlier: the zoology of the district adjacent to the pass is also indicative of its warmer temperature: wolves are more numerous, but the chamois is not so common. Bears are also more numerous than near the pass of Mont Cenis, but this is probably owing to the covert afforded by the pine-woods. In the plain at the summit of the pass is a hamlet called Bourg Mont Genèvre, about eight miles from Briançon. There was here an hospice for the protection of travellers, founded in A.D. 1340, by Humbert, Lord of Briançon; it stood in the midst of the village, but has long fallen into decay. Napoleon designed, in 1807, to restore it, and to place it in the hands of the Trappist monks, but the design was never fulfilled, though the following inscription was prepared for it by the members of the Institute:—

NEAPOLEONIS AUG. PROVIDENTIA
HOSPITIO GENEVRENSI
CONDITO
CARITATIS ERGA PEREGRINANTES
OFFICIA TRAPENSIBUS EXERCENDA
RESTITUIT
ANNO MDCCCVII.

From the summit of the pass the road winds down the steep side of the mountain five or six miles to Cesanne, at its foot on the Sardinian side. Where the slope is considerable and the soil soft, the road is secured by pine-trees embedded in the roadway at right angles to its direction, firmly propped and wedged with stones and earth, and secured at their outer extremity by a strong railing. The road commands a fine view of the Col de Sestrières, distant about ten or twelve miles from Cesanne. Two roads lead from Cesanne to Turin: one by the Col de Sestrières, the picturesque and almost impregnable fort of Fenestrelles, used as a state prison, and the town of Pignerol; the other by Exilles and Susa, where it unites with the road from Grenoble and Chamberri [Chambery, P. C.] over Mont Cenis.

The pass of Mont Genèvre was known to the antients. The Caturiges occupied the country on the west or French side of the pass; the Garoceli, the east or Sardinian or Piedmontese side. That Bellovesus, the reputed leader of the Gauls in their early occupation of northern Italy, crossed the Alps by this passage, is stated by Livy (v. 34), whom in this case we must regard as reporting the prevalent tradition. The same writer (xxi. 32-38), and Strabo (lib. iv. p. 209, ed. Casaub.; p. 319, ed. Janson, Amsterd. 1707) make this the passage by which Hannibal crossed the Alps; but this is very disputable [Hannibal, P. C.], and the best modern critics are in favour of his passage by the Little St. Bernard, the Alpis Graia of the antients. The prevalent opinion among the Romans, according to Livy, was in favour of the Alpis Pennina, or Great St. Bernard. Cæsar certainly fought his way across Mont Genèvre, in his rapid march with five legions to arrest the migration of the Helvetii. (Caes. *De Bell. Gall.*, i. 10.) In the time of Livy the pass was known by the name of the Saltus Taurinus (*Liv.* v. 34); in the time of the earlier Roman Emperors it was usually designated Alpis Cottia, or Alpes Cottiæ, a name properly applicable to the adjacent parts of the Alpine range. During the continuance of the Western Empire it was one of the main communications between Italy and Gaul. The name Alpes Cottiæ, or Cottianae, which occurs in Tacitus (*Hist.* i. 61 and 87), was derived from Cottius, an Alpine chieftain, who amid his mountain fastnesses maintained his independence after the subjugation of the rest of Gaul; and who, having made his peace with Augustus Cæsar, contributed much to the improvement of the route. (Ammian. Marc., xv. 10.) Vestiges of Roman works in the pass may still be traced, and columns and inscriptions have been dug up at the Bourg Mont Genèvre. In the middle ages the Latin name of the mountain and pass was Mons Janus: this name and the modern designation are evidently connected. During the middle ages and down to the present century the Col was passable only by mules and persons on foot. Towards the close of the last century, a conflict took place between the French and Sardinian troops on the very summit of the pass. In 1802, at the suggestion of J. C. F. Ladoucette, Préfet of the department of Hautes Alpes, and with the sanction of Napoleon, the present road was made by the inhabitants of Briançon and the neighbouring communes, assisted by the soldiers of the garrison of Briançon. This magnificent road from Briançon to Cesanne is thirty feet wide, and is well kept up on the French side of the frontier. It was called by order of Napoleon 'Route d'Espagne en Italie,' and was opened in 1804. An obelisk, sixty feet high, in honour of the emperor, was raised in 1807, with four inscriptions: one in Latin, one in Spanish, one in Italian, and one in French, on tablets of black Como marble. The inscriptions were destroyed by the Austro-Sardinian army, which entered France by this way in 1815, but the obelisk itself was allowed to remain.

(Vaysse de Villiers, *Itinéraire Descriptif de la France*; Ladoucette, *Histoire, Antiquités, &c. des Hautes Alpes*; Brockedon, *Passes of the Alps*.)

GENISTA (the Latin Genista), a genus of plants belonging to the natural order Leguminosæ. The calyx is 2-lipped; the upper lip bifid, the lower trifid. It has a subulate ascending style; a terminal, oblique, introrse stigma. The species have yellow flowers, and most of them yield a yellow dye. The Planta Genista, or Whin, the Gen of the Celts, and the Gênet of the French, was the badge of a long race of English kings, hence called Plantagenets. Upwards of eighty species are included in this genus, but few are applied to any important uses. They are found principally in the south of Europe, and some few are natives of Great Britain.

G. pilosa has a smooth procumbent stem, and obovate, lanceolate, obtuse leaves; ovate, blunt stipules. The peduncles, calyx, and underside of the leaf are silky, and the pods hairy. It is a native of the south of France, and is also found in Suffolk and Cornwall in England, in sandy places.

G. tinctoria, Dyer's-weed, or Woad, has a depressed stem, with erect branches, without thorns; lanceolate leaves, hairy at the edges; minute subulate stipules; racemose flowers; and glabrous corolla and pods. The branches are from one to two feet high, glabrous and downy above. This plant is a native of Europe, and is found in pastures, fields, and thickets in England. The flowers yield a yellow colour, which is much used for dying wool When cows are allowed to feed on this plant their milk becomes bitter and disagreeable, and the unpleasant taste of cheese and butter is often attributable to this cause. *G. tinctoria* has also a medicinal reputation. The seeds act as a mild purgative, and the ashes are also said to be a valuable diurectic.

G. anglica, Needle-Whin, has a spinous ascending stem, leafless below; unarmed, glabrous, flowing branches; ovate-lanceolate leaves; and glabrous stems and corolla. It is a native of Europe, in France and Denmark, and is found in Britain on moist boggy commons.

G. acanthoclada has trifoliate leaves, nearly sessile; linear, complicated, silky leaflets; stiff and spinose branches. The flowers almost opposite, and disposed along the branches in a kind of interrupted spike. It is a native of the Levant in exposed places, and in the island of Melos. This plant appears to be the *μέλαινα ῥίζα* of Hippocrates, *σκορπίος* of Theophrastus, and the *ἀσπάλαθος* of Dioscorides.

G. Hispanica has lanceolate villous leaves; branched, stiff spines; terminal racemes, somewhat capitate. It is a native of Spain and the south of France. Fraas states that this species is the 'genista' of Roman writers (Virgil, 'Georg.' ii. 434; Pliny, xxi. 9. 12, 22. 24, 9.; Columella, 4, 31).

G. purgans is an erect branched shrub with very few leaves and axillary solitary flowers on short pedicels. It is a native of France, on hills, especially in the Cevennes, where it is used by the villagers as a cathartic.

G. monosperma has erect branches; very few linear oblong leaves, clothed with a depressed pubescence; and lateral few-flowered racemes. It is a native of Spain, Portugal, Barbary, and Egypt. On the shores of Spain it is found to be very useful in binding the otherwise drifting sand, and by its beautiful fragrant blossoms it converts a barren waste into a lovely garden. The goats feed on the leaves and young branches, of which they are particularly fond. The Spaniards call both the plant and the districts over which they grow Rætamas, from the Arabic word Rætam. The species of this genus thrive well in a mixture of loam, peat, and sand, and young cuttings will easily strike in a potful of sand with a bell glass over them, which must be taken off and wiped occasionally, lest the cuttings absorb too much moisture.

(Don, *Gardener's Dictionary;* Babington, *Manual of British Botany;* Fraas, *Synopsis Plantarum Floræ Classicæ;* Burnett, *Outlines of Botany.*)

GE'OPHILA (from γῆ, the earth, and φιλ, love), a genus of plants belonging to the natural order Cinchonaceæ. It has the limb of the calyx 5-parted with linear spreading segments; the corolla tubular, with a pilose throat and 5 rather recurved lobes, with 5 anthers inclosed; the stigma bifid, the berry ovoid, angular, crowned by the calyx, 2-celled, 2-seeded.

The species are creeping herbaceous plants with stalked cordate leaves, like those of a violet; the stipules are solitary, undivided; the flowers sub-sessile, umbellate, surrounded by bracts, which are shorter than the flowers.

G. reniformis has the petioles hairy above; reniform obtuse leaves with the lobes at the base approximate; the bracts linear; the peduncles 4-6-flowered, shorter than the leaves. It is a native of moist shady places in the hotter parts of America, as Havanna, Jamaica, Puerto Rico, Brazil, and the basin of the Orinoco. The root of this plant is emetic, and may be used with advantage as a substitute for ipecacuanha. There are several species of this genus, all of which were formerly referred to the genus Psychotria.

(Don, *Gardener's Dictionary;* Lindley, *Flora Medica.*)

GEORGE, ST., is one of the Azores or Western Islands. It lies between 27° 50′ and 28° 20′ W. long, and 38° 30′ and 38° 45′ N. lat., between the islands of Terceira and Pico. It is a long, narrow island, extending in a west-north-west and east-south-east direction about thirty-five miles, with a breadth of about five miles. This would give an area of 175 square miles; but probably it does not exceed 160 square miles, or about ten square miles more than Rutlandshire.

The island appears to be entirely composed of volcanic rocks. They rise with an abrupt mural ascent along the northern shores, and this part of the island is almost uninhabited. But the southern coast is in general little elevated above the sea, and there occur many tracts of nearly level ground which are cultivated with great care. Along the middle of the island runs a more elevated tract, rising in some parts to more than 2000 feet, with an almost level top where it has not been changed by more recent volcanic eruptions. For though this island does not contain what may be properly called a volcano, it is subject to volcanic eruptions, accompanied with scoriae, ashes, pumice-stone, and volcanic sand, which cover extensive tracts of ground. The last and perhaps most violent of these eruptions happened in 1808.

The climate is extremely agreeable. As the temperature varies only between 50° and 75°, no severe cold is ever experienced in winter, nor is the heat of summer ever intense. Though rains are frequent, the air is not moist, which is ascribed to the absorption of humidity by the volcanic nature of the soil. St. George, like the other Azores, is particularly remarkable for the incessant gusts and gales to which it is subject throughout the year. Many attribute this circumstance to the volcanic nature of the group, but it probably originates in the difference of the temperature of the sea at large and that of the gulf stream, which approaches near the most western of the Azores.

St. George yields all the productions of the Azores, and most of them of superior quality. Its wines, especially that of Castelhenes, are superior to all others; they are exported to Fayal, and sold at Horta under the appellation of Fayal wines. Grain is not much cultivated, except Indian corn, of which sufficient is grown for the consumption of the inhabitants. The vegetables are of many kinds, among which the potato, sweet potato, and yams are most abundant; the yams are superior to those of any of the Azores, and almost equal to West Indian, both in size and flavour. In modern times the inhabitants have paid much attention to the cultivation of fruit, especially of oranges and lemons, and have had the greatest success. The higher grounds of the island afford excellent pasture for cattle; and butter and cheese, both of which are celebrated, are sent in large quantities to Horta. Cattle is exported to Madeira and Lisbon, and the meat is stated to be as good as English beef, except for fatness.

St. George constitutes a portion of the department of Angra. The capital is Ponto de las Velas, a city of about four thousand inhabitants, situated on the shores of a large open bay, and walled in on the sea-side: on the opposite side it is bordered by high mountains. Farther east are the two small towns of Urselina and Calheta.

The year in which this island was discovered is not known. It was taken possession of in the name of Jacomo de Bruges, by Guilherme van Deraga, in 1450, and colonized by a mixture of Flemings and Portuguese. The population is stated to amount to more than twenty thousand inhabitants. As the island has no safe harbour, it receives the foreign goods which it consumes from Angra or Fayal, to which places it sends its produce.

(Ashe, *History of the Azores;* Von Buch, *Physikalische Beschreibung der Kanarischen Inseln;* Boid, *Description of the Azores.*)

GEORGE OF DENMARK, PRINCE, has a place in English history as the husband of one of our queens, and as having resided many years in England and held a high public office. He was born 21st April, 1653, and was the youngest son of Frederick III., king of Denmark, and the only brother of Frederick's successor, Christian V. His mother was Sophia Amelia, daughter of George, duke of Lüneburg. He made his first visit to England, after a short tour in France, in July, 1669, when he was introduced at court, but remained only a few days. At the battle of Lunden, fought between the Danes and the Swedes, 14th December, 1676, Prince George is stated to have distinguished himself by his bravery; and the rescue of the king his brother, after he had been taken prisoner by the enemy, is attributed mainly to him. The Princess Mary of York having been married to the Prince of Orange in 1677, the duke her father is said to have pressed his brother the king to leave to him the disposal of his other daughter Anne; but Charles thought it more advisable to comply in this instance with the national wish, and to have her also married to a Protestant. Anne's first suitor was the Prince of Hanover (afterwards her successor, George I.), who came over to pay his addresses to her in 1681, but had scarcely landed when he was recalled by his father, who had negotiated a marriage for him with the daughter of the Duke of Zell. Some time afterwards overtures were made in behalf of his brother by the king of Denmark, and, Prince George having come over, he and Anne were married at St. James's on the evening of the 28th of July, 1683. 'The marriage,' says Burnet, 'did not at all please the nation; for we knew that the proposition came from France. So it was apprehended that both courts reckoned they were sure that he [the Prince] would change his religion.' For this apprehension, however, there never seems to have been the least ground.

On the accession of his father-in-law as James II., Prince George was made a privy counsellor; and he was not understood ever to have made any opposition to the measures of the court till the last moment. The truth however appears to be that he was a mere cypher. Charles II. is said to have declared that he had tried him drunk and sober, and, he added with an oath, there was nothing in him. Nobody seems to have thought it worth while at this time even to try to make a tool of him. When the Revolution came, he is understood to have acted under the direction of his wife. It had been arranged some days before by her and Lord Churchill (afterwards the Duke of Marlborough), who was much in their confidence, that he should go over to the Prince of Orange, and Anne had transmitted to William an express promise to that effect. Prince George however continued with the king till the night of the 24th of November (1688), when, being at Andover, on his leaving table after having supped with James by his majesty's invitation, he rode off in company with the Duke of Ormond, Lord Drumlanrig, and Mr. Boyle, and joined William at Sherborne Castle; having left behind him a letter to his father-in-law, in which he attributed what he had done to zeal for the Protestant religion. 'What?' said James, when he was told of his flight, '*Est-il possible* gone too?' This, it seems, was the prince's common phrase on all occasions; and it had been in great requisition during some previous days, when reports of one desertion after another were constantly coming in.

After the acceptance of the crown by William, Prince George was naturalized by act of parliament, and immediately before the coronation of the new king and queen, in April, 1689, he was created an English peer by the titles of Baron of Wokingham, Earl of Kendal, and Duke of Cumberland. He accompanied the king to Ireland in 1690, and was present at the battle of the Boyne. He used to attend and vote in the House of Lords both in the reign of William and in that of Anne, and he was even made occasionally to vote against the court in the former reign. His name stands affixed to the protest made against the rejection of the Place Bill of 1692, which had passed the Commons, and the defeat of which was only effected in the Upper House by the greatest exertions of the government. In other cases, again, they would get him to vote against his own convictions; as, for instance, in that of the bill against Occasional Conformity brought in by the Tory ministry in the first year of Queen Anne, when about to divide in favour of which he is reported to have said to Lord Wharton, the leader of the opposition to the measure, 'My heart is vid you.' Indeed he was only an occasional conformist himself, being in the habit of attending the Lutheran service in a chapel of his own, although he submitted to take the sacrament according to the forms of the Church of England when it became necessary to do so on his being appointed to office.

On the accession of Anne, while the actual command of the army was left in the hands of Marlborough, Prince George was declared generalissimo of all the queen's forces by sea and land; and he was also made lord high admiral, but with the novelty of a council to assist or act along with him. The legality of this arrangement, Burnet tells us, was at first much questioned; but the respect paid to the queen prevented the matter from being brought forward in parliament, so that the objections never went beyond a secret murmur. The queen also sent a message to the Commons desiring them to make some suitable provision for her husband in case he should outlive her; and it was agreed that he should in that case have an income of 100,000*l.* 'He was,' says Burnet, 'many years older than the queen, and was troubled with an asthma, that every year had its effects on his health; it had brought him into great danger this winter; yet the queen thought it became her to provide for all events.' Great opposition however was made in the Lords to a clause in the act exempting the prince from being comprehended in an incapacity created by the act settling the succession on the House of Hanover, which had provided that no foreigner, although naturalized, should hold any employment under the crown after that family came to the throne. The clause was opposed on two grounds: first, as improperly inserted in a money bill (which the Commons have always maintained cannot be altered, though it may be rejected, by the Lords); secondly, as giving a false meaning to the incapacity in the act of succession, which it was contended was never designed to apply to persons who had been already naturalized. But the queen pressed the clause, 'with the greatest earnestness,' says Burnet, 'she had yet showed in anything whatsoever: she thought it became her as a good wife to have the act passed; in which she might be the more earnest, because it was not thought advisable to move for an act that should take Prince George into a consortship of the regal dignity.' Burnet himself had his share in the displeasure conceived by the queen against those who opposed the clause; which, he asserts, was put into the bill by the court or Tory party 'only because they believed it would be opposed by those against whom they intended to irritate the queen.'

The prince's administration of the Admiralty was not glorious. Under date of the following year, 1703, we find Burnet already stating that at sea 'things were ill designed and worse executed:' 'the making Prince George our high admiral,' he goes on, 'proved in many instances very unhappy to the nation; men of bad designs imposed on him, he understood those matters very little, and they sheltered themselves under his name, to which a great submission was paid.' In 1703, in 1704, and again in 1707, the loudest complaints were brought forward in parliament both against the proceedings of the lord high admiral's council and the conduct of affairs at sea. Under date of the last-mentioned year Burnet writes:—'Great losses were made, and all was imputed to the weakness, or to a worse disposition, in some who had great credit with the prince, and were believed to govern that whole matter; for, as they were entirely possessed of the prince's confidence, so, when the prince's council was divided in their opinions, the decision was left to the prince, who understood very little of those matters, and was always determined by others.' In fact as Marlborough, now a duke, governed the army in his own name, he governed the navy also through his brother, Admiral George Churchill, who was all along the prince's chief adviser. The prince is said to have sometimes complained of his insignificance or want of influence; but his dissatisfaction evaporated in the quietest way. Lord Dartmouth has some curious notices of him in his splenetic notes to Burnet's history. In one place he says: 'His behaviour at the Revolution showed he could be made a tool of upon occasions; but King William treated him with the utmost contempt. When Queen Anne came to the crown, she showed him little respect, but expected everybody else should give him more than was his due; but it was soon found out that his interposing was a prejudice in obtaining favours at court.' Dartmouth goes on to state that all foreign princes had him in very low esteem; and he mentions some strange surmises made abroad as to the causes of his want of influence, which were certainly altogether imaginary. 'After thirty years living in England,' this note concludes, 'he died of eating and drinking, without any man's thinking himself obliged to him; but I have been told that he would sometimes do ill offices, though he never did a good one.' (Burnet, 'Own Times,' i. 643. See also note on ii. 489.) Burnet says in one place ('Own Times,' ii. 515) that the prince had been bred to the sea; but we apprehend this to be a mistake.

His death took place at Kensington Palace on the 28th of October, 1708. 'The queen,' says Burnet, 'had been, during the whole course of her marriage, an extraordinary tender and affectionate wife; and in all his illness, which lasted some years, she would never leave his bed, but sat up sometimes half the night in the bed by him, with such care and concern, that she was looked on very deservedly as a pattern in this respect.' In drawing the prince's character, besides giving him a mild and gentle temper, and making him free from all vice, Burnet says that he had made a good progress in mathematics, and knew much more generally than he could well express, 'for he spoke acquired languages ill and ungracefully.' His little capacity for business, however, was made still less by his indolence or love of ease, which appears really to have been his strongest passion, or the most marked point of his character. Anne bore him no fewer than nineteen children, of whom only five lived to be baptized, and even of these two died on the day on which they were born. A daughter Mary, born 2 June, 1685, lived till 8 Feb. 1687; another, Anne Sophia, born 12 May, 1686, lived till 2 Feb. 1687; only a son, William, born 24 July, 1689, and soon after created duke of Gloucester (though the patent never passed the great seal), and in 1696 elected and installed a Knight of the Garter, outlived his infancy: he died 30 July, 1700. He was a boy of great promise, and a copious account of him is given by Burnet, who was his preceptor. There are portraits both of Prince George and of the Duke of Gloucester at Kensington Palace. Prince George was a Knight of the Garter, but the date of his election is not recorded in any of the accounts we have consulted.

GERA'NIUM (from γέρανος, crane; the long beak which terminates the capsules resembles the bill of a crane), a genus of plants, the type of the natural order Geraniaceæ. The flowers have 5 petals and 5 sepals, 10 monodelphous stamens alternately larger and with glands at their base. There are 79 species of this genus enumerated, of which 13 are British; of these only two are applied to any useful or medicinal purpose.

G. Robertianum has 2-flowered peduncles; obovate, entire, or slightly emarginate petals; very long glabrous claws; transversely wrinkled downy capsules, smooth seeds, ternate agrimate leaves, and stalked trifid inciso-pinnatifid leaflets. This plant has small bright crimson flowers, and is found on waste ground, walls, and banks in Great Britain, in Brazil, and Chile. The whole herb has a strong disagreeable smell, which is said to be a preventive against bugs. A decoction of the plant is recommended as likely to give relief in calculous cases. It contains tannin and exerts an astringent action on the system, and is given to cattle in some diseases.

G. maculatum, Spotted Crane's-bill, has a rather angular stem covered with retrograde pubescence; 3-5 parted leaves with deeply-toothed lobes; obovate entire petals; the filaments of the stamens hardly ciliated at the base. This species is a native of North America, from Canada to North Carolina. The flowers are of a pale lilac colour. On account of the astringent nature of this plant, it is known in some parts of North America as *Alum-root*, and is employed successfully as a remedy in dysentery among children, a disease very prevalent in the parts of the country where it grows. The tincture is recommended in cases of ulcerated sore-throat and soreness of the gums, &c. Dr. Bigelow discovered the presence of large proportions of tannin and gallic acid in this plant. The quantity of tannin appears to be greater than that of any other constituent.

G. tuberosum, a plant growing in the south of Europe, particularly in Italy and Silesia, is the γεράνιον of Dioscorides (iii. 121), and the Geranium tertium of Pliny (xxvi. 11).

The hardy perennial kinds of geranium are very beautiful plants, and well adapted for ornamental cultivation. They will thrive in any common garden soil with ordinary care.

(Don, *Gardener's Dictionary*; Babington, *Manual of British Botany*; Fraas, *Synopsis Plantarum Floræ Classicæ*.)

GE'RARD, FRANCOIS, BARON, one of the most distinguished painters of France, was born of a French father and Italian mother at Rome in 1770. He went early to Paris, and was first placed with the sculptor Pajou, and finally with David, as he found painting better suited to his taste than sculpture. Gérard's first work of note was the blind Belisarius carrying his dying guide in his arms, painted in 1795; it is now in the Leuchtenberg gallery at Munich, and is well known in prints. The next work which attracted notice was Psyche receiving the first kiss from Cupid, which, though extremely elaborate in execution, is an inferior work to the Belisarius: its delicate execution and academical drawing are nearly its only merits; the figures are motionless and lifeless. Cupid and Psyche look like tinted statues; the words of Cicero (*De Nat. Deor.* i. 27) on the Venus Anadyomene of Apelles—that her tints were not blood, but a resemblance of blood—would not apply well to this picture. These however were not the works of the mature artist, and they were followed by many admirable pictures in history, poetry, and portrait.

Some of Gérard's works are among the best and largest oil paintings in existence. His entrance of Henry IV. into Paris, his masterpiece, painted in 1817, is, in more than one sense, a prodigious work: it is thirty French feet wide by fifteen high, and is almost one huge mass of life and character; the drawing is correct, vigorous, and varied, the colouring good, and it is a perfect school of costume for the period: it has been engraved by Toschi. This picture was painted for Louis XVIII. as a substitute for the Battle of Austerlitz, painted by Gérard in 1810, and it procured him his title of Baron. The Battle of Austerlitz, and the Coronation of Charles X., painted in 1827, are of the same vast proportions as the Henry IV., but they are as inferior in execution as in subject. The Battle of Austerlitz is, like many other of the large paintings of Napoleon's battles, little more than a display of military uniforms, though it is superior to the majority of the works of its class, and is equal to its subject: there is an engraving of it by Godefroy. The Henry IV. and the Battle of Austerlitz are at Versailles. The Coronation of Charles X. was nearly destroyed in the revolution of 1830: but had it been entirely so, Gérard would probably have rather gained than lost in reputation; a robe picture is however a poor subject for any painter, but particularly for a great painter.

Of Gérard's small pictures, the best is perhaps Thetis bearing the armour of Achilles, painted in 1822, and purchased by Prince Pozzo di Borgo. The composition and drawing are extremely beautiful; the whole is in the highest degree admirable: there is an engraving of it by Richomme. Two such works as the Henry IV. and the Thetis display rare powers for the same painter; and when we consider in addition that he was constantly engaged in portrait painting, in which he was unsurpassed in his own time, his title to the reputation of one of the greatest painters of modern times is manifest. A list of Gérard's portraits would almost amount to a list of the most illustrious personages of his age: Pierre Adam has etched a collection of eighty full-length portraits after him, seven inches and a half by five inches and a half, French—'Collection des Portraits Historiques de M. le Baron Gérard, premier peintre du Roi, gravés à l'eau-forte par M. Pierre Adam, précédée d'une Notice sur le Portrait Historique.'

Gérard died Jan. 11, 1837: he was a member of the Institute of France; a chevalier of the orders of St. Michel and the Légion d'Honneur; and member of the academies of Munich, Vienna, Berlin, Copenhagen, Turin, Milan, and Rome.

There are many notices of Gérard in the French and German contemporary periodical press—*Kunstblatt*, &c. &c.

GERBIER D'OUVILLY, SIR BALTHASAR, a miniature painter and architect, born at Antwerp about 1591. He came young to England and was a retainer of the Duke of Buckingham's as early as 1613. He accompanied the duke to Spain, and painted a miniature of the Infanta for James I.; he was also employed in the treaty of marriage between Prince Charles and the Infanta Maria, though acting ostensibly only as a painter. He was employed also in Flanders after the accession of Charles I. to negotiate a private treaty with Spain, the same treaty in which Rubens was commissioned on the part of the Infanta, and about which he came to England. In 1628 he was knighted by Charles at Hampton Court; he was naturalised in 1641, and died in 1667 at Hempsted-Marshall, the seat of Lord Craven, which was built by Gerbier himself.

Gerbier was the author of several curious works which are noticed at considerable length by Walpole. One, entitled 'Les Effets pernicieux des meschants Favoris,' &c., he terms—'an ignorant, servile rhapsody, containing little argument, many lies, and some curious facts, if the author is to be believed.' No. 3384 of the Harleian MSS. is entitled—'Sir Balthasar Gerbier, his admonitions and disputes with his three daughters, retired into the English nunnery at Paris, 1646.' One of these daughters was maid of honour to the princess Condé, and passed for her mistress when the princess made her escape from Chantilly, when the prince was imprisoned by Mazarin. There is a portrait of one of Gerbier's daughters, as a little girl, by Rubens, in the collection of Lord Spencer: there are also two pictures of Gerbier's family attributed to Vandyck; one belonging, in Walpole's time, to the Prince of Wales, the other to Mr. Sampson Gideon. Gerbier's portrait in one piece with Dobson the painter and Sir Charles Cotterel, painted by Dobson, is in Northumberland House; there is or was also in the same collection a miniature of the Duke of Buckingham on horseback, dated 1618, by Gerbier himself. In the Pepys Library at Cambridge there is a miscellaneous collection of robes, &c., emblazoned and illuminated by Gerbier. Gerbier appears to have been a courtier, and to have had a lively care for his own interests. He kept in Charles's favour after the death of Buckingham, and he was in favour also with Charles II.: he returned with him to England and designed the triumphal arches which were erected for his reception. He was master of the ceremonies to Charles I., and in 1628 entertained him and the queen at his own house, at a supper, which must have cost at least a thousand pounds, says a contemporary. Gerbier states in one of his works that Charles had promised him the office of surveyor-general of works, after the death of Inigo Jones.

(Walpole, *Anecdotes of Painting*, &c.)

GERMAN SILVER. [Copper, P. C., p. 504.]

GERMEN. [Pistil, P. C.]

GESE'NIUS, FRIEDRICH HEINRICH WILHELM, one of the most distinguished Orientalists of modern times, was born at Nordhausen, on the 3rd of February, 1786. He was educated in the gymnasium of his native place, and afterwards in the universities of Helmstedt and Göttingen. After the completion of his studies, he was for a short time employed as teacher at the paedagogium of Helmstedt: in 1806 he received the post of repetitor in the theological faculty of the university of Göttingen. In 1809 Gesenius, on the recommendation of the celebrated historian Johannes von Müller, was appointed professor of antient literature in the gymnasium of Heiligenstadt. This office, however, was of short duration, for in the year following he accepted the appointment of professor extraordinary of theology in the university of Halle, where, in 1811, he was raised to the rank of ordinary professor. During the war of the Liberation the university was closed, and when it was opened again, in 1814, Gesenius resumed his former office, and was created doctor of divinity. During the summer of 1820 he made a journey to Paris and Oxford, where he collected materials for his great lexicographical works on the Semitic languages. He died on the 23rd of October, 1842. Gesenius was unquestionably the greatest scholar of modern times in his particular department of Oriental literature, and the light he has thrown on the Semitic languages, and especially on the Hebrew, has made a new æra in this branch of philology. As a theologian he belonged at first to the Rationalistic party, but after the appearance of Strauss's 'Life of Christ' he joined the philosophical and critical school, in consequence of which he was often very severely attacked by the orthodox party.

His works on the Hebrew language enjoy a universal reputation, and some of them are translated into most European languages. The most important among them are—1, 'Lexicon Manuale Hebraicum et Chaldaicum in Veteris Testamenti Libros,' 2 vols. 8vo., Leipzig, 1833. This work was originally written in German, and went through two editions; the third was made in Latin, and a fourth, in German, appeared in 1834. 2, 'Hebräisches Elementarbuch,' 2 vols. 8vo. The first vol. of this work is a Hebrew Grammar, of which the twelfth edition appeared at Leipzig in 1839; the second is a Hebrew Delectus, and the seventh or last edition was edited after the author's death by De Wette, Leipzig, 1844. 3, 'Kritische Geschichte der Hebräischen Sprache und Schrift,' Leipzig, 1815, 8vo., is intended as an introduction to the study of Hebrew; a second edition appeared in 1827. 4, 'De Pentateuchi Samaritani Origine, Indole et Auctoritate,' Halle, 1815. 5, 'Ausführliches grammatisch-kritisches Lehrgebaüde der Hebräischen Sprache, mit durchgängiger Vergleichung der verwandten Dialecte,' Leipzig, 1817, 8vo. 6, 'A German translation of the prophet Isaiah, with a philological, critical, and historical commentary, Leipzig, 1820-21, 3 vols. 8vo.; of the first vol. a second edition appeared in 1829. 7, 'Scripturae Phoeniciae Monumenta quotquot supersunt edita et inedita ad Autographorum optimorumque Exemplorum Fidem edidit, Commentariis illustravit,' &c. parts I.—III., with plates, Leipzig, 1837, 4to. 8, 'Versuch über die Maltesische Sprache, zur Beurtheilung der neulich wiederholten Behauptung, dass sie ein Ueberrest des alt-Punischen sei,' Leipzig, 1810, 8vo. 9, 'Thesaurus philologicus criticus Linguæ Hebraicæ et Chaldaicæ Veteris Testamenti,' vol i. consisting of two parts, and the second of one, Leipzig, 1829-42, 4to. A few copies of this work, which is in reality an enlargement of the one mentioned above under No. 1, were printed in folio. Gesenius also contributed a great number of articles on Hebrew and other Oriental subjects to Ersch and Gruber's great 'Encyclopædia.' Biblical geography is especially indebted to him for the notes which he added to the German translation of Burckhardt's 'Travels in Syria and Palestine,' Weimar, 1823, two vols. 8vo.

(*Neuer Nekrolog der Deutschen* for 1842; Gesenius, *Eine Erinnerung für seine Freunde*, Berlin, 1842, 8vo.)

GHISI. [MANTUANO, P. C. S.]

GIAMBERTI. [SAN GALLO, P. C.]

GIBSON, RICHARD, a celebrated dwarf and painter, and page (of the backstairs) to Charles I., was born in 1615. He was the pupil of Francis Cleyn, and studied afterwards the works of Sir Peter Lely, whom he imitated; Lely painted his portrait in 1658. Gibson was only three feet ten inches high, and he married, in the presence of Charles and his queen, Anne Shepherd, who was of exactly his own height. Waller wrote some verses on the occasion.

Gibson appears to have been an excellent painter, especially in water-colours. There is a very good drawing by him of Charles the First's queen, at Hampton Court. A miniature painting by him of the parable of the lost sheep was the cause of Vanderdoort's death; it belonged to Charles, who prized it very much, and he intrusted it to the keeping of Vanderdoort, who put it away with such care, that when the king asked him for it he could not find it, and he hanged himself in despair; it was found afterwards by his executors and restored to the king. Gibson was patronized also by Philip earl of Pembroke; and he is said to have painted Cromwell several times. He taught painting to the queens Mary and Anne, daughters of James II.

Gibson and his wife were painted several times: by Vandyck, by Dobson, and by Lely. Vandyck introduced his wife in the picture of the Duchess of Richmond at Wilton. They had nine children, five of whom lived to maturity, and attained the proper size. Gibson died in 1690, and his wife in 1709, aged eighty-nine.

(*Essay towards an English School*, 1706; Walpole, *Anecdotes of Painting*.)

GILBERTSOCRINUS, a genus of fossil Echinida, from the mountain limestone. (Phillips.)

GILL, JOHN, D.D., an eminent dissenting divine of the Baptist persuasion, was born at Kettering, in Northamptonshire, on the 23rd of November, (Old Style), 1697. His parents, though in humble life, gave him a superior education in the grammar-school of his native town, until the enforcing of a rule which required attendance upon episcopal worship occasioned his withdrawal, in common with other children of dissenters. He continued his studies in private, and attained considerable proficiency in the Greek, Latin, and Hebrew languages. About the age of twenty he began to preach at Higham Ferrars among the denomination to which both he and his parents belonged, and in 1719 he removed to London, to take charge of a congregation which then assembled at Horsleydown, Southwark, but removed in 1757 to a new chapel in Carter Lane, near London Bridge, over which he presided until his death, on the 14th of October, 1771, a period of more than half a century. Of his numerous publications, which are said to have been equal to 10,000 folio pages, many were of a controversial character and of temporary interest. That by which he is best known is his 'Exposition of the Bible,' published at various times in distinct portions. The 'Exposition of the Song of Solomon' appeared in a folio volume in 1728, and was republished with corrections and additions in 1751 and 1767. In this work Gill replies to Whiston's endeavours to prove the 'Song of Solomon' to be a spurious book. The 'Exposition of the New Testament' appeared in three folio volumes, in 1746, 1747, and 1748, in which last year the degree of D.D. was conferred upon the author from Marischal College, Aberdeen. The Old Testament was completed at various times in six folio volumes, and a second edition of the whole was published shortly before his death. A third complete edition of the 'Exposition' was published in 1809 and 1810, in nine large quarto volumes, with a very copious memoir of the life and writings of Dr. Gill, from which the above facts are derived. Among his other works we may mention 'The Prophecies of the Old Testament respecting the Messiah considered, and proved to be literally fulfilled in Jesus,' published in 1728, in answer to Collins's 'Scheme of Literal Prophecy considered;' a 'Treatise on the Doctrine of the Trinity,' published in 1731, and intended to check a then growing tendency to Sabellianism among the Baptists; the 'Cause of God and Truth,' in four volumes, octavo, published in 1735 and following years, being a defence of Calvinistic against Arminian sentiments, in which Gill displayed a strong inclination to Supralapsarianism; a 'Dissertation concerning the Antiquities of the Hebrew Language, Letters, Vowel-points, and Accents,' 1767, octavo; and a 'Body of Doctrinal Divinity,' two volumes quarto, 1769; and 'Body of Practical Divinity,' one volume quarto, 1770, which were republished together in 1795 in three volumes, large octavo, as 'A Complete Body of Doctrinal and Practical Divinity,' with a portrait of Dr. Gill. This edition, as stated in the advertisement, was published at the request of several ministers, as 'a work which enters into, fully explains, and ably defends the whole system of evangelical truth; a work in which the opinions of the ancient fathers and churches on all the principles, doctrines, and duties of Christianity are critically examined and candidly stated, as are likewise the opinions of the most celebrated philosophers who have been the opponents of Divine revelation.'

GILLENIA, a genus of plants belonging to the natural order Rosaceæ, the sub-order Spireæ. It has a tubularly campanulate 5-cleft calyx, 5 linear lanceolate petals, 10-20 stamens, very short, inclosed in the tube, 5 carpels almost united into a five-celled capsule, and 2 seeds in each cell. There are only two species of this genus.

G. trifoliata has several stems from the same root, a foot or two in height, alternate trifoliate leaves, the flowers, which are few in number, forming a sort of panicle. It is a native of North America in shady places, from Florida to Canada. The root is emetic, and possesses properties similar to those of ipecacuanha. It must however be administered in larger doses, and is not so certain in its effects. Some authors attribute a tonic power to this plant when taken in small doses.

G. stipulacea is distinguished by its foliaceous ovate deeply-cut stipules. It grows in humid woods and damp places from Tennessee to Kentucky, in North America. The medicinal properties of this species are the same as those of *G. trifoliata*.

The species of Gillenia are elegant and hardy plants, and are therefore worthy of cultivation. They grow best in a peat soil, and may be readily propagated by dividing at the roots early in the spring.

(Don, *Gardener's Dictionary*; Lindley, *Flora Medica.*)

GILLIES, JOHN, LL.D., was born on the 18th of January, 1747, at Brechin, in the Scottish county of Forfar. He belonged to a respectable and enterprising family. One of his younger brothers became eminent as a lawyer, and died not long ago, after having been for many years a judge of the Supreme Court in Scotland. Dr. Gillies was educated at the University of Glasgow, where, before he was of age, he taught the classes of the Greek professor, then old and infirm. Soon after this he removed to London with the design of occupying himself in literary labour. But before settling there he paid a visit to the Continent; and on his return he was engaged by the Earl of Hopetoun as travelling tutor to his second son. This young man, while under his care, died at Lyon in 1776; and his tutor's attention to him was rewarded by an annuity for life from his father.

In 1778 Dr. Gillies published his translation of Lysias and Isocrates. He had by that time received his degree as Doctor of Laws; and to this, in later life, he added other literary honours, being a member of several societies in our own country, and a corresponding member of the French Institute and the Royal Society of Göttingen. He next went abroad again with two other sons of the Earl of Hopetoun, one of them the late earl, the other Sir Alexander Hope, who was governor of Chelsea Hospital. Returning to England about 1784, Dr. Gillies published, in 1786, the first part of his 'History of Ancient Greece.' In 1793 he was appointed to succeed Dr. Robertson as Historiographer Royal for Scotland, a sinecure place with a salary of two hundred pounds a year. In 1794 he married. Enjoying a moderate competency, he prosecuted his studies with leisure; and his subsequent writings appeared at long intervals. During his latest years he was very infirm, though labouring under no disease, and had retired altogether from general society. In 1830 he settled at Clapham, near London, where he spent the remainder of his quiet old age, and died on the 15th of February, 1836, of mere decay, having just entered his ninetieth year.

The following are his published works:—1, 'The Orations of Lysias and Isocrates, translated from the Greek, with some account of their Lives; and a Discourse on the History, Manners, and Character of the Greeks, from the conclusion of the Peloponnesian War to the Battle of Chæronea,' 1778, 4to. 2, 'The History of Ancient Greece, its Colonies and Conquests' (afterwards entitled Part the First); 'from the earliest accounts till the Division of the Macedonian Empire in the East; including the History of Literature, Philosophy, and the Fine Arts,' 1786, 2 vols. 4to. This work had reached a sixth edition in 1820, 4 vols. 8vo. There is a German translation of it, 'Geschichte von Altgriechenland,' 11 vols. 12mo., Vienna, 1825. 3, 'View of the Reign of Frederic II. of Prussia, with a Parallel between that Prince and Philip II. of Macedon,' 1789, 8vo. 4, 'Aristotle's Ethics and Politics, comprising his Practical Philosophy, translated from the Greek; illustrated by Introductions and Notes, the Critical History of his Life, and a New Analysis of his Speculative Works,' 1797, 2 vols. 4to. The 'Supplement to the Analysis of Aristotle's Speculative Works, containing an account of the Interpreters and Corrupters of Aristotle's Philosophy, in connection with the Times in which they respectively flourished,' 1804, 4to., was incorporated also in a second edition of the translation published in the same year, 2 vols. 8vo., and in a third edition, the last which has appeared. 5, 'The History of the Ancient World, from the Dominion of Alexander to that of Augustus, with a preliminary survey of preceding periods,' 1807-10, 2 vols. 4to.; reprinted in 4 vols. 8vo. as 'The History of Ancient Greece, its Colonies and Conquests, Part the Second,' 1820. 6, 'A new Translation of Aristotle's Rhetoric, with an Introduction and Appendix explaining its relation to his Exact Philosophy, and vindicating that Philosophy by proofs that all departures from it have been deviations into Error,' 1823, 8vo.

The First Part of the 'History of Greece' appeared in the same year with the first volume of Mitford's work, and, if inferior to it, is yet superior to anything of the sort which our language till then possessed. The plan is well digested; but neither the pompous verbosity of its narrative nor the general dulness of its dissertative portions is likely to recover for it the popularity of which newer views have now robbed it. The translations of Dr. Gillies, however meritorious their intention, do not deserve high praise. They are everywhere at the very least paraphrastic, and in many places reprehensibly unfaithful. Those from the orators are the least faulty; and for Isocrates the translator's style, elaborate, diffuse, and thoroughly modern in its structure, was not on the whole ill calculated. But to Aristotle's works his mode of treatment does great injustice. His desire of popularizing his author has made him depart almost always from his manner of expression; and the same motive, aided not unfrequently either by mistake as to his nomenclature or by the wish to evade a difficulty in the text, has made him often misrepresent even the matter which the philosopher gave him. Indeed this description of their faults is hardly full or severe enough, especially in reference to the Ethics and Politics, which he can scarcely be said to have translated at all, so much do his professed translations abound in inaccuracies, in omissions, in unauthorised interpolations. Their demerits are exposed, bitterly yet not unjustly, in Thomas Taylor's preface to his version of the Metaphysics of Aristotle. Gillies' version of the Rhetoric is not so bad in the more popular portions; but here also the more abstract portions are very faulty. Two examples may be referred to, which together throw utter confusion over those parts of the Rhetoric that treat the theory of argumentation. He not only falls into the common mistake of holding the Enthymeme to be with Aristotle, as in more recent writers, a name for a syllogism with one premise suppressed, instead of signifying a syllogism in matter contingent; but he repeatedly interpolates this erroneous gloss, and thus causes perplexity where a literal translation would have caused none. Again, in rendering the difficult passages where Aristotle proposes a classification of the kinds of matter which furnish enthymemes (passages probably interpreted rightly by Majoragius and in substance interpreted in the same way by Dr. Whately), he does not even preserve the philosopher's cardinal distinction between the enthymeme from signs and the enthymeme from likelihoods, as arguments of two distinct classes, but slurs over the difficulty by a vague and unmeaning abridgment.

GILLRAY, JAMES, the celebrated caricaturist, was born about the middle of the last century. He was originally a writing engraver, and is said also to have been a strolling player for a short time. He had an acute perception of character, a strong sense of the ludicrous, and at the same time a great ability for drawing, and a practical skill in engraving. His great faculty was the burlesque; his works, however, often contain much wholesome satire. Social abuses and absurd conventionalisms were often the subject of his ridicule; but his pencil was more frequently directed against political abuses; the doings and enactments of the Tory ministries and the events of the great war were his favourite themes. His first political satire was published in 1782, and in allusion to Fox and Lord Rodney's victory. The last of his caricatures appeared in 1809: it represented 'a barber's shop in assize-time,' and was from a design by H. W. Bunbury, who designed several other of the caricatures which were engraved by Gillray. This last plate was executed at intervals between fits of mental aberration, which terminated shortly afterwards in a total suspension of the intellectual faculties, in which state he remained until his death on the 1st of June, 1815. His works appeared singly: but they have been published in sets, genuine, and spurious or copies. An 'Illustrative Description,' with a complete set of his genuine works in 304 sheets, was published by McLean, London, in 1830. Many of them exceed the bounds of the burlesque, and are far in the province of the gross and absurd; he also frequently took great personal liberties. George III. and Pitt are two of his best characters; Napoleon he has entirely missed; he probably had a difficulty in meeting with his portrait; he is only recognizable by the part he plays; Gillray's caricatures, however, to be thoroughly understood, require a familiarity with the party history of the time; they are mostly mere works of the day, and Gillray himself was little more than a caricaturist, unlike Hogarth, a true satirist, whose works are for all time.

GIN, or GYN, a machine employed instead of a crane, chiefly by artillerymen, for the purpose of raising guns, howitzers, &c. on their carriages. It consists of three round poles from twelve to fifteen feet long, and five inches in diameter at the lower extremity, tapering to about three inches and a half at the top.

The three poles are, by means of an iron bolt passing through straps, or by a rope passed several times round each, united together at their upper extremities in such a manner that they may be turned about their place of union; and when the machine is set up, the feet of the poles are planted in the ground at about eight or nine feet from each other. The feet of two of the poles are kept at that distance by means of a rope or an iron bar, which may be temporarily placed in a horizontal position near their lower ends; and between the same two poles, at about three feet and a half from the ground, is a wooden roller, or windlass, which, by means of handspokes, may be turned on its axis, the pivots entering into holes sunk in iron cheeks attached to the poles. The third pole, commonly called a 'pry-pole,' has a greater extent of movement than the others about the upper extremity, so that all the three poles, previously to being set up, may lie on the ground: when set up, two blocks with their *fall*, or rope, are employed in raising or lowering the gun, the upper block being fixed to the top of the poles, and the other, by means of a rope, to the piece of ordnance: the rope from the upper block passes over the windlass before mentioned.

Two poles fastened together at the top, and set up like the sides of the letter A, the whole being kept steady by means of ropes made fast to the upper extremity and to strong pickets driven into the ground, are also employed for raising or lowering artillery, by means of two blocks with their rope, the extremity of the latter usually passing round the cylinder of a windlass, capstan, or crab. This apparatus is called shears.

GINKELL, GODART DE, FIRST EARL OF ATHLONE, was a native of Holland, and the head of a family of great antiquity among the nobility of that country, where he bore the titles of Baron de Reede, de Ginkell, and others which may be read in the peerages, and was a general of cavalry. He came to England at the time of the Revolution of 1688, either with the Prince of Orange or immediately after. When two Scotch regiments, in the beginning of March, 1689, declared for King James and marched from Abingdon, where they were quartered, for Scotland, General Ginkell was sent after them with a body of horse, and soon overtook and reduced them. In 1690 he accompanied King William to Ireland, and commanded a party of Dutch horse at the battle of the Boyne (1st July). When the king returned to England, the conduct of the war was left in the hands of Ginkell; and he succeeded in effecting the reduction of the country before the end of the following year. The town of Baltimore surrendered to him, 7th June, 1691; Athlone was taken by storm on the 1st of July; on the 12th of the same month he gained the battle of Aghrim [P. C., vol. i., 209]; and on the 3rd of October an end was put to the war by the surrender of Limerick. On the 3rd of November Ginkell returned to Dublin, and was banqueted by the corporation; he then came over to England, where, on the 4th of January, 1692, the Commons ordered seven of their members to attend him with the thanks of the House, and on the 20th of February he was made a peer of Ireland, with the titles of Earl of Athlone and Baron of Aghrim. The next week he was entertained at Merchant Tailors' Hall by the lord mayor and corporation of London. The following year the king, after the House of Commons had sent up an address requesting that a recompense might be given to him suitable to his services, made him a grant of the forfeited estates of the Earl of Limerick, amounting to 26,480 acres, which was confirmed by an act of the Irish parliament passed on the 7th of December, 1695; but in 1699 an English act was passed appointing a commission to inquire into the considerations upon which this and other similar grants had been made in Ireland; in the next session by another act all the lands so granted were vested in trustees authorised to hear and determine upon all claims relating to them; and one of the acts of this board appears to have been the resumption or invalidation of the grant made to the Earl of Athlone. Burnet's account however is not very clear: he says, in mentioning the appointment of the board, that the earl had sold his estate 'to those who thought they purchased under an unquestionable title; yet all that was laid aside, no regard being had to it; so that this estate was thrown into the heap' ('Own Times,' ii. 239). Afterwards, in giving an account of the proceedings of the House of Commons in 1701, when, the board of trustees having become extremely unpopular, attempts were made to obtain its suppression, he says, 'One motion was carried, not without difficulty, in favour of those who had purchased under the grantees, and had made great improvements, that they should be admitted to purchase with an abatement of two years' value of the estates; the Earl of Athlone, whose case was very singular, as was formerly set out, having sold his grant to men who had reason to think they had purchased under a secure title, a special clause was offered in their favour; but the party had studied so far to inflame the nation against the Dutch, that in this the votes were equal, and, the Speaker's [Harley's] vote being to turn the matter, he gave it against the purchasers.' (Idem, iii. 300.) From this account it would seem that, supposing this vote of the House of Commons to have been conclusive, as appears to be assumed, it was not the Earl of Athlone, but the persons to whom he had sold the lands from whom they were now taken back. The latter, indeed, might possibly have their remedy against the earl as having purchased under what had proved to be a bad title. The account in the common peerages is, that the grant was reversed by parliament (it is not said whether the English or the Irish) on the 15th of December, 1695, or eight days after it had been confirmed by the Irish parliament, and that the value of the estates was appropriated to the payment of the public debts. This is manifestly quite a loose and blundering statement. It is added, that thereupon the family retired to Holland, 'with what feelings of resentment or disappointment,' says Sharp's 'Genealogical Peerage,' 'we are not informed.' The Earl of Athlone, however, continued his military services to the end of the reign of King William. He shared in William's defeat at Landen, 29th July, 1693; and he commanded the Dutch horse in Flanders in 1695 and 1696. He also commanded the Dutch forces serving under Marlborough in the war with France which broke out in 1702, after the accession of Queen Anne. But this post he did not hold long, his death having taken place on the 10th of February, 1703. The Peerages state that the first Earl of Athlone married Ursula-Philipota de Raasfeldt, and had by her two sons, of whom the eldest succeeded to the title. It afterwards, however, fell to the son of the second, who succeeded as the fifth earl in 1747; and his descendants inherited the title till the death of the late lord, without issue, in 1844, when it became extinct. He was the ninth earl. It is remarkable that, with the exception of the first earl, if he ever took his seat, no Earl of Athlone sat in the Irish parliament for more than a century after the creation of the peerage. The family continued to reside in Holland; but Frederick Christian Renaud, the sixth earl, came over here on the French invasion of that country in 1795, and took his seat in the Irish House of Lords on the 10th of March in that year.

GIOCONDO, FRA GIOVANNI, an Italian architect of Verona (of the fifteenth century), celebrated for his almost universal acquirements, was a great Greek and Latin scholar, a theologian, philosopher, and engineer, and was skilled in perspective and in decoration, especially in inlaid wood-work. He is mentioned in the highest terms by many contemporary writers, and particularly by his countryman Julius Cæsar Scaliger, who was his pupil in the Greek and Latin languages. He served the Emperor Maximilian in Germany, Louis XII. in France, and Leo X. at Rome: he built the Ponte della Pietra at Verona, that of Nôtre Dame at Paris, and succeeded Bramante as architect of St. Peter's, the foundations of which he much improved. Vasari mentions other of his architectural works; he also says that he built two bridges over the Seine. He turned a great portion of the waters of the Brenta from the Venetian lagoons, directing them to Brontolo, many miles to the south of Venice, by which means the Venetian waters were kept perfectly free from the vast quantities of mud brought down from the Alps by the Brenta; this Vasari terms Giocondo's greatest work, and a signal service for Venice: the same or a similar channel still exists, and is called the Brenta Nuovissima. Amongst Giocondo's literary services Vasari mentions a great collection of antient inscriptions which he copied in Rome and presented to Lorenzo de' Medici: he also first discovered several of the letters of the younger Pliny in an old library at Paris; and he published an illustrated edition of Vitruvius at Venice in 1511.

In the continuation of St. Peter's, Giocondo was appointed conjointly with Giuliano da San Gallo and Raphael, and the latter speaks of Giocondo in the following terms in a letter (published by Richardson, and inserted in recent Lives of Raphael) to his uncle, dated July 1, 1514:—'He (the pope) has given me a companion, a very learned old friar, who is upwards of eighty years of age; and as the pope sees that he cannot live long, and as he has the reputation of great knowledge, his holiness has given him to me as an assistant, that I may learn of him, and discover any great secret he may have in architecture, and thus perfect myself in the art. He is called Fra Giocondo.' According to this, if Raphael was a correct judge of age, or had ascertained the fact of Giocondo's age, he must have been born about 1430, twenty years earlier than the date given by Vasari. Singularly enough, though not with unusual inconsistency, Vasari, in mentioning Giocondo incidentally in the Life of Raphael, says that he died in 1537, aged eighty-seven, yet in Giocondo's own life, which follows soon afterwards, he says, 'He died at length very old; but it is not known exactly when or where.' It is not known with certainty to what religious order he belonged, but he is supposed to have been a Franciscan. He was still living in 1521.

(Vasari, *Vite de' Pittori*, &c.; Dal Pozzo, *Vite de' Pittori, &c. Veronesi*; Milizia, *Opere*; Quatremere de Quincy, *Dictionnaire d'Architecture*, &c.)

GIOFFRE'DO, MARIO GAETANO, one of the few good architects that Naples has produced, was born in that city, May 14th, 1718. Greatly to the dissatisfaction of his parents, who intended him for the law as the most honourable profession, and the most likely to lead to distinction, Gioffredo resolutely determined that architecture should be his pursuit; and he was accordingly placed under Martino Buonocore, an architect of considerable reputation, but of little talent. The pupil was not long in finding out the mediocrity of his master, and commenced a course of private self-instruction by studying the best Neapolitan edifices, those by Fansaga and Domenico Fontana, and the writings of Vitruvius and Palladio. He further extended his studies not only to mathematics, but to antiquities and history in their connection with art, and also took lessons in design and figure-composition, both from Solimena and from Francesco di Mura, another able artist of that time.

Gioffredo at the age of twenty-three began to practise in his profession, but it is unfortunately one which is more or less at the mercy of opportunity, since unless favoured by that, architectural talent has scarcely any means of discovering itself to the public. On one of his visits to Rome he solicited permission to compete for the church of San Giacomo degli Spagnuoli, then about to be rebuilt there: his application was very coldly received by the Spanish dignitary Herreros, who observed that they got their singers and not their architects from Naples; to which Gioffredo replied, he would convince them that Naples had architects also worth having. Nor did he fail to make good his word, for his designs obtained the preference, although he had to contend with Sardi, Fuga, and Vanvitelli, to the second of whom, we may observe, Milizia erroneously attributes the building.

Afterwards, though he had full employment at Naples, and on government works in Calabria Ultra, where he was for some time engaged in superintending the working of the iron-mines in the Valle di Canneto, he had not many opportunities of signalizing himself as an architect. The principal buildings of architectural note by him at Naples are the two palazzi Campolieto and Coscia, and the Chiesa dello Spirito Santo; for though great public improvements, the two new streets, that of Monte Oliveto and the one called De' Pellegrini, do not properly come under the head of architectural works. Still, had he even executed less in the practice of his profession, he would possess a claim to notice which is shared by comparatively very few in it, for he published an excellent work on architecture in 1768, which however he did not carry on to the extent he originally contemplated, on account of the very great expense for engravings which it would have imposed upon him.

In 1783 his services were rewarded by his being appointed the chief government architect, with a very liberal salary. Soon afterwards a disorder of his eyes, brought on by excessive study, terminated in total blindness. In that condition his only solace was derived from the talents of his four daughters, all of whom were most accomplished musicians. He fell at last into a state of profound melancholy, from which death relieved him on March 8th, 1785.

GIRAUD, COUNT GIOVANNI, one of the best and most popular writers of Italian comedy, was born at Rome, October 28th, 1776, and was of a noble and wealthy family that had been originally of French extraction. Of his first studies and his early passion for the drama and everything connected with the theatre, he himself has given an amusing account in the general preface to his comedies. When he was at the age of sixteen, the death of his father, Count Ferdinando, left him to frequent the theatre without restraint. Even before that time he had begun to attempt dialogues and scenes in imitation of Goldoni, Chiari, and other dramatists, but it was not till some years afterwards that he composed his first regular piece, 'I Gelosi per Equivoco,' nor was that performed till 1807. Its decided success inspired him afresh with inclination to write for the stage, which had been rather damped by the discouraging remarks of the manager to whom it had been first offered; and in the very same year he produced his 'L'Ajo nell' Imbarazzo' (The Tutor in a Scrape), which is universally allowed to be his masterpiece, and one of the happiest specimens of modern Italian comedy. In 1812 he went to Paris with his elder brother Pietro, and he again visited France in 1815, after the restoration of the Bourbons, and also came over for a short time to England. On his return to Italy he published (1816) his 'Teatro Domestico,' and produced some fresh pieces for the stage, but was soon after seized with a strange fancy for entering into mercantile speculations and other schemes, which, besides diverting him from the career in which he had distinguished himself, failed so completely, that he was at length reduced to comparative poverty. His disappointments greatly affected both his health and his mind; he fell into a declining state, and was at last carried off by a severe nervous attack in the spring of 1834.

Giraud possesses more of comic power than is displayed by any of his contemporaries; he exhibits more of incident, situation, and stage effect; and if his dialogue seldom rises above the level of ordinary conversation, it is at least marked by vivacity, and is free from that drawling flatness which is one great defect of modern Italian comedy. Some of his pieces were founded upon real circumstances, and in one instance this brought him into a very serious dispute with the family of the Marchese Albergati (another celebrated dramatist), for his 'Sospetto Funesto' was supposed by them to allude very undisguisedly to an unfortunate domestic affair, and the suspicious circumstances attending the sudden death of the marquis's second wife. The piece was in consequence prohibited; nor does it appear to have ever been published. To all of those which he did publish he prefixed a separate preface, which self-commentaries possess a value and interest of their own.

GIRDER. [Trussing, P. C.; Floor, P. C. S.]

GIRODET TRIOSON, ANNE LOUIS, one of the most celebrated of the recent French painters, was born at Montargis on Jan. 5, 1767, and was the favourite pupil of David; he studied also some time in Italy. His name is really Girodet; he adopted that of Trioson in 1812, from his guardian, a physician. His first picture of note was the Dream of Endymion, painted in Rome; and in 1806 he created considerable sensation by his large picture of a scene from the Deluge, now in the Louvre, a composition exceeding all limits of probability, quite void of true dramatic character, dead in modelling and in colour, and good only in the academical outline of the figures, which, however, though about to fall headlong, are motionless: the only support of a whole family of five is a broken branch, held by one arm of the father, who is carrying an old man on his back; the group has just lost its equilibrium, yet the branch is completely broken and bent about eighty degrees from its natural position, in which it must have been completely out of the reach of the father, or once reached there could be no possible danger of the group falling, as it must have been planted far and firmly upon the rock. The whole composition is an example of the awful made ridiculous by bad treatment.

There are three other works by Girodet in the Louvre,—the Endymion, the Burial of Atala, from Châteaubriand, and the Revolt of Cairo, an extremely extravagant composition. Girodet's chief merits are an elaborate execution and an academical beauty of design; but it is generally a cold lifeless beauty. One of his best pictures is Pygmalion and his Statue, in the Somariva collection, which is remarkably chaste and beautiful in composition and execution, and it a subject which does not suffer from Girodet's peculiar style it has been engraved by Laugier.

Most of the best works of Girodet have been well engraved, as well as a vast number of designs for publishers. A collection of literary works, also by him, was published in 1829, under the title 'Les Œuvres posthumes, Poétiques et Didactiques, de Girodet Trioson,' in 2 vols. 8vo., containing also a Life and Correspondence.

Girodet was a member of the Academy of Painting and of the Institute of France; a knight of the order of St. Michael, and officer of the Legion of Honour: he died December 9, 1824. A sale of his effects was made after his death, when some of his drawings realised enormous prices.

GIRVAN, a market and post town and burgh of barony on the coast, in the district of Carrick, in Ayrshire, about 20 miles south-south-west from Ayr, and about 54 miles south-south-west from Glasgow. The parish of Girvan extends about nine miles along the shore, and on the average about four miles inland, having thus an area of about thirty-six square miles, or above 23,000 statute acres: it is traversed by a range of hills having an average elevation of 900 feet, but rising in one place to 1200 feet, and is watered by the Girvan Water and one or two other small streams. The parish contains a considerable quantity of good arable land in the lower ground, yielding, according to an estimate made in 1837, about 3800 quarters of oats, 2600 quarters of wheat, and 18,000 bolls of potatoes. There are about 800 or 900 head of cattle, chiefly cows for the dairy, and above 2100 sheep. There is a considerable salmon-fishery at the mouth of the Girvan; and the bay of Girvan affords a variety of excellent fish, such as cod, haddock, whiting, mackerel, soles, flounders, turbot, and lobsters; but no attempt has been made to turn this supply to much account. Some limestone is dug; copper-ore has been found, but is not now worked; nor is there any coal in the parish, though there is in the neighbourhood. The town is beautifully situated, and commands a fine view of the sea, with the peninsula of Cantire, the islands of Arran and Bute, and other islands, Ailsa Craig, and the coast of Ireland in the distance. It is an ill-built mean-looking place, and consists in great part of small houses, one story high, containing a weaving-shop and a room to live in, the latter sometimes tenanted by several families. The population consists chiefly of hand-loom weavers and their families; a number of them are Irish immigrants, wretched in condition, untidy and dirty in their habits, and destitute of that forethought and independence of character which mark the native population. There are a parish church, a Secession meeting-house, a small Methodist meeting-house, used in the week as a school-room, and a small school-room, used as a Roman Catholic chapel. The population of the parish at the different enumerations in the present century was as follows:—1801, 2260; 1811, 3097; 1821, 4490; 1831, 6430; 1841, 7424; namely, 3662 males, 1918 of them under twenty years; and 3762 females, 1842 of them under twenty. The number of houses in 1841 was 1099, namely, 1069 inhabited, 26 uninhabited, and 4 building. Only about one-tenth of the population is agricultural. There are two branch banks; and some corn is shipped from the quay, which is small. It is thought that a good harbour might be formed at a moderate expense. There are a parish school, a subscription school for teaching the children of the poor to read at 1*d.* per week, and many private schools, both in the town and in the rural part of the parish. There are a small subscription library, a library belonging to the Agricultural Society of the district, two circulating libraries, and a number of benefit societies and a savings-bank. Girvan was erected into a burgh of barony in 1696, by charter granted to Sir Andrew Muir. A baillie court is held weekly for debts not exceeding 2*l.*

(*New Statistical Account of Scotland*; *Gazetteer of Scotland*, published by Fullarton and Co., Glasgow, 1842; *Population Returns*.)

GLACIER. Attention has been of late so strongly drawn to the mechanical theory of glacier movements and the possible geological effects of such movements, that it appears necessary to add a few lines to the notice of glaciers given in a former volume. [GLACIERS, P. C.] The hypotheses by which the descent of the vast masses of frozen snow down the valleys of the Alps and other mountainous regions has been explained, or attempted to be explained, are essentially two. First, the original notion of Saussure, put in its most original form, that the glacier masses descended the valleys by the *force of gravity;* and secondly, the later notion of Charpentier, that the icy masses were *pushed* down the valleys by an internal expansion caused by congelation of water in their internal cavities. Each of these original notions takes at least two forms. Saussure's hypothesis, indeed, appears in three modifications of importance.

1 A. The view of Mr. R. Mallet, communicated to the Geological Society of Dublin, recognises the descent of the glacier by gravity, but adds the hydrostatic pressure of water below the glacier—*upward* and *forward;* and it is impossible to deny to this speculation the merit of removing some considerable difficulty in the reception of the general hypothesis of Saussure.

1 B. The view of Professor J. Forbes, who, besides noticing peculiar structures (the blue bands) in the glacier ice, and measuring the velocity of glacier movements in different parts of the valley, and in the central and lateral parts of the 'ice current' (if we may so speak), has proved the *bending* of the ice from a straight transverse line during its movements; and has, by means of artificial preparations, imitated some of the peculiar glacial structures. His view is, that glaciers descend the valleys in consequence of so much mutual yielding and adjustment (plasticity) of their parts as to entitle them to be regarded as *viscous* or *semifluid masses*, flowing slowly under the influence of gravity.

1 C. Mr. Hopkins, recurring to the original notion of Saussure, maintains the mechanical probability of the glaciers *sliding down* their containing valleys, as *solid* bodies; that is to say, sliding in consequence of the general slope of the valley, and not in consequence of the internal displacements and readjustments of the icy mass. Displacements and readjustments happen in this view no less than in Mr. Forbes's hypothesis. The icy mass is subject to *extension*, to *flexure*, and *fracture* under *tension*, and a variety of accidents, which Mr. Hopkins has employed to explain the unequal rates of movement, the varying forms of fissures, &c. in glaciers. Ice may be regarded as in a certain degree plastic, since it is flexible; but none of these things interfere with the essential condition of this hypothesis, viz., the *sliding* of the whole ice-mass on its bed. This sliding is in a great measure due to the perpetual slow fusion of the lower surface of the ice, which leaves it in a constant state of disintegration, &c. Mr. Hopkins has made experiments on the sliding of ice; from which it results, that even at angles of inclination from the horizon much below 1°, the movement of the ice masses on a rough flagstone, while the lower surface was subject to slow fusion, was very discernible, and found to follow a simple law proportioned to the sine of the angle of inclination.

2 A. The second branch of the hypothesis alluded to, originating with Charpentier, has further ramified into two forms. Charpentier thought the congelation of water in many *fissures* of the glacier must necessarily urge portions of it forward in the direction of least resistance. But as the glacier is sliding by day and by night, in summer and in winter, sliding unequally in different parts of its descent, and not with such *an order of inequality* as fits to the hypothesis; and as there is no assignable reason (in this hypothesis) for the formation of new *fissures*, and the continuation of the process, this whole speculation (the *dilation* hypothesis) has been abandoned.

2 B. Another form has been given to it by M. Agassiz. This eminent explorer of the Alpine glaciers ascribes their onward movement to congelation of water, not in the cavities of Charpentier, but in minute capillary fissures and spaces among the granular constituent masses of the glacier. With such a power of expansion, altogether independent of gravity, M. Agassiz esteemed it possible to allow of the movement of glaciers, even across level countries, and thus to account for many geological phenomena difficult to be otherwise explained, as erratic blocks and other diluvial phenomena. Mr. Hopkins has, however, conclusively shown that by the means supposed no such power of onward movement can be exercised. Mr. Forbes has proved the actual phenomena of glaciers to be inconsistent with the assumption of such congelation as a cause and with the effects ascribed to it by Agassiz. It is clear from all experiments and mechanical reasonings, that gravity causes the descent of glaciers; but there remain some further researches to be made into the true internal structure of ice, and the true state of the lower surface of glaciers, before we can regard the inquiry as complete.

The geological interest attaching to a correct theory of glacier movements is considerable.

The investigations of Agassiz and others into the history of the glaciers of the Alps, &c., and their former greater extension, have rendered it very probable that this enormous ice-power has been actively at work in early geological periods in situations where now no fields of ice ever occur. Observations of effects such as glaciers are known to produce on surfaces which they traverse; smoothed and rounded rocks—grooved surfaces—striation parallel to the grooves,—appear to require the existence and movement of glaciers down some of the valleys which intersect the Snowdonian, the Cumbrian, and Irish mountains. One of the effects attendant on glaciers is the transport of detritus on the surface of the ice till it melts, or, in the case of the glacier meeting the sea, breaks off in an iceberg to be drifted by oceanic currents. It is believed by Agassiz that the immense single blocks of stone which lie on the Jura, opposite the valleys of the Alps, have been deposited there by glaciers, not drifted by water-currents, and this speculation he has applied to far greater areas and more difficult cases, such as the accumulation of erratic blocks, gravel mounds, and diluvial heaps in level regions like those which margin the antient tertiary Bay of Dublin, or abound in the central plains of England. From so great an extension of this speculation, founded as it is on an erroneous hypothesis of glacial movement, Mr. Hopkins's demonstrations warn us to dissent; but if, as may be easily believed, the antient glacier streams of Cumberland delivered the detrital blocks of Shap and Carrock into the sea by the breaking off of icebergs, these may have been drifted by currents to Staffordshire, to the mouth of the Tyne, and the valleys of York and Holderness.

It may be objected that for such an icy covering to Snowdon and Skiddaw, a great reduction of climate is necessary, and that this is not consonant with the general tenor of geological inferences, which point to more elevated temperatures in early periods. But the reply is easy. The evidence of warm climates in northern zones relied on by geologists applies to *far earlier periods*; and in respect of this comparatively late period, a reduction of temperature to the extent required for the production of glaciers on the mountains of Wales and Cumberland is perfectly possible by a mere change of the disposition of land and water—since in fact the temperature of the British Islands is now *in excess* above the mean of their latitude by 5°, 10°, 15°, and more, and this excess is merely due to oceanic currents and other conditions which vary with the distribution of land and water.

(Saussure, *Voyages dans les Alpes;* Mallet, in *Trans. of the Dublin Geol. Soc.;* Forbes, in *Jameson's Journal and Tour in the Alps;* Hopkins, in *Cambridge Trans. and Phil. Magazine.*)

GLASS, JOHN, founder of the sect of Glassites in Scotland, was born on 21st September, 1695, at Auchtermuchty, a parish in the county of Fife, of which his father was clergyman. He studied at St. Andrews and Edinburgh, and in 1719 was ordained minister of the parish of Tealing near Dundee. He became a popular preacher, and his sermons, extending to two or three hours in length, were attended by crowds of people from distant parts of the country. He exhibited his disposition to differ with the other members of the church of Scotland, by attacking the principles of the Solemn League and Covenant, and other public declarations intimately connected with the growth of the Presbyterian polity. He was deposed by the church courts on 12th of April, 1728. His position being re-considered by the Genera Assembly of 1739, it would appear that they decided that he was entitled to retain his status as an ecclesiastical person, but not to hold a benefice, as he refused to comply with the necessary tests. He had in the mean time removed to Dundee, where a few hearers gathered round him, and, gradually accumulating, formed a considerable sect. It is not easy from any known announcement of them to discover their tenets; they have a mystical appearance, and relate to a spiritual union which binds the members into one body as a church, without its being represented by an outward ecclesiastical polity. The Glassites are generally respectable people, and their founder lived an unspotted life. He died in 1773.

(Chambers, *Biog. Dict. of eminent Scotsmen.*)

GLASS PAINTING is practised as follows:—The design having been first drawn on paper, the glass is laid thereon, and the outline traced on the glass with black or brown composed of a very fusible glass, coloured with a metallic oxide, and ground extremely fine in oil of tar or spike. The parts intended to be yellow, orange, or red are then coated, either on one or both sides, according to the tint required, with a mixture composed of an alloy of silver and antimony ground up with the red oxide, which is obtained by subjecting sulphate of iron to a red heat. The glass is then exposed to a red heat, or, as it is termed, fired, in which process the tracing-colour is fused, and adheres permanently to the glass. The mixture of silver and antimony stains the glass, but does not melt, so that the oxide of iron, which is in the state of dry powder, may be brushed off, leaving the glass coloured, but as transparent as before. The other colours, composed, as for enamel [ENAMEL, P. C.], of a very fusible glass coloured with metallic oxides, are then added, and the glass is again fired. In most cases the glass is fired between the application of each colour, as some colours require more heat than others. In subjects which are too large to be executed in one piece, the joinings are carefully arranged to run in the outline; and for draperies, &c. the artist avails himself of glass already coloured in the manufacture (pot metal), and which requires shadowing, diapering, &c.

In painting glass, the colours applied remain on the surface of the glass, and interfere with its transparency. In staining glass, the colour sinks into the glass a very small distance, but leaves it as transparent as before: the only colours which can at present be stained are yellow, orange, and red.

There is a kind of ornamental window-glass called matted work, in which the glass is covered with a very fusible composition, either white or tinted, previously reduced to an impalpable powder. This composition is then removed from certain parts of the glass, according to the required pattern, and, after firing, produces on the glass a dull ground with a bright pattern. The demand for ornamental glass having increased lately, several persons have attempted, some by stencilling, others by the application of machinery, to produce it at a cheap rate; and matted work can now be obtained at one-fourth of the price that would have been charged a few years since.

There is also another method of ornamenting glass, rather inappropriately termed embossing, which also consists of a bright figure on a dull ground. The parts intended to be dull are painted over with varnish; hydrofluoric acid is then poured on, which etches the glass to a certain depth. After the acid and varnish are washed off, the glass is ground by rubbing with another piece of flat glass and fine emery. This process removes the original surface of the glass, and produces the dull ground; and the design, having been sunken by the action of the acid, is untouched in the grinding process, and left bright.

GLAUCIUM (from γλαυκός, 'sea-green, or glaucous,' in allusion to the colour of the plant and its habitation by the sea-side), a genus of plants belonging to the natural order Papaveraceæ. It has two sepals, four petals, and indefinite stamens; elongated 2-valved capsules, a bilamellate stigma, and ovate reniform seeds. The species are evergreen glaucous biennial or annual herbs, abounding in a copper-coloured acrid juice, said to be poisonous and to occasion madness. The flowers are yellow or crimson, and the English name of the genus, Horn Poppy, originates in the horn-like shape of the pods.

G. luteum, Yellow-horned Poppy, has a smooth stem and a tubercular scabrous pod. The flowers are large, and of a golden-yellow colour. It is found on the sandy sea-shores of Great Britain, and also in the Carolinas and Virginia. It is the μήκων κερατῖτις of Theophrastus (*Hist. Plant.*, 9, 13).

G. phœniceum is regarded by De Candolle as a variety of *G. corniculatum*. It is a native of the south of Europe, and is occasionally found on the coast of England. It is however considered by Babington to be a doubtful native. The flowers are crimson, and have an elegant appearance. Don enumerates six species of Glaucium, none of which however are applied to any useful purposes. The species of horn-poppy thrive well in any common garden-soil, and may be easily raised from seeds, which ripen in great abundance.

(Don, *Gardener's Dic.;* Babington, *Man. Brit. Bot.*)

GLAUX, a genus of plants belonging to the natural order Ranunculaceæ. It has a bell-shaped calyx, 5-parted, coloured, and without any corolla, by which peculiarity it is distinguished from all other plants of the same order. There are 5 stamens inserted at the base of the calyx; the capsules are few-seeded, opening with 5 valves. There is but one species of this genus.

Glaux maritima, the Black Saltwort, has a procumbent stem, opposite ovate glabrous leaves, axillary sessile pink flowers with obtuse segments. It grows on the sea-shore and salt-marshes, and is a native of Great Britain.

(Babington, *Manual of British Botany.*)

GLEANING. The practice of gleaning in corn-fields what the reapers of the harvest leave behind is vulgarly supposed to be a legal custom which the 'owner or occupier of the field has no right to prohibit, and that the poor who enter a field for this purpose are not guilty of trespass;' but the only authority in support of this view is an extra-judicial dictum of Lord Hale. Blackstone, in his '*Commentaries*,' book iii. c. 12, remarks that this humane provision seems borrowed from the Mosaical law (*Levit.* xix. 9, and xxiii. 22, &c.), and apparently adopts Lord Hale's opinion. The question has, however, twice been tried in the Court of Common Pleas. In the first case the defendant pleaded that he being a poor, necessitous, and indigent person, entered the plaintiff's close to glean; and in the second the defendant's plea was the same, with the addition that he was an inhabitant legally settled within the parish. Mr. Justice Gould gave a judgment in favour of gleaning; but the other three judges clearly decided that the claim had no foundation in law, and that 'it was a practice incompatible with the exclusive enjoyment of property, and was productive of vagrancy and many mischievous consequences.' (1 H. Bl., *Rep.* 51, quoted in Christian's ed. Blackst., *Com.*, vol. iii. p. 213.)

The general custom in all parts of England is to allow the poor to glean, in some cases before the harvest is carried, but more generally perhaps not until afterwards. Persons who are not actually necessitous sometimes avail themselves of permission to glean, and by commencing their labours as soon as it is daylight, they gain as much as they would have done from the wages which they would have earned if they had been employed by the farmer to secure the crop. In this case the privilege is abused, and the community not benefited. In some districts the farmers meet together and establish rules for regulating the practice of gleaning, with a view of protecting themselves, and likewise of confining the privileges to the necessitous poor of the neighbourhood. The following are rules which were agreed upon at a meeting of farmers in Hertfordshire, 11th August, 1845:—1, That no person shall be allowed to glean in any field, until the day after the corn shall have been carted and the field cleared; 2, That no person be allowed to enter the fields for the purpose of gleaning until after eight o'clock in the morning, or to remain therein after six o'clock in the evening; 3, That no able-bodied labourer above sixteen years of age and under sixty shall be allowed to glean in any of the fields situated within the parishes [above named]; 4, That any person or persons found breaking the rules laid down in the foregoing resolutions shall be considered a trespasser, and prosecuted accordingly. In some cases the only restriction is as to the hours when gleaning is allowed; and this is a very proper one, as in the absence of any rule gleaners have been known to commence before three o'clock in the morning, that is, before daylight, and while the crop was still in the field.

The following table is from a paper prepared by Dr. Kay Shuttleworth, on the earnings of agricultural labourers in Norfolk and Suffolk (*Journal of Statistical Society of London*, vol. i., p. 183), and it professes to show the value of corn gleaned by 388 families:—

			Average number of Children in a Family.	Average Annual Amount.
46	families	with no children . .	..	£0 17 $10\frac{1}{4}$
110	„	„ all the children under 10	$2\frac{7}{8}$	0 18 $7\frac{1}{2}$
97	„	„ one child above 10 .	$3\frac{7}{10}$	1 0 $6\frac{1}{4}$
85	„	„ two children . .	$4\frac{6}{10}$	1 5 $6\frac{1}{2}$
37	„	„ three . . .	$5\frac{1}{4}$	1 9 $6\frac{1}{4}$
13	„	„ four . . .	7	1 6 $9\frac{1}{2}$

The total value of gleanings of the 338 families was 423*l.* 12*s.*, and the average for each family 1*l.* 1*s.* 10*d.*, which was one-fifth of the average harvest wages of each of the same number of families.

GLEDITSCHIA, a genus of plants named in honour of Gottlieb Gleditsch, a professor at Berlin, and author of a work on the sexual system of Linnæus entitled 'Consideratio epicriseos Siegesbeckianae in Linnaei systema plantarum sexuale et methodum botanicam.' (Bischoff, p. 562.) He was a good botanist, and contributed a valuable paper on the reproductive organs of the Fungi to the Transactions of the Berlin Academy in 1748. This genus belongs to the natural order Leguminosæ and the suborder Cassieæ. The flowers are unisexual, the calyx has 3-4-5 equal sepals, which are connected together at the base into a cupule. The petals are equal in number to the sepals; two of them are connected into a carina. The leaves are abruptly pinnate and bipinnate on the same tree. The flowers have a greenish colour, and are disposed in spikes.

G. triacanthos, the Three-horned Acacia or Honey Locust, is a large tree, native of the Carolinas and Virginia, and attaining a height of from 50 to 80 feet. When the tree is young, the trunk and branches are covered with small prickles, which become hard as it increases in age, and form a formidable defence. The foliage is of a light shining green, and is particularly elegant. In the neighbourhood of London the leaves do not appear until late in the spring, and drop off early in the autumn. The seeds are covered with a sweet pulp, which, when infused and fermented, forms an intoxicating liquor which was used by the American Indians.

G. monosperma, the One-seeded Gleditschia, is a native of the Carolinas, Florida, and Illinois, in damp woods. It attains a height of from 60 to 80 feet, and much resembles the former species. When none of the seeds ripen it is impossible to distinguish them. There are 8 species of Gleditschia enumerated, all of which possess the same general characters. As ornamental trees they are much esteemed, both on account of their elegant foliage and the varied and picturesque forms assumed by the tree, together with the singular appearance of the spines. They require a deep rich soil in a situation not exposed to high winds.

(Loudon, *Encyclopedia of Trees and Shrubs*; Don, *Gardener's Dictionary*.)

GLEEMAN'S SONG. [SAXON LANGUAGE AND LITERATURE, P. C.]

GLYCE'RIA (from γλυκερός, sweet), a genus of plants belonging to the natural order of Grasses and the tribe Festucineæ. It has unequal acute submembranous glumes, the outer palea with 5-7 strong, prominent, distinct and parallel ribs and a scarious margin, subcylindrical, unarmed; the styles terminal. The species are handsome grasses with long stems, and mostly inhabit watery places. There are two species found in Great Britain, *G. aquatica* and *G. fluitans*. They contain a large quantity of saccharine matter, but are coarse grasses.

(Babington, *Manual of British Botany*.)

GLYCERIN. [CHEMISTRY, P. C. S.]

GLY'CINE. [WISTARIA, P. C.]

GLY'PHIS, a genus of fossil Placoid fishes, from the London clay. (Agassiz.)

GLYPTOCE'PHALUS, a genus of fossil Cycloid fishes, from the London clay. (Agassiz.)

GLYPTO'STEUS, a genus of fossil Ganoid fishes, from the old red-sandstone of Elgin and Clashbennie (Agassiz): two British species.

GLYPTOGRAPHY. [ELECTRO-METALLURGY, P. C. S.]

GNAPHA'LIUM (from γνάφαλον, which signifies the wool which the fuller cuts off in fulling the cloth), a genus of plants belonging to the natural order Compositæ, to the sub-order Corymbiferæ, the tribe Senecionideæ, the subtribe Gnaphalieæ, the division Helichryseæ. It has the ray florets pistilliferous, the centre with both stamens and pistils, all of them tubular; the pappus capillary; the receptacle flat, naked; the involucre hemispherical, imbricated; the scales equalling the florets, but not mixed with them. The corolla of the outer florets is often obsolete. The species of this genus have a soft pubescent foliage with dry flowers, which keep for a long time without perishing, and, like those of some species of Helichrysum and Xeranthemum, are called 'everlastings' or 'immortal' flowers. The species are numerous. Five are British. Of these *G. siliquosum* is the most common, growing in wet and sandy places. *G. luteo-album*, *G. sylvaticum*, *G. supinum*, and *G. pusillum* are all rare plants. Several of the species of the old genus Gnaphalium are referred to new genera as Antennaria and Filago. *G. dioicum* is *Antennaria dioica* of Gærtner. It grows on mountain heaths in Great Britain, and is commonly called cotton-weed, and by the older herbalists *pes cati*. Its flowers were admitted into the older pharmacopœias under the name of *Flores hispiduli pes cati*. They are astringent, and were employed in the cure of hooping-cough, phthisis, and hæmoptysis. *G. arenarium* (*Helichrysum arenarium*) has been employed as a remedy in dyspnœa. *G. Stœchas* of Linnæus, Goldilocks, the *Helichrysum Stœchas*, is mentioned by Theophrastus (*Hist. Pl.* 9, 21). The flowers of this plant were formerly much used in medicine, but are seldom employed at the present day.

(Babington, *Manual of British Botany*; Burnett, *Outlines of Botany*; Fraas, *Synopsis Plant. Fl. Classicæ*.)

GNETA'CEÆ, a natural order of plants belonging to the small class of Gymnosperms. The species consist of small trees very much branched, or of sarmentose shrubs with opposite or clustered branches, and thickened separable articulations. The leaves are opposite, entire, with pinnate veins, sometimes very minute and scale-shaped. The ligneous tissue of the wood is marked with circular disks. The flowers are monœcious or diœcious; the stamens are contained in a 1-leaved calyx; the ovary is perforated at the apex, containing in a single cavity a solitary erect ovule; the ovule pointed by a style-like process, formed from the membrane of the nucleus; there is no trace of a style or stigma.

This small order of plants has been formed by Blume, whose memoir in the 'Annales des Sciences Naturelles' contains the principal knowledge we have of this order. 'This little family,' he says, 'constitutes a part of that natural class of vegetables in which the fertilization of the ovule takes place immediately, without the aid of style or stigma, through the foramen of the ovule itself. Through Ephreda, which has hitherto been placed with Coniferæ, the order is closely connected with the latter: and, on the other hand, it tends towards Casuarinaceæ, plants of a higher degree of organization; since Gnetaceæ is beyond all doubt an instance of a more perfect kind of evolution than either Coniferæ or Cycadaceæ. From both these orders Gnetaceæ differ in the greater perfection of their sexual organs, especially of their stamens; and at the same time their ovules are not absolutely naked, but covered with a pericarpial integument pierced at the summit. In the male flowers the perianth is tubular; at first quite closed up, in the manner of certain Artocarpeæ, but eventually it is ruptured by the rising of the stamen. There is no trace of a perianth of this sort in the neighbouring orders; but in Coniferæ a totally different organization of anther occurs, that part not opening, as in Gnetaceæ, by transverse pores of the apex, but always at the side, and generally longitudinally.'

The species of this family are natives of the temperate parts of Europe, Asia, and South America. Gnetum is an inhabitant of the hottest parts of India and Guiana.

Some of the species of Gnetum are used as food. The seeds of G. Gnetum are eaten in Amboyna, and are roasted, boiled, or fried. The green leaves are cooked and eaten like spinach. The inside of the fruit of *G. urens* is lined with stinging hairs; the seeds are, however, eaten: the stem exudes a transparent gum, and when cut across yields a large quantity of transparent water, which is drunk.

(Lindley, *Natural System of Botany*.)

GOBIUS, a genus of Acanthopterygious osseous fishes, belonging to the family *Gobioidæ*. All the species have two dorsal fins, scaly bodies, and a disk beneath the throat formed by the united ventral fins. By means of this disk they have the power of attaching themselves to rocks. Several species of Goby are met with on the British coast. The largest is the *Gobius niger* of Linnæus, which attains the length of six inches, and ranges from Cornwall to the Orkneys. Mr. Couch has inquired into the habits of the black Goby, and finds that when it has seized its prey it carries it off alive in its mouth to its resting-place, which is among rocks. The other British Gobies, *G. bipunctatus*, *G. minutus*, *G. gracilis*, and *G. unipunctatus*, are mostly inhabitants of sandy ground. On the shores of the Mediterranean Gobies abound, and are also found in deep water, even to a depth of fifty fathoms. The deep-water species are distinct from those frequenting the coast-line.

The species of *Gobius* are very tenacious of life, and are capable, like their neighbours, the Blennies, of living some time out of water. The most remarkable fact connected with the history of these fishes is their nidification. That the Goby built a nest was known to the antient Greeks. This nest they construct in spring, of seaweeds, &c., and in it the female deposits her eggs, whilst the male watches over them until they are hatched. The nest of the Goby is very well built, and has of late been observed on our own coasts. True Gobies occur in the seas of the southern hemispheres as well as in those of the northern.

GOES, HUGO VANDER, a celebrated old Flemish painter and pupil of John Van Eyck. He was a native of Bruges according to Van Mander, but of Antwerp according to Vasari, who calls him Hugo d'Anversa. He spent some time in Italy, and after his return to the Netherlands appears to have settled in Ghent. He conducted the festival which was held at Ghent at the inauguration of Charles the Bold as Count of Flanders, on July 27, 1467. In 1473 he painted the decorations for the pope's jubilee; and he was, according to the town archives, frequently employed by the authorities of Ghent down to the year 1480. The cause of his residing in Ghent is conjectured to be a supposed marriage with a beautiful maid of that place, the daughter of a citizen of the name of Jacob Weytens, in an apartment of whose house Vander Goes painted in oil a celebrated picture of David and Abigail, in which he introduced the portrait of the daughter with whom he was in love, beautifully painted: it has been celebrated in verse by Lucas de Heere, but has since perished. Vander Goes seems to have survived his supposed wife, for, probably about 1480, he entered the Augustine convent of Roodendale in the wood of Soignies near Brussels, in which he became a canon; he was buried there, and the following inscription was written over his tomb:—

> "Pictor Hugo Van der Goes humatus hic quiescit.
> Dolet ars, cum similem sibi modo nescit."
> (Swertius, *Monumenta Sepulcralia*, &c.)

There are many extant works attributed by various writers to Vander Goes, but few with certainty: the Museum of Berlin has eight; there are four at Munich, and several at Vienna, and in the Netherlands. Passavant thinks that the two large pictures of James IV. of Scotland and his queen, with the Saints Andrew and George, at Hampton Court (Nos. 509, 510), are by Vander Goes, because they are similar to the pictures at Berlin; but they are much more likely to have been painted by Mabuse, to whom they are attributed, and who was in this country in the reign of Henry VII., James's father-in-law: James also was not married until 1503, when Vander Goes had probably been dead some time.

One of Vander Goes' masterpieces is the Crucifixion between the two thieves, in the church of St. James at Bruges, which, to preserve it during the iconoclastic rage in the sixteenth century (1566), was coated with black and inscribed with the ten commandments: it was afterwards cleaned, and still remains.

Vander Goes excelled in painting women, but he appears to have been unequal in his execution. His best works are conspicuous for the beauties of the Van Eyck and old Flemish school—colour and careful execution, with its prim postures and meagre forms.

(Van Mander, *Leven der Schilders*, &c.; De Bast, *Messager des Sciences et des Arts*, Gand, 1824; *Kunstblatt*, 1826; Passavant, *Kunstreise*, &c.; Rathgeber, *Annalen der Niederländischen Malerei*, &c.)

GOLD-BEATERS' SKIN. The preparation of the delicate membrane known by the name of 'gold-beaters' skin' forms part of an exceedingly dirty and disagreeable class of manufactures called by the French 'boyauderie,' from the word 'boyau,' intestine. The strings for violins, harps, and guitars [Catgut, P. C. S.], gold-beaters' skin, and some other valuable articles of a membranous character, are made from the intestines of animals—not (except in a few cases) from the whole thickness of the intestine, but from a very thin membrane which covers it either on the interior or the exterior. This class of employments is more largely carried on at Paris than elsewhere; and the boyaudiers mostly congregate in one spot.

It is from the large intestine of the ox that gold-beaters' skin is prepared. This intestine is composed of three coats or sheathings; the mucous membrane on the inside, the peritoneal membrane on the outside, and the muscular membrane between them. The peritoneal membrane is the one required for the purpose; and this used formerly to be loosened from the others by allowing the putrid fermentation to ensue; but this process occasioned such a fetid odour in the neighbourhood of the boyauderies at Paris, that a prize was offered to the discoverer of any new method whereby this separation could be effected in a less offensive manner. The result we shall speak of presently.

In the first place, the intestine is freed from all greasiness by soaking, scraping, and washing; it is then turned inside out, and put into a tub. The tub contains a strong alkaline liquor, in which the intestine is allowed to steep for several hours; and at the expiration of that time the mucous membrane has become so far loosened as to be easily removed. The alkaline liquor employed, called 'eau-de-Javelle,' removes all trace of fetid odour. The peritoneal membrane is afterwards carefully removed, and stretched out to dry. It is next steeped in a weak solution of potash, and carefully scraped. After this it is stretched out on a frame, with that surface undermost which had adhered to the muscular membrane; another membrane, placed the contrary way uppermost, is laid upon it, and the two are easily made to unite firmly together. The membrane is then moistened successively with different liquids, of which one is a solution of alum, one a solution of isinglass, and another a layer of white of egg. Beating, drying, and pressing are also among the processes to which the membrane is subjected; each manufacturer appearing to have his own peculiar mode of proceeding.

A packet of skins properly prepared for gold-beating is rather a costly piece of apparatus; but it will bear a surprising amount of beating without injury. The skins may be used for several months without becoming thinner or weaker. They acquire however by degrees a greasiness of surface which unfits them for their office; and this greasiness is removed by interleaving them with pieces of clean white paper, and hammering them for a considerable time, whereby the greasiness is removed from the skin to the paper.

An allusion has been made to the mode in which the membrane (called 'baudruche') used to be made in France. The matter has been deemed in that country so serious as to engage the attention both of medical men and of the legislature. M. Parent Duchâtelet ('Dictionnaire de l'Industrie Manufacturière,' art. 'Boyauderies') states that the odour arising from the putrefactive fermentation of the substance whence this is made, is more loathsome than any other incident to manufactures; and that the effect of the exhalation on the health of the inhabitants who lived near the boyauderies was such as to lead the French government, towards the end of the last century, to prevent the boyaudiers from continuing to carry on the manufacture in the faubourg where they had congregated, and where a street was named after them, the Rue de la Boyauderie. They left that spot, and established themselves near Montfaucon; but here they formed a new centre for disease and infection. At length, in or about 1820, the Council of Health offered a prize, to be given through the medium of the prefect of police, for the discovery of any mode, either mechanical or chemical, for separating the peritoneal membrane without subjecting the intestine to the putrefactive action. M. Labarreque obtained the prize, by showing how chlorine could be employed both to fumigate the workshops, and to loosen the membranes one from another without allowing the offensive odour to escape.

With regard to the exact truth of the statement, that this odour, and the processes which produced it, were highly deleterious to health, persons are of different opinions. M. Guersent, a physician, and Parent Duchâtelet himself, assert that there is nothing seriously deleterious in them. Be this as it may, all agree that the stench was horrible, and that great satisfaction was felt when the new mode was discovered, under the hope that it would be adopted. Yet the boyaudiers are said to oppose the utmost obstacles to the reception of the new plan, and (as in the case of the needle-pointers of Redditch and the fork-grinders at Sheffield) to adhere to their old system in spite of all suggested improvements.

In 1810 the different manufactories of France were ranged in classes according to the unhealthiness of the employments; and the boyauderies were placed at the head of the list of 'Etablissements Insalubres:' they were subjected to rather strict regulations in relation to the position and general arrangements of the buildings; and these rules are still acted on in cases where the new method is not adopted.

GOLD-BEATING. This is a process whereby gold is brought to the state of very fine leaves, for use in various kinds of gilding. The remarkable ductility of gold—a quality possessed by it to a greater degree than by any other known substance—is here taken advantage of to the fullest extent, as a means of limiting the quantity of this costly material required in gilding. So far is the attenuation carried, that a hundred square inches of nearly pure gold can be purchased for about sixpence.

It is by a combined process of rolling and hammering that the attenuation of the gold is produced. The metal is melted in a small crucible by the heat of a wind furnace; and is cast into an iron ingot-mould, so as to form an oblong flat bar about three-quarters of an inch in width, and weighing two ounces: a little borax is used to facilitate the melting of the gold, and the ingot-mould is greased on the inside to prevent the adhesion of the gold to it. The ingot, when removed from the mould, is immersed in hot ashes, whereby the gold is both annealed and freed from grease. When cold, it is ready to undergo the process of reduction in thickness, and proportionate extension in length and breadth. Formerly, in France, the ingot was beaten out to the state of a thin riband, by the use of a forging-hammer about three pounds weight; but the French gold-beaters now carry this hammering only to such an extent as to reduce the ingot to the state of a plate about one-sixth of an inch in thickness, and then finish by the use of the 'rolling,' 'flatting,' or 'laminating' mill. In England this forging is dispensed with, and the reduction of the gold to the state of a riband is effected by means of the mill. This mill consists of two rollers made of polished steel, perfectly cylindrical in form, and adjusted with very great nicety; it must so act as to reduce the gold equally in every part, or else the further thinning could not be properly carried on. The milling is carried on until the ingot of two ounces is spread out to a surface of 960 square inches, with a thickness of rather more than 1-800th of an inch.

This thin riband of gold is then consigned to the hands of the gold-beater. The hammering does not take place on the gold itself; but thin membranes are interposed between the hammer and the gold. These membranes are of three kinds: an outside covering of common parchment; a set of leaves made of very fine and smooth calf-skin vellum; and another set made of the gold-beaters' skin described in the last article. The riband of gold is cut up into small pieces, each measuring exactly an inch square; and a hundred and fifty of these are interleaved with an equal number of leaves of vellum, about four inches square; each piece of gold being placed on the middle of a leaf of vellum. Over this packet of vellum-leaves is drawn a parchment case, open at both ends; and over this another parchment case in the opposite direction; so that the vellum and gold are enclosed tightly on all sides. The entire packet thus prepared is beaten. This beating is effected on a smooth block of marble, strongly imbedded beneath, and bounded on three sides by a raised ledge of oak wood; the front edge is open, and has a leathern flap attached to it, which serves as a kind of apron for catching fragments of gold that may fall off in the subsequent operations. The hammers employed are very ponderous, weighing about sixteen, twelve, and ten pounds respectively; the heaviest is used first, and the others are brought into use as the gold becomes thinner.

The packet of vellum and gold is laid on the stone, and the workman beats, with regular and heavy blows, on the middle of the upper side; there is a spring or elasticity of the packet which enables the hammer to rise easily after each blow; otherwise the work would be too laborious for any man continuously. The beater turns the packet over from time to time, to equalize the action among the leaves; and he occasionally bends the packet to and fro, to destroy any slight adhesion between the gold and the vellum: he also opens the packet at intervals, to see how the operation is proceeding. The beating is continued until each little inch-square piece of gold has become expanded nearly to the size of the vellum-leaves; and in order that the whole of the hundred and fifty pieces may be equally acted on, the packet is occasionally opened, and the inner pieces placed near the outside, to receive more action from the hammer.

When this degree of attenuation has been attained, the use of the vellum-leaves ceases, and that of the gold-beaters' skin commences. The packet is opened, and each piece of gold, being taken out and placed on a kind of cushion, is cut into four pieces with a knife.

The pieces of gold, now increased in number from a hundred and fifty to six hundred, are interleaved with an equal number of pieces of the prepared gold-beaters' skin. The packet thus prepared is enclosed in parchment, and beaten in the same way as before, but with a smaller hammer. The pieces of gold become by degrees expanded, until they attain nearly the size of the skin-leaves. The packet is again opened, the leaves of gold are again cut into four each, and the quarters are again interleaved with gold-beaters' skin. The cutting is, in this second instance, effected by the smooth edge of a strip of cane, since the thin gold would be liable to adhere to a steel knife. As the pieces of gold, now 2400 in number, would be too numerous to be beaten in one packet, they are divided into three parcels of 800 each, and each packet is interleaved with gold-beaters' skin, enveloped in parchment, and beaten, in the same way as before. A third time these leaves expand nearly to the size of the skin-leaves; and by this expansion the necessary degree of thinness is attained. By the three beatings and the two quarterings, the gold is expanded to an area about 190 times greater than it presented when in the form of a riband. The attenuation may be rendered more intelligible by stating that 100 square feet of the leaf-gold weigh no more than an ounce—a result nearly as surprising as anything presented in the mechanical arts. Gold can be beaten to a much greater degree of thinness than that ordinarily used; but the waste occasioned by broken leaves, and the additional nicety and labour required, more than counterbalance the advantages.

When the last beating is finished, the packet is opened, and the thin leaves of gold removed one by one. The gold-beater makes use of a delicate pair of long pincers, made of white wood, and takes up the fragile leaves of gold one by one. Each leaf is laid down on a cushion, and blown out fla by the breath of the workman: if any of them have been broken or injured in the beating, they are thrown aside, to be remelted for future use; but otherwise each leaf has the ragged edges cut from it, so as to bring it to the size of about three inches and a quarter square. Small books are prepared, each book containing twenty-six leaves of paper about four inches square; both surfaces of every leaf are rubbed with red chalk, to prevent the adhesion of the gold; and twenty-five leaves of gold are placed in each book. In this form the leaf-gold is sold.

The French adopt the same general mode of proceeding as the English gold-beaters, but vary it slightly in detail. The laminated riband is cut into pieces an inch and a half long by an inch wide, and about 1-24th of an inch thick. Twenty-four of these are laid one on another on a smooth slab of steel, and hammered until they are two inches square. Fifty-six of those expanded leaves are made up into a packet, with two leaves of vellum between each. This packet is enclosed in a sheath, and is beaten with a hammer in the same way as in England. Indeed the hammering and quartering, and the use first of vellum and then of gold-beaters' skin, are the same in most of their features as those already described; but the French gold requires more hammering on account of the greater weight and size of the pieces at the commencement of the beating.

Two other metals, silver and copper, have sufficient ductility to be brought into the state of thin leaves by hammering; and both are used to a limited extent in this state in the arts. But these metals would fracture long before such a degree of thinness could be obtained as in the case of gold; and indeed the smaller value of the material renders it less important to economise material in this way: consequently leaf silver and copper are thicker than leaf-gold.

GOLDING, ARTHUR, was born in London, of a good family, at some time in the early part of the sixteenth century. In 1564 he was living in the house of secretary Cecil, in the Strand; and his dedications show him to have been patronized also by the Earls of Leicester and Essex, Lord Cobham, Sir Christopher Hatton, and other men of station in his time. His earliest known work was printed in 1562. After the death of Sir Philip Sidney, which took place in 1584, he completed Sir Philip's translation of Philippe de Mornay's French treatise on the truth of Christianity; and he must have been alive till 1587, when that translation was published, or perhaps for two or three years longer. The dates of his published writings extend over the whole of the period thus marked out. They amount to about thirty; of which however, besides some copies of verses, one only is original, a religious 'Discourse upon the Earthquake' of 1580. The rest of them are translations, chiefly from the Latin, but some from the French. Several are theological or ecclesiastical works, of Calvin, Chytræus, Bishop Grosteste, and others: two or three are historical. But those which were most useful to his contemporaries were his translations from the Latin classics. These embraced, in succession, prose versions of Justin, Cæsar, Seneca, Pomponius Mela, and Solinus, and a spirited and not very unfaithful translation of Ovid's Metamorphoses into fourteen-syllable verse. Four books of the Ovid were published in 1565, and the complete work in 1575. Golding deserves to be commemorated, on account of the great influence which he and other translators of the classics exercised upon the dawning poetry of England.

GOMER-CHAMBER. [CHAMBER P. C.]

GOMERA, one of the Canary islands, is situated between 28° 1′ 30″ and 28° 13′ N. lat., and between 17° 48′ and 18° 4′ W. long., more than twenty miles from the western shores of Teneriffe. In shape it resembles an isosceles triangle, of which the base is nearly twenty miles long, and the other two sides fifteen. Mac Gregor assigns it an area of 168 square miles, so that it is only a little larger than the smallest of the English counties, Rutlandshire (149 square miles). The surface is extremely mountainous and uneven. It presents a continual succession of narrow glens, or barrancos, and narrow ridges, which terminate on the shores with high and steep rocks. It is not known to what elevation the highest summits rise above the sea, but the circumstance that they sometimes preserve the snow which falls on them for several days would lead us to suppose that they must exceed 6000 feet. The elevation of its mountains must be the cause that the island is abundantly watered, and the sides of the mountains mostly covered with wood. The soil is stated to be of excellent quality, but only one-ninth is under cultivation, and even this small proportion is badly worked, which is attributed to the entire want of enclosures. The climate is not so hot as that of the other Canaries, but in all those places which are built in the narrow barrancos it is unhealthy for want of ventilation. The productions are the same as those of Teneriffe (P. C. vol. xxiv. p. 204), to which island it exports wine, brandy, orchilla, silk, and dry fruits. The population amounts to about 9000 individuals, or 54 to a square mile. The principal place is San Sebastian, inhabited by about 1000 individuals. In this town Christopher Columbus was settled for some time before he sailed to America, and it is here that he is said to have received some information of the existence of the New World, from an Andalusian captain, Alonzo Sanchez de Guelva, who had been cast-away by a gale and returned to Gomera. The port of San Sebastian, called Puerto de la Gomera, is said to be the best in the Canary Islands for large vessels. This island was conquered by John de Bethencourt in 1406, is at present the private property of the Marquis of Belgida and San Juan, and has the title of a county.

(*Die Canarischen Inseln nach ihren gegenwärtigen Zustande*, von Mac Gregor.)

GONDAR, the capital of Abyssinia, is in 12° 36′ N. lat. and 37° 32′ E. long., not far from the northern border of the plain which reaches from the northern shores of Lake Tzana to the table-land of Wogghera, and extends about thirty miles in that direction. From the base of the table-land several low ridges run southward into the plain, and at the extremity of one of them the town is built, between two small rivers, the Angerab on the east, and the Gaha on the west. The town covers a considerable space of ground, which formerly, as it appears, was entirely filled up with buildings and gardens, but the larger portion at present consists of ruins or tracts overgrown with canes. The inhabited portion does not consist of one continuous mass of buildings, but of seven isolated groups of buildings, lying at some distance from one another. The largest of these groups lies on the western side, and is only inhabited by Mohammedans: hence it is called Islambad; and not far from it is Etsheghebad. These two quarters contain half the population of the town. One of them, called Felashabad, is inhabited only by Jews.

Over this space and mostly among the ruins a great number of churches are dispersed. It is stated that there are fifty. The buildings are in form and arrangement very different from our churches. They have the form of a cylinder surrounded by a corridor. In the midst of the buildings is a space in the form of a cube, surrounded by a wall. The centre of this space is occupied by a kind of throne of wood, which is to represent the tabernacle. A conical roof of straw covers the whole building. Many large doors lead from the corridor to the body of the church, and three smaller ones from the body of the church to the cubical enclosure. There are numerous paintings on the doors, walls, and beams, but they have no great claim to artistic excellence. The churches are surrounded by avenues of large trees.

The houses have the shape of a cylinder, and a conical roof of straw. A gate leads from the street into a spacious court-yard, and hence a large door into a small room, at the back of which there is a large saloon; at its other extremity is an alcove, which occupies the back portion of the building. The saloon has five doors. One opens, as already observed, into the large court-yard between the house and the street. Two doors, placed at the right and left of the principal entrance, lead to the two oblong rooms which enclose the saloon on either side, and from which two other doors lead to two smaller court-yards. Two other doors of smaller dimensions are near the alcove. One of them leads to a small and dark room, in which all things of value are deposited; and by the other the master of the house, who always sleeps in the alcove, can get without being observed into the adjacent room, and into one of the smaller court-yards. When the house has two stories, the upper one is arranged in this manner and inhabited, the lower being only used as stables. One of the lateral rooms serves as a kitchen. The smaller court-yards are separated from one another by walls, and they communicate with the larger court-yard only by the saloon. The houses are built of volcanic stones in their natural shapes, and they are cemented by a loamy earth.

To the north of the town stands the palace of the emperor, or Negus, which was built by Fasildar in the seventeenth century. It is surrounded by a high wall surmounted by embrasures, and contains a large court-yard and several large buildings, now in ruins, except one of moderate size, in which the present emperor resides.

The number of houses, according to Rüppel's estimate, does not exceed 1000, and the population does not exceed 6500. The continual internal wars, which in the last sixty years have laid waste the whole surrounding country, have greatly diminished the population. With the exception of the numerous clergy, all the inhabitants are engaged in commerce. As almost every month the regular communication between the different parts of the country is interrupted by the invasion of an enemy or the turmoils of its inhabitants, all kinds of goods are subject to sudden and great changes in price, and this has induced every person to enter into speculation. Besides, Gondar is situated on the only well-frequented road which leads from the harbour of Massowa to the interior of Africa, and all goods brought from Europe, Asia, or Egypt to be consumed in those parts pass through the hands of merchants established in Gondar. Very few articles are made in this town: those of iron are the most important, but they are limited to knives, ploughshares, and lance-heads: the iron is imported from the province of Gojam, which lies south of Lake Tzana. Several families are engaged in tanning, and those who make shields of leather furnish an article distinguished by beauty and of good quality. Earthenware is made in large quantities; but this branch of industry is confined to the Jews. The workmen in silver are not distinguished by skill or taste. The copying of books is still carried on to a great extent, and is generally done with neatness and even beauty; and the binding of the books shows much taste.

(Bruce's *Travels to discover the Sources of the Nile*; Rüppel, *Reise in Abyssinien.*)

GONIO'GNATHUS, a genus of fossil Cycloid fishes, from the London clay. (Agassiz.)

GONIO'PHORUS (Agassiz), a genus of fossil Echinida, from the green sand. (Morris's *Catalogue.*)

GOODS AND CHATTELS. [Chattels, P. C.]

GOODYERA, a genus of plants belonging to the natural order Orchidaceæ, and the tribe Limodoreæ. It has a ringent perianth; the lips entire, included, saccate at the base; the stigma rostellated, subcordate; the rostellum erect, bipartite, with a large squarish appendage between its slender segments. One species of this genus, *G. repens*, is found in Scotland. It has a stem 6 to 8 inches high, with the radical leaves ovate, stalked, reticulated, and the whole upper part of the plant covered with minute stalked glands. It is found principally in fir-forests.

(Babington, *Manual.*)

GOOSEBERRY. [Ribes, P. C.]

GORCUM, or GORINCHEM, is a small town in the province of South Holland, in 51° 50′ N. lat., and 4° 58′ E. long. It is situated on the right bank of the Merve, at its confluence with the Linge, which flows through the town. Gorcum is a fortified town, and offered some resistance in the invasion of Holland by the Prussians in 1787. The French, on their retreat in the spring of 1814, left a garrison in it, which gave occasion to some fighting. The population is now about 7000 inhabitants: they have no manufactures worth speaking of, except tobacco-pipe heads. The trade is chiefly in corn and in salmon, of which they have considerable fisheries. The house is still shown in which Grotius took refuge after his escape from the Castle of Loevestein, in which he was imprisoned.

(Stein, *Lexicon*; Hassel, *Handbuch*; Cannabich, *Lehrbuch*; Stein, *Geogr. Lehrbuch*, by Hörschelmann.)

GORDON, ROBERT, was born in Aberdeenshire about the year 1580. He studied first at Aberdeen, and afterwards at Paris. On his father's death in 1600 he returned to Scotland, and succeeded to his ancestral estate of Straloch. At this time the vast collection of maps, and corresponding letterpress geographical and historical descriptions, projected by Blaeu of Amsterdam, was in progress. The Dutch editors had been put in possession of some geographical drafts of the various provinces of Scotland, drawn by Timothy Pont, an eminent geographer. These drafts, which are now preserved in the Advocates' Library, are singularly minute and curious, and very valuable as throwing light on the state of the country and the condition of property in Scotland at the time when they were executed. Pont had died in the execution of his task, leaving these drafts, minute and apparently accurate, but fragmentary and totally destitute of arrangement. The editors of the Atlas applied to King Charles, and solicited his patronage of the portion of the work applicable to Scotland, and his appointment of a person qualified to complete the work. It was placed by royal authority in Gordon's hands, in 1641. The part of Blaeu's Atlas commonly called 'Theatrum Scotiae,' was finished by Gordon in 1648, and forms one of the eleven volumes of that work. It contains forty-nine minute and highly finished maps of the various provinces of Scotland, accompanied by a description in Latin, full of the results of extensive and accurate research. The result of the knowledge and labour bestowed on this work was to give a greater prominence to Scotland in this general geographical work than the position of the country entitled it to. Gordon's labours were considered as of so much national importance, that by a special act of parliament he was exempt from the quartering of soldiers and other public burdens, and as he abstained from connecting himself with either side, he was respected in the midst of his labours by both the parties by which the country was then distracted. Gordon died in 1661. The geographical papers which he had originally prepared were still more extensive than the work published by Blaeu. There is a large mass of them among the MSS. in the Advocates' Library, in the printed catalogues of which their titles will be found, and some portions of them have been lately printed by the book-clubs. Gordon had collected materials for a history of his own adventurous time. His son, James Gordon, clergyman of Rothiemay, who seems to have assisted him in his geographical labours, put these materials in a narrative form, and the 'History of Scots Affairs,' thus prepared, was printed in 1841, in three volumes, 4to. for the Spalding Club.

(Chambers, *Biographical Dictionary of Eminent Scotsmen*; *Introduction to History of Scots Affairs from* 1637 *to* 1641, by James Gordon, Parson of Rothiemay; Works referred to.)

GORSE. [Ulex, P. C.]

GOSSON, STEPHEN, a native of Kent, was born in 1554. In 1572 he was entered at Christchurch, Oxford, where he took his bachelor's degree, and then removed to London. He was there a family tutor, and wrote three plays—a tragedy called 'Catiline's Conspiracies,' a comedy called 'Captain Mario,' and 'Praise at Parting,' a moral play. These plays were never printed, and would now be quite unknown but for the remorseful mention which the author himself afterwards made of them. He was but twenty-five years old when he published one of the most curious, and the second in order of time, of the Puritanical tracts inveighing against plays and stage-playing. This was 'The Schoole of Abuse, conteining a plesaunt invective against Poets, Pipers, Plaiers, Iesters, and such like Caterpillers of a Commonwealth,' 1579, 1587. This pamphlet, more scurrilous than either pleasant or logical, was reprinted by the Shakespeare Society, in 1841. It was followed in the same year by Gosson's miscellaneous volume, called 'The Ephemerides of Phialo' (reprinted in 1586), one part of which, 'A Short Apologie of the Schoole of Abuse against Poets, Pipers, Players, and their Excusers,' was directed against Thomas Lodge's 'Reply to Stephen Gosson touching Plays.' Both of these works of Gosson were dedicated to Sir Philip Sidney, who, according to Spenser, scorned the writer for his labour. He took up the argument again, with violent personal abuse of Lodge, in his 'Plays confuted in Five Actions,' published in 1581 or 1582, and dedicated to Sir Francis Walsingham. Another work of Gosson is the 'Pleasant Quippes for Upstart Newfangled Gentlewomen,' printed in 1595, and again in 1596; a versified composition containing some hard satirical hits, but no poetry. His only other known effusions are verses prefixed to three works of his day, and a sermon called 'The Trumpet of War,' which was printed in 1598. Gosson had then taken orders, and was parson of Great Wigborough in Essex. In 1600 he was instituted to the rectory of St. Botolph, Bishopsgate; and it is a curious fact that there exists a letter of his dated in 1616, in which, with expressions of respect, he recommends, to Edward Alleyn the player, three poor people for admission to Dulwich Hospital. Gosson held the rectory of Saint Botolph at his death, which took place in his parish on the 13th of February, 1623, when he was sixty-nine years old.

GOUJON, JEAN, a celebrated French sculptor of the sixteenth century, called sometimes the Correggio of sculptors, from the softness and delicate roundness of his execution, especially in basso-rilievo, in which he was excellent; he is also sometimes termed the father of French sculpture. Many of his works have perished, but two of the best still remain: the bassi-rilievi of the Naiades of the Fontaine des Innocents, and the four colossal Caryatides in the Louvre, in the 'Salle des Cariatides,' so named from Goujon's works, built in the reign of Henri II. Goujon was also an architect; he was architect to the king, and was appointed, conjointly with

Pierre Lescot, to superintend the building of the Louvre. He was employed also in other works by Henri II.; and he made for him a large naked statue of his mistress, Diana of Poictiers (the Duchess of Valentinois), which is now in the Louvre, in the Salle d'Angoulême. The figure, which is reclining and resting against a stag, has been extravagantly praised; but it is neither well proportioned, nor does it possess any fine development of form characteristic of the female: it is long, and wants undulation of line; but this peculiarity might be supposed to belong to the individual, were not the nymphs of the Fontaine des Innocents conspicuous for the same defects, which shows that they are defects of manner. The accessary parts of his works are elaborately executed. Goujon was a Huguenot, and fell a victim to the massacre of St. Bartholomew, in 1572; he was shot while on a scaffolding, working upon some bassi-rilievi at the Louvre. His remaining works have been recently engraved and published in large octavo, by A. Reveil, 'Œuvres de Jean Goujon, gravé au trait d'après ses Statues,' &c., Paris 1829. (D'Argenville, *Vies des fameux Architectes et Sculpteurs*, &c.; Dandrè Bardon; Watelet; Reveil et Duchesne; &c.)

GOYEN, JAN VAN, a celebrated Dutch painter, born at Leyden in 1596. He studied under several masters, and lastly under E. Vandervelde; and is distinguished for busy canal and river scenes, and occasionally sea pieces; some of his figures were painted by Jan Steen. His pictures are good in all respects saving colour, in which they are cold, green, and dark—owing no doubt chiefly to the effect of time upon an injudicious choice of colours, or, as some conclude, to the use of Haarlem blue. Van Goyen was certain and rapid in his execution, and once wagered, as related by Hoogstraeten (Academie der Schilderkunst), with two other painters, N. Knipbergen and J. Parcelles, to paint the best picture in a single day: the works of all three were good, but the judges awarded the prize to Parcelles. He died at the Hague, according to Houbraken, in 1656. There are a few etchings by him.

(Houbraken, *Groote Schouburg*, &c.)

GOZZOLI, BENOZZO, a celebrated old Italian painter, born at Florence in 1400, according to Vasari, who calls him simply Benozzo in his first edition, but 1406, according to Ciampi. He was the pupil of Fra Giovanni da Fiesole, whose works, as well as those of Masaccio, he studiously imitated, but he failed completely in attaining Masaccio's style of design. Many of Benozzo's frescoes still exist in a tolerable state of preservation, more or less. Those in the Campo Santo at Pisa are considered the best. He painted here twenty-four pictures, covering one whole side of the building; he commenced in 1469, and finished them in 1485, and was paid for each picture about ten ducats (66 lire); he was to paint by agreement three pictures in a year. Supposing Benozzo's whole time was thus occupied, which it probably would have been if he had painted three pictures every year, we have a great painter fully employed in the middle of the fifteenth century, for a salary of less than thirty ducats, or about 13*l.* sterling per annum. This sum was worth in England at the same time, about twenty oxen [Austen, William, P. C. S.]; and if we compare with it the value of twenty oxen in the present day, we shall arrive perhaps at a fair estimate of the value of an eminent painter's time at that period: which will be upwards of 300*l.*: a sufficient income, if for the spring and summer months only. Benozzo was, however, paid at a higher rate at Orvieto, in 1447, when he received seven ducats per month: but this must have been merely during the spring and summer months, when fresco painters can only work.

Benozzo painted also in Florence, at Rome, at Volterra, and at San Gimignano, but he settled and died at Pisa, in what year is not exactly known. Vasari was misled by the inscription on his tomb in the Campo Santo, which is not the date of Benozzo's death, but the date of the year in which Pisa presented him with the tomb during the progress of the paintings. The inscription was evidently placed during Benozzo's life-time; it is as follows:—'Hic tumulus est Benotii Florentini qui proxime has pinxit historias. Hunc sibi Pisanorum donavit humanitas MCCCCLXXXVIII.' He probably died in 1485.

(Vasari, *Vite de' Pittori*, &c., and the notes of Schorn's German Translation; Ciampi, *Notizie inedite della Sagrestia Pistojese*; Rosini, *Descrizione delle Pitture del Campo Santo di Pisa*; Rumohr, *Italienische Forschungen*.)

GRACILLARIA. [Sea-Weeds, P. C.]

GRADIENTS. [Railway, P. C., p. 250.]

GRAHAM, JOHN, Viscount Dundee, commonly called Claverhouse, from the name of an estate belonging to his father Sir William Graham, of whom he was the second son. He was probably born about the year 1649 or 1650. He is said to have studied at St. Andrews, and to have made some proficiency in the mathematics; but learning was not a sphere in which he shone; and Sir Walter Scott, who endeavoured to raise his character from that of the ordinary soldier of fortune, and to endow him with a higher tone of feeling, cannot help comparing his letters to those of a chambermaid. Many of the younger sons of the Scottish gentry—poor, intrepid, and accustomed to that superiority over their neighbours which suits a man at once for command in a half-disciplined army—had by these qualities held commissions during the Thirty Years' war, without being very fastidious about the side on which they fought. Graham was evidently brought up to this trade. He entered first the French and then the Dutch service, obtaining in the latter considerable distinction. Being however refused the command of a regiment, he returned to Scotland in 1677. He obtained a captain's commission in one of the troops of horse employed in enforcing obedience to the penal laws against nonconformists in Scotland. Among many cruel instruments, he became conspicuous by his barbarity, and obtained an unenviable renown in history, romance, and local tradition. A considerable body of Covenanters having announced that they were to hold a solemn preaching on 1st June, 1679, Graham, on his way to disperse them, was met by an advanced body of these enthusiasts, armed and well commanded, who, in a piece of ground called Drumclog, dispersed his troopers, and compelled him to fly for his life. At the subsequent battle of Bothwell Bridge his exterminating counsels were fortunately counteracted by the milder genius of Monmouth, the commander of the expedition. In 1688 he was raised to the peerage by the title Viscount Dundee and Lord Graham of Claverhouse. While the Convention Parliament was sitting in Scotland arranging the Revolution settlement, he put himself at the head of some Highland and Irish marauders, with whom, on the 17th of June, 1689, he successfully defended the pass of Killicrankie against Mackay until he was killed by a random shot.

(Douglas's *Peerage of Scotland*; Laing, *History of Scotland*; and other historical works.)

GRAHAM, ROBERT, the third son of Dr. Robert Graham, afterwards Moir of Leckie, was born at Stirling on the 3rd of December, 1786. He followed his father's profession, and in the early part of his life practised medicine at Glasgow. Previous to the year 1818 there was no separate chair of botany in the University of Glasgow, and lectures on this subject were read by the professor of anatomy in the summer season. On the government establishing a separate chair for botany, Dr. Graham was appointed to the post. In 1821 the chair of botany becoming vacant in the University of Edinburgh, Dr. Graham was the successful candidate for the office. He was also appointed physician to the Infirmary, and conservator of the botanic garden of Edinburgh. To the latter office he speedily devoted much attention, and to his exertions the garden is mainly indebted for its present flourishing condition.

Although Dr. Graham evidently possessed but little botanical knowledge, on his being appointed to the Glasgow chair he devoted himself with great enthusiasm to the study of it in Edinburgh, and he probably enlisted the feelings of his pupils more by his enthusiasm than his deep knowledge. One plan which he adopted was very successful in producing a love of the science he taught, and that was his practice of making excursions with his pupils to some distant part of the country. He thus examined, during successive summers, the floras of several important districts of Scotland, England, Wales, and Ireland. The knowledge which he thus obtained, induced him to prepare materials for a Flora of Great Britain, which however he did not live to publish. His published works consist chiefly of descriptions of new or rare plants which flowered in the botanic gardens of Edinburgh. These, as well as notices of his excursions and other papers, appeared in the 'Edinburgh New Philosophical Magazine,' Curtis's 'Botanical Magazine,' and Hooker's 'Companion to the Botanical Magazine.'

Although Dr. Graham was a strong and powerful man, his health gave way some years before his death, and he eventually died on the 7th of August, 1845, of an encephaloid tumour which occupied the back part of the thorax and pressed upon the great vessels of the heart. He was a frank kind-hearted man, and few men have left behind them a larger circle of affectionate friends to lament his death.

(*London and Edinburgh Journal of Medical Science.*)

GRAHAM, SIR THOMAS. [Lynedoch, Lord, P. C. S.]

GRAHAM, MARIA. [Calcott, Sir Augustus, P. C. S.]

GRANA'TEÆ, a natural order of plants separated by David Don from Myrtaceæ [Myrtaceæ, P. C.], and containining only the species of the genus Punica [Punica, P. C.]. It differs from Myrtaceæ in the leaves being destitute of glands, and in being without the intramarginal vein, as also in the nature of its fruit, its pulpy seeds, and convolute cotyledons. (G. Don, *Gardener's Dictionary.*)

GRANGER, REV. JAMES. So little is known of the personal history of Granger, that even the date of his birth appears to be unrecorded. He studied at Christ Church, Oxford, and was presented to the vicarage of Shiplake, in Oxfordshire, where, according to the dedication of the work which brought him into notice, he had 'the good fortune to retire early to independence, obscurity, and content.' This work, which must have occupied many years of preparatory labour, is entitled 'A Biographical History of England, from Egbert the Great to the Revolution; consisting of characters disposed in different classes, and adapted to a methodical Catalogue of engraved British Heads; intended as an Essay towards reducing our Biography to system, and a help to the knowledge of Portraits.' The first edition appeared in 1769, in two 4to. volumes, each forming two parts, so that it is often described as in four volumes. Some copies of this edition were printed upon one side of the paper only, to leave room for manuscript notes, or for the insertion of illustrations. In 1774 appeared, in the same size, a 'Supplement' of corrections and additions, in one volume, which was incorporated in the second edition of the whole work, in four volumes, 8vo., in 1775. The third, published in 1779, is evidently from the same types as the second. According to Nichols's 'Literary Anecdotes,' vol. v. p. 267, there was another (which however is erroneously called the *third*) edition in 1804, which we have not seen, but which is mentioned in the 'Gentleman's Magazine' for October, 1803, as in preparation; and a fifth edition, with upwards of four hundred additional lives, appeared in 1824, in six thin royal 8vo. volumes. Granger made considerable progress in the preparation of a continuation of the work, and there are extensive manuscript collections in the British Museum, which were formed by his friend Sir William Musgrave to assist him in this object, but he did not live to complete it; and the continuation, which extends only to the end of the reign of George I., and was compiled by the Rev. Mark Noble, partly from his own and partly from Granger's collections, did not appear until 1816. It is in three volumes, 8vo. Granger's work certainly contains much curious matter, and has been useful in promoting a taste for British biography; but, as it was designed rather as an illustration of British portraits, than as an account of British worthies, we find him, as Chalmers observes, 'preserving the memory of many of the most worthless and insignificant of mankind, as well as giving a value to specimens of the art of engraving which are beneath all contempt.' So great an impulse was given to the taste for collecting portraits by the publication of this work, that in many cases it was pursued with an ardour truly ridiculous, books being unscrupulously mutilated to supply the demand, and the most preposterous prices being given for engravings of little intrinsic value or genuine historical interest. Granger, who published nothing else except a few single sermons and tracts, died on the 14th of April, 1776, at the age, it is supposed, of about sixty. An 8vo. volume, containing extracts of his correspondence with several literary contemporaries relative to his work, and miscellanies and notes of tours in France, Holland, and Spain, edited by J. P. Malcolm, appeared in 1805. Chalmers's 'Biographical Dictionary,' and sundry notices in Nichols's 'Literary Anecdotes' and the 'Gentleman's Magazine,' form the principal authorities for his life.

GRANT, ANNE, commonly called Mrs. Grant of Laggan, a miscellaneous writer, was born at Glasgow on 21st February, 1755. Her maiden name was Macvicar, and her father Duncan Macvicar held a commission in the army and served for some time in America before the Revolution. He became possessed of considerable estates in the township of Clarendon, now in the state of Vermont, which on the breaking out of the war were appropriated by the revolutionists, while he did not come within the scheme of compensation to sufferers, as he resided in Britain during the war. In 1773 he became barrack-master of Fort Augustus in Inverness-shire, and there his daughter met Mr. Grant, the clergyman of the neighbouring parish of Laggan, to whom she was married in 1779. In 1801 she was left a widow with a large family, and in very straitened circumstances. She had for some time shown a taste and talent for poetry, and in 1803 her friends prevailed on her to publish a volume of 'Original Poems with some Translations from the Gaelic,' which was very successful. Since the time of her first residence in the Highlands she had studied the position and habits of the people, and written a series of letters on the subject to her intimate friends, from 1773 downwards. She had thus fortunately prepared for herself a resource against poverty. She was prevailed on to collect these letters, and offer them for publication to Messrs. Longman and Co. They agreed to publish the series, taking the risk and giving her half the profits. Thus were published in 1806 'Letters from the Mountains,' one of the most successful of the productions of light literature in its day. She says, 'My booksellers dealt liberally with me, and many persons of distinguished worth interested themselves in me, and sought my acquaintance in consequence of perusing these letters.' She subsequently lived at Edinburgh, where she was the highly esteemed centre of a circle of accomplished and amiable people. Through a long train of domestic calamities, accompanied by bodily infirmities, she preserved an equal serenity of temper, her company was sought by the best Scottish society, and she was even enabled, while carrying on a long war with pecuniary difficulties, to be generous to others. In a letter written in 1830 she thus characteristically describes part of her day's occupations: 'Afterwards come dependants. Could you dream of my having dependants, who have all my life been standing on the edge of the gulf of poverty without falling in; and this, not because I had much worldly prudence, but because I made a stern self-denial, and what Miss Edgeworth calls civil courage, serve me instead? Well, but my dependants want a letter to some one, or advice, or a governess's place, &c., and my protégées have turned out so well, that I have constant applications for such persons.' She published 'Memoirs of an American Lady,' in 1808; and 'Essays on the Superstitions of the Highlands of Scotland,' in 1811. She died on 7th November, 1838.

(*Memoir and Correspondence of Mrs. Grant of Laggan*, 3 vols.)

GRAPHIS. [Liverworts, P. C. S.]

GRAPHITE. [Plumbago, P. C.]

GRAPTO'LEPIS, a genus of fossil Ganoid fishes, from the carboniferous system of Carluke. (Agassiz.)

GRAVELOT, HUBERT FRANÇOIS D'ANVILLE, designer and engraver, was born at Paris in 1699. He was the brother of D'Anville, the eminent geographer. When about thirty years of age, Gravelot commenced the study of painting under Restout, but he eventually adopted designing, and established himself in London as a designer and etcher about the year 1732, and found considerable employment: he returned however to Paris in 1745, and obtained considerable reputation there, chiefly as a designer. His principal works are—the drawings for the monuments of kings for Vertue; many of the etchings to Sir Thomas Hanmer's edition of Shakspere, after his own and Hayman's designs; also those for Theobald's 'Shakspere' from his own designs; a large print of Kirkstall Abbey, and many ornamental designs, executed in England. In Paris he designed the illustrations for Luneau de Boisjermain's Racine; for the great edition of the works of Voltaire by Pancoucke, and for editions, of the 'Contes Moraux' of Marmontel, and of the works of Boccaccio, and of Ariosto. He died in 1773.

(De Fontenai, *Dictionnaire des Artistes*; Vertue, *Catalogue of Engravers.*)

GREEN, VALENTINE, a celebrated English mezzotint engraver, was born in Warwickshire in 1739. After serving a short time with a line engraver at Worcester, he came to London in 1765, and turned his attention to scraping in mezzotint. He acquired a great reputation by his many prints after West, especially two large plates published a few years after his arrival in London, of the Return of Regulus to Carthage, and Hannibal swearing eternal enmity to the Romans, two of West's most celebrated pictures now at Hampton Court, and originally painted for George III. The Stoning of St. Stephen after West is one of Green's masterpieces. He engraved also many of the pictures of the Düsseldorf Gallery, for which he was granted an exclusive privilege by the Elector of Bavaria in 1789, who afterwards conferred on him the title of Hof Kupferstichер (court engraver). He executed also several great plates after Rubens, including the Descent from the Cross at Antwerp, and other masterpieces. He engraved in all upwards of three hundred plates. He was elected an associate engraver of the Royal Academy in 1774: he died in 1813, aged 74.

(Bryan, *Biographical Dictionary of Painters and Engravers.*)

GREENE, ROBERT, was a native of Ipswich. The date of his birth was probably a few years later than 1550. He was educated at St. John's College, Cambridge, where, in 1578, he took his bachelor's degree, and his master's in 1583; and he was incorporated at Oxford in 1588. Between 1578 and 1583 he travelled on the Continent, visiting Italy and Spain; and it has been asserted, on the evidence of concurring probabilities, that at some time or other in the early part of his life he took holy orders. But his academical degrees are almost the only facts in his history that can be ascertained with exactness. From about 1584 he was a frequent writer for the press and for the stage; and from some of his pamphlets, which make a half-poetical kind of confessions not unlike those of Byron, a few particulars of his melancholy career may be doubtfully gathered. It thus appears that he married the daughter of a gentleman in Lincolnshire; but that, after she had borne a child to him, he abandoned her for a mistress; and his subsequent life seems to have been spent in alternate fits of reckless debauchery and of the distresses and remorse which his excesses caused. In August, 1592, a surfeit at a tavern in London threw him into an illness, which proved fatal. He was then in a state of abject poverty: and in a letter which he wrote to his wife the day before his death, charging her to pay a debt of ten pounds owing by him to his host, a poor shoemaker near Dowgate, he declared that, if this man and his wife had not succoured him, he must have died in the street. His death-bed was attended by the shoemaker's wife, and by another woman who was the sister of a hanged malefactor, and by whom he had had a natural son. He expired on the 3rd of September, 1592. Next day he was buried in the new churchyard near Bedlam.

The name of this unhappy man is very important in the early history of the English drama. Marlowe was the most distinguished of those poets who took the great steps which heralded the rise of Shakspere. Greene and Peele held the second rank among those precursors of the golden age of our dramatic poetry. Greene no where exhibits either the glowing passion or the overflowing imagination of Marlowe; and his works are not only unequal, but in all respects irregular and anomalous. Yet they show much sweetness of fancy, many touches of nature in incident as well as in character, and a poetic spirit which, if not lofty, is far above the range of the prosaic or ordinary. He was a man of decided genius; and his plays are valuable monuments of this interesting period in dramatic history. None of them were printed till after his death. Five have come down to us that are certainly his: 'The History of Orlando Furioso,' 1594, 1599, an eccentric but imaginative and not uninteresting performance; 'A Looking-Glass for London and England,' 1594, 1598, 1602, 1617, written by Greene and Thomas Lodge jointly, a dramatic version of the prophecy of Jonah against Nineveh, and, amidst its whimsicalities, the most dramatic of Greene's works; 'The Honourable History of Friar Bacon and Friar Bungay,' 1594, 1599, 1630, 1655, a legendary play, natural and poetical, and on the whole the most pleasing of the series; 'The Comical History of Alphonsus, King of Arragon,' 1599, a group of heroic pictures, in which the poet emulates, with tolerable success, the swelling vein of Marlowe; 'The Scottish History of James the Fourth,' 1598, a most extravagant yet not unpoetical invention, having nothing of history in it but the names. There has been attributed to Greene, upon very doubtful evidence, the lively drama of 'George a-Greene, the Pinner of Wakefield,' printed in 1599. It has likewise been asserted that he wrote, or had a share in writing, one or both of the plays which are the groundwork of 'Henry VI.,' Parts ii. and iii. The opposite and sounder opinion is maintained, and the state of the controversy set forth, in Mr. Knight's editions of Shakspere ('Essay on Henry VI. and Richard III.')

'George a-Greene' is in all the editions of Dodsley's Old Plays: 'Friar Bacon' is in Mr. Collier's edition of that collection. Two excellent editions of Greene's dramatic works, with all his other compositions in verse, have been published by Mr. Dyce, 2 vols. 12mo., first printed in 1831. In those volumes Mr. Dyce has given a full account of Greene's Life, with copious specimens of his prose works, and a list of them which is complete, or almost so. The list embraces thirty-four pieces, which are undoubtedly his. Their matter is very various. In his gayer hours he wrote love-stories and other novels; sketches of society, chiefly in its disreputable walks; and miscellaneous essays: in his moments of remorse he wrote warnings to debauched youth, and ample but exaggerated and romantic confessions of his own follies. Pieces of this last class are the following:—'Greene's Never Too Late: or, a Powder of Experience sent to all Youthful Gentlemen to root out Infectious Follies,' 1590; 'Greene's Mourning Garment, given him by Repentance at the Funerals of Love,' 1590; and 'Greene's Groatsworth of Wit, bought with a Million of Repentance,' 1592, which was published soon after his death by his friend and fellow-labourer Henry Chettle, and has been reprinted by Sir Egerton Brydges, 1813. One of his novels, 'Pandosto, the Triumph of Time,' otherwise called 'The Hystorie of Dorastus and Fawnia,' is the original of 'The Winter's Tale.' It was first printed in 1588, had reached a twelfth edition in 1735, and is reprinted by Mr. Collier in his 'Shakespeare's Library,' 1840. Some other tracts of Greene will be found in the 'Archaica' and 'Harleian Miscellany.' All the prose works are interspersed with pieces in verse, which are by far the best parts of them. The style is their weak point: it is deformed by a close copying of Lilly's worst affectations; and although, when we examine the matter, we often discover picturesque descriptions, and sometimes touching passages of narrative, yet nowhere in the tedious and perplexed mass do we find any reason for saying more of Greene's prose compositions, than that they are indifferent works written by a man of genius.

GREGO'RIO, ROSA'RIO, born in 1753; he studied at Palermo, became a priest, and was made a canon of the cathedral of that city. He made himself known by his historical and antiquarian learning, which he applied especially to illustrate the history of his native country. In 1789 he was appointed Professor of Law in the University of Palermo. He was one of the first to suspect the imposture of the Maltese adventurer Vella, who had forged a pretended Arabic diplomatic code of the period of the Saracenic dominion in Sicily, and had succeeded in deceiving some men of learning, among others the Prelate Airoldi, who for a time patronized him. Gregorio having a strong suspicion of the imposture, applied himself to the study of Arabic, in order to be able to sift the whole matter; and the result was that he became convinced, and convinced others, of Vella's fraud, which was afterwards clearly exposed by the learned Hager, of Vienna, in a journey which he made to Sicily in 1794. An account of this curious controversy is found in the Fundgruben des Orients.' In 1790 Gregorio published a collection of Arabic historical works and documents concerning the history of Sicily: 'Rerum Arabicarum quæ ad Historiam Siculam spectant ampla Collectio,' 1 vol. folio, which he dedicated to King Ferdinand. It contains, 1, Novairi's 'History of Sicily;' 2, an anonymous 'Chronicle of Sicily,' from a MS. in the Library of the University of Cambridge; 3, Sheaboddin's 'History of Sicily;' 4, 'Extracts from Abulfeda's Annals which relate to the History of Sicily;' 5, Al Khattib's 'Chronological Series of the Dynasties of the Aglabides and Fatimites who ruled over Sicily;' 6, 'Historical Parallels of the Rulers of Sicily during the Saracenic Period;' 7, 'A Description of Sicily from Edrisi's Geography;' 8, 'Illustrations of several Inscriptions in the Cufic Character found in Sicily;' 9, 'A Dissertation on the Calendar used in Sicily under the Arabs;' 10, 'A Sketch of the Geography of Sicily during the same period;' 11, 'Biographical Notices of Arabian Writers, natives of Sicily.' The Arabic text of the original historical works and documents is given with a Latin version, to which are appended copious notes by Gregorio. Some of the historical works had been previously published by Caruso, in his 'Bibliotheca Historica Regni Siciliæ,' but in a very imperfect and incorrect state, owing to Caruso's want of knowledge of Arabic. Having thus illustrated the Saracenic period, Gregorio undertook to illustrate also that of the Aragonese dynasty in Sicily, thus affording a continuation to Caruso's work above quoted, which extended through the Norman and Suabian periods: 'Bibliotheca Scriptorum qui Res in Sicilia gestas sub Aragonum Imperio retulere. Eam uti Accessionem ad Historicam Bibliothecam Carusii instruxit, adornavit, atque edidit Rosarius Gregorio, S. Panormitanæ Ecclesiæ Canonicus et

Regius Juris publici Siculi Professor,' 2 vols. folio, 1791-2. This collection contains the 'Historia Sicula' of B. de Neocastro; an anonymous account of the famous conspiracy of Procida, written in the vernacular Sicilian dialect; a narration, likewise in the Sicilian dialect, of the arrival at Catania of King Jayme of Aragon; the 'Historia Sicula ab a. 1282 ad 1337' of Speciale, and its continuation to the year 1361, by Michael Platiensis, an anonymous history of Sicily from 1337 to 1412, written in Sicilian; the chronicle of Simone di Lentini, and other chronicles; besides an ample collection of diplomatic documents of the Aragonese period, illustrating the laws and customs of that age. In 1794 Gregorio published his 'Introduzione allo Studio del Dritto Pubblico Siciliano,' in which he examines the sources of the law of Sicily, the various constitutions of the Normans, Suabians, and Aragonese, the 'consuetudines' of Sicily, and the proper method for studying and expounding the same. In 1806 he published the first volume of his 'Considerazioni sulla Storia di Sicilia dai Tempi Normanni sino ai presenti,' a work which was afterwards extended to six volumes, the last two being published after the author's death, and which supplies an excellent commentary on the history of Sicily. He also wrote 'Discorsi intorno alla Storia di Sicilia,' which have been likewise published after his death, and in which he discards the fabulous stories of those who claimed for Sicily a remote civilization and literature of Phœnician or Asiatic origin, anterior to Greek colonization. Gregorio assumed to prove that the earliest colonies in Sicily came from the West, and not from the East, from Iberia, Liguria, and Latium, and not from Syria.

Gregorio filled several offices under the government. He was made revisore or book censor, judge of the Ecclesiastical Court, and Regio Economo Ecclesiastico, or auditor of church property. But his emoluments continued to be scanty until a short time before his death, when he was presented to the Abbacy of Santa Maria di Roccadia. He died in 1809. He is one of the writers who have done most for elucidating the history of Sicily: he was one of those single-minded studious men, who are to be met here and there amidst the vortex of Neapolitan and Sicilian dissipation and sensuality, and who live as it were in a world of their own, retaining a kind of primitive simplicity which contrasts strangely with everything around them.

(Scinà, *Prospetto della Storia letteraria di Sicilia nel Secolo XVIII.*, Palermo, 1824-27.)

GREGORY, OLINTHUS GILBERT, was born at Yaxley, a small village in Huntingdonshire, January 29th, 1774, of humble but respectable parents. At an early age he was placed under the care of the celebrated mathematician Mr. Richard Weston, who was a contributor to the 'Ladies' Diary,' and other mathematical publications of his day. Under his superintendence Mr. Gregory made much progress in his studies, for at the early age of nineteen, and not long after leaving school, he published his 'Lessons, Astronomical and Philosophical.' Shortly afterwards he prepared an excellent treatise on the 'Use of the Sliding Rule,' which he submitted to Dr. Hutton, Professor of Mathematics, at the Royal Military Academy, Woolwich. This treatise however was never published, though it contained many valuable and original applications of the instrument, useful for practical purposes. The writer of this notice was indulged with a perusal of the manuscript a short time previous to the death of the distinguished author. This work was the means of opening a correspondence between Mr. Gregory and Dr. Hutton, which ripened into mutual friendship, and terminated only by death. In 1798, Mr. Gregory removed to Cambridge to assist the editor of a provincial newspaper: he soon however relinquished the sub-editorship, and resolved to open a bookseller's shop, at the same time announcing his intention to give instruction in the mathematical sciences, and resolving to follow that profession alone which should prove the more lucrative. The encouragement he met with as a preceptor speedily induced him to dispose of his books, and to devote his whole attention to the occupation of a mathematical instructor. His correspondence with the 'Ladies' Diary' commenced whilst he resided at Yaxley, in the year 1794, and he continued to write for that useful periodical during his stay at Cambridge. In 1800 he published his 'Treatise on Astronomy,' which he dedicated to his friend and patron Dr. Hutton. This work brought him into much notice, and in the year 1802, the Stationers' Company appointed him editor of the 'Gentleman's Diary,' and another of their annual publications. About the same period he was appointed editor of the 'Pantalogia,' and soon after, through the influence of Dr. Hutton, he was appointed a mathematical master in the Royal Military Academy. In this situation he rose through the various gradations of office, and on the resignation of Dr. Hutton he filled the professor's chair with the highest reputation, until obliged, through indisposition brought on by intense application to study, to resign it in June, 1838. The following is a list of his published works:—1793, Lessons, Astronomical and Philosophical, 1 vol.; 1801, Treatise on Astronomy, 1 vol.; 1802, appointed editor of the Gentleman's Diary; 1806, Treatise on Mechanics, 3 vols.; 1807, Translation of Haüy's Natural Philosophy, 2 vols.; 1808, Pantalogia, of which he was the general editor, and the contributor of about one-half, 12 vols.; 1810, Third volume of Dr. Hutton's Course of Mathematics, of which he composed about one-half: he afterwards edited an edition of the whole three volumes of the Course; also, Letters on the Evidence of Christianity, 2 vols.; 1815, Tracts on the Trigonometrical Survey; 1816, Plane and Spherical Trigonometry, 1 vol.; also, Dissertation on Weights and Measures; 1817, Account of his Pendulum Experiments and Astronomical Observations made at Shetland: this appeared in the Philosophical Magazine; 1818, appointed editor of the Ladies' Diary, and general superintendent of the Stationers' Company's Almanacs; 1825, Mathematics for Practical Men, 1 vol.; 1839, Address to the Gentlemen Cadets of the Royal Military Academy, on resigning the chair of Mathematics; 1840, Hints to Mathematical Teachers, 1 vol.; and Tables to be used with the Nautical Almanac.

Soon after the publication of his excellent treatise on Mechanics, the University of Aberdeen conferred on him the title of LL.D., but the work by which Dr. Gregory is best known is his 'Evidences of Christianity,' which has had an extensive sale. Dr. Gregory had the honour of being a member of almost all the learned societies in Great Britain and the continent, and was one of the twelve gentlemen who founded the Royal Astronomical Society, of which he was for some time the secretary. His connexion with the Ladies' and Gentleman's Diaries brought him into communication with young students who were desirous of distinguishing themselves in the exact sciences, and the period of his superintendence of those valuable works will be long remembered as that in which every meritorious contributor found a friend in the editor.

In 1823 Dr. Gregory was employed at Woolwich in making experiments to determine the velocity of sound. For this purpose he caused mortars, guns, and muskets to be fired at various distances from the observer; and his conclusion was that the velocity of sound, when not affected by the wind, is 1100 feet per second, when the temperature of the air is expressed by 33° (Fahr.); a result which agrees nearly with the results of experiments made at the same time on the continent.

Dr. Gregory's pleasing manners were completely in accordance with what might have been expected from the preceding remarks: all he did and said was dictated by benevolence of feeling, and he was a man of unbounded charity. As a Christian, he was moral and devout, and as a scholar he merited and obtained the consideration of the first mathematicians of the day; his great zeal in his vocation, his parental kindness, his earnest and impressive admonitions, his entertaining, improving, and philosophical conversation, and his ever-readiness to assist, will be gratefully remembered by many. He took a warm interest in the cultivation of mathematics, to which he may be said to have devoted, with the most indefatigable perseverance, nearly the whole of his valuable life. He died on Tuesday the 2nd of February, 1841, universally regretted by all who knew him, at his residence on Woolwich Common, in the 67th year of his age.

GRENADIERS are the tallest and strongest men of a battalion; they are embodied in one company, which is disposed at the head of the battalion when in column, and on the right flank when in line.

In France, as early as the year 1667, four men, appointed during a siege to throw grenades into the covered way of a fortress, and to take the lead in an assault, were distributed in each company of that which was called the king's regiment (infantry); and three years afterwards these men were formed into a separate company: subsequently every regiment in the French service had a company or two companies of grenadiers, and the regiment of guards had three: they were considered as the *élite* of the soldiery, being men of tried steadiness and valour. In 1676, the king of France instituted a company of cavalry designated horse-grenadiers, whose duty it was to repair roads previously to a march of the household troops.

It is probable that men under the denomination of grenadiers formed part of an English army soon after the introduction of that class of soldiers into the French service; for, from a list of the commissioned officers of the army in 1684, it appears that most of the regiments had grenadier companies. A corps of grenadiers was also attached to each of the three troops of horse-guards; in 1693 these were formed into a troop, and in 1702 another troop was added.

The English foot-grenadiers were at first probably employed in duties similar to those of the corresponding troops in the French service: for, in a work on the English military discipline (1686), they are said to be provided with muskets, swords, pouches to carry grenades, and hatchets: with these last, after firing and throwing their grenades, they were to cut down obstacles in order to enable the troops to rush on the enemy.

The men in the first of the three regiments of foot-guards are now designated 'Grenadier Guards,' and the Scots Greys constitute a regiment of horse-grenadiers; in both of those regiments a high bear-skin cap is worn: but the men forming the grenadier companies of regiments of the line wear the same kind of caps, and, except slight peculiarities in the ornaments of the coat and hat, they are clothed and armed like other infantry soldiers.

GREUZE, JEAN BAPTISTE, a celebrated French painter, was born at Tournus in Burgundy in 1726. He was first instructed by Landon at Lyon; he studied also in the Royal Academy at Paris, and later at Rome. Nearly all Greuze's pictures are illustrations of the affections or domestic duties, their observance or violation: he painted but one historical piece—Severus reprimanding his Son Caracalla: portraits he painted frequently. Greuze is unique in the French school, and he is sometimes termed the Lachausée of Painting, and also less appropriately, the French Hogarth. He was fond of exciting and pathetic scenes; the following are some of his most celebrated pictures:—a Father explaining the Bible to his Family; the Blind Man cheated; the Good Mother; the Paralytic Father; the Unnatural Father; the Village Bride; the Huntsman's Return; the Broken Pitcher; the Little Girl and the Dog, 'La Petite Fille au Chien,' by some considered his best picture; l'Enfant au Capucin; la Dame de Charité; le Gâteau des Rois; la Fille Honteuse; la Bonne Education; la Paix du Ménage; la Prière à l'Amour; le Fils Puni, &c. &c., all of which have been engraved, and many by J. J. Flipart and the elder Massard; la Petite Fille au Chien, has been engraved by Ch. Porporati.

Greuze was long an associate or agréé of the French academy of painting, but as he was placed in the class of *genre* (du genre bas) painters, when he was elected a member, he considered it an indignity, and he retired altogether from the academy. He died March 21, 1805. In some earlier catalogues of the Louvre Gallery his birth and death are erroneously given as in 1734 and 1807 respectively; errors which have in consequence found a place in other works, as in Waagen's 'Kunstwerke,' &c. in Paris, but they have been corrected in later editions of the catalogue.

There are six pictures by Greuze in the Louvre—the Broken Pitcher; two companion pieces representing the departure from home and the return of a prodigal or dissipated son, entitled in the catalogue, Le Depart and Le Retour; the former has been sometimes misnamed the Father's Curse, owing no doubt to the very extravagant anger and attitude of the father; two portraits, one of Greuze himself; and his celebrated picture of the Village Bride, L'Accordée du Village, which was purchased for the royal collection at the sale of the Marquis de Menars for 16,650 francs: the Marquis de Menars paid only 9000 francs for it. Greuze's works, however, are increasing in value generally; yet he cannot be considered a great painter. His works have much truth of character, but nearly all his subjects are chosen from common life, and there is something generally theatrical in his treatment. They are however better as illustrations of character than as paintings; his drawings, at least the contours, are generally correct and vigorous, but the intermediate modelling, except in the head, is feeble: he was very deficient in light and shade and colour, and his draperies want character, or indeed common truth: his heads are well modelled but generally extravagant in expression.

(Gault de Saint-Germain, *Les trois Siècles de la Peinture en France.*)

GREVILE, SIR FULKE, afterwards LORD BROOKE, was born in 1554. He was the only son of Sir Fulke Grevile, of Beauchamp Court, in Warwickshire; and his mother was a daughter of Ralph Neville, Earl of Westmoreland. He became a fellow-commoner of Trinity College, Cambridge, but afterwards studied at Oxford. Having then travelled on the continent, he was introduced at court on his return, and soon appointed to a lucrative office in the Court of the Marches of Wales. Possessed, however, by the adventurous spirit of the times, he made several attempts to escape into foreign service, which were always defeated by Queen Elizabeth's refusal of leave. In 1585 likewise he and Sir Philip Sidney, his distant kinsman and most cherished friend, were brought back by a royal messenger when they had already embarked to accompany Drake to the West Indies. Next year Sir Philip was killed at Zutphen. Grevile, knighted in 1597, sat repeatedly for his native county in parliament, and continued to receive tokens of the royal favour till the queen's death. King James was equally well disposed, bestowing on him Warwick Castle (which he repaired at a large expense); but he is said to have disagreed with Secretary Cecil, and did not obtain any new advancement till after that minister's death. In 1615 he was appointed under-treasurer and chancellor of the exchequer; and in 1620 he was raised to the peerage by the title of Baron Brooke of Beauchamp Court. Next year, resigning his post in exchequer, he became a lord of the bed-chamber. Soon afterwards he founded a history lecture in the university of Cambridge, endowing it with a hundred pounds a-year. On the 30th of September, 1628, being in his mansion in Holborn, he had an altercation with an old serving-man, who, irritated by what passed, stabbed him mortally in the back, and then destroyed himself. Lord Brooke was buried in St. Mary's Church, Warwick, under a monument which he had himself erected, with this inscription—'Fulke Grevile, servant to Queen Elizabeth, counsellor to King James, and friend to Sir Philip Sidney. Trophæum Peccati.' He was never married.

Three volumes of his writings were printed after his death. 1, 'Certain Learned and Elegant Workes of the Right Honorable Fulke Lord Brooke, written in his youth and familiar exercise with Sir Philip Sidney,' 1633, small folio. This volume contains three didactic poems (A Treatise of Human Learning, An Inquisition upon Fame and Honour, A Treatise of Warres), two tragedies on the model of Seneca (Alaham and Mustapha), Cælica (being a collection of a hundred and nine small poems, called sonnets, though not answering to the name), and two prose letters, one of which is really a long moral essay. 2, 'The Life of the Renowned Sir Philip Sidney: with the True Interest of England, as it then stood in relation to all Foreign Princes,' &c. &c., 1652, 12mo. 3, 'The Remains of Sir Fulke Grevile, Lord Brooke, being poems of Monarchy and Religion, never before published,' 1670, 8vo. All known copies of the volume of 1633 want the first twenty-two pages; and it has been conjectured that these contained the 'Treatise on Religion,' and were cancelled as objectionable, probably by order of Laud. Short specimens of his poetry are selected by Campbell and Ellis; his didactic poems are given at full length in Southey's 'Select Works of the British Poets,' 1831: and his 'Life of Sidney' was reprinted by Sir Egerton Brydges.

Lord Brooke was alike proud of being Sidney's friend and of being the patron of Camden, Davenant, and other men of letters. His own literary fame, in modern times, has scarcely been equal to his merits. He is more remarkable, however, for power and subtlety of thought than for originality of imagery or for felicity of language. His prose is lumbering and dissertative: his life of Sidney is a commentary, not a narrative. His rhymed tragedies too, in form as undramatic as those of his contemporary Sir William Alexander (to which they bear some resemblance), are not less undramatic in substance. Indeed they are hardly so much as intelligible, as representations either of incident or of character. But even in them there is much of that which constitutes the charm of his didactic poems, the pointed enunciation of elevated moral sentiments or of refined metaphysical reflections. There could be culled from his works, and most abundantly from his noble 'Treatise on Human Learning,' a rich store of sententious and finely thought apophthegms, of the kind which sparkle in the lines of Pope. This poet indeed owes to Lord Brooke several obligations. One of the lines oftenest quoted from the 'Essay on Man' is but an alteration of his line, 'Men would be tyrants, tyrants would be gods.' The pervading fault is obscurity of language, caused partly by an anxious straining after conciseness, partly by want of mastery over the mechanism of verse, and partly perhaps by indistinctness in some of the conceptions which flowed in with such variety and swiftness upon his active and searching intellect. Southey had good reason for calling Lord Brooke the most difficult of our poets, but equally good reason for recalling attention to his didactic poems.

GREY, CHARLES, second EARL GREY, was born March 13th, 1764, at Fallowden, near Alnwick, in Northumberland. His family was ennobled in the reign of Edward VI., and although the peerage became extinct, the family had for eight or nine generations been of consideration. In 1802 Sir Charles Grey, the father of the second earl, was raised to the peerage for his military services, with the title of Baron Grey de Howick, and in 1806 he was created Earl Grey. He died in November, 1807, in his seventy-ninth year.

Charles Grey was sent to Eton, and before he had attained his sixteenth year he proceeded to Cambridge, where he remained about two years, and then passed over to the Continent and made the tour of France, Spain, and Italy, which occupied him about two years.

Mr. Grey's parliamentary career began in 1786, when he was returned as member for the county of Northumberland. He attached himself to the party and still more to the person of Mr. Fox. In these days it will perhaps be considered unfortunate that his maiden speech in the House of Commons in 1787 was in opposition to Mr. Pitt's commercial treaty with France. He contended that its tendency would be to separate England from the old and faithful allies with whom she had been associated in checking the long-cherished hostility of France towards this country; that the aim of France was to monopolize the trade with the recently revolutionized American States with a view to the increase of her naval power; and that this was an exception to be made to the general policy of entering into commercial treaties with other nations. In 1788, at the age of only twenty-four, he was selected as one of the managers to conduct the trial of Warren Hastings; and in the following year he took a prominent part in the discussions on the Regency Bill. Notwithstanding his youth and the short time that he had been in parliament, he had already attained a position of considerable eminence, and a high reputation as a speaker, at a time when Fox, Burke, and Sheridan were at the height of their fame as orators.

The opening scenes of the French revolution, and still more the future progress of that event, exercised for many years an absorbing influence over both the foreign and domestic policy of England. The Whigs were agitated by differences of opinion, which destroyed party ties and even broke up private friendships. Fox and Mr. Grey were the leaders of the small but able party which constituted the opposition during the first period of the French revolutionary war. Their object was, first to prevent the war, and after it had commenced their earnest desire was to bring it to a close.

The first acts of the French revolution were favourable to popular liberty; and the association called the Society of the Friends of the People, which was formed in England early in 1792, with the object of obtaining a reform in parliament, was joined by the more liberal men of the Whig party, and Mr. Grey was one of the founders and most active members of the society. On April 30, 1792, at the request of the society, he gave notice of a motion for the following session on the subject of parliamentary reform. The motion was to the effect that 'the evils which threatened the constitution could only be corrected by timely and temperate reform.' Before the motion could be brought forward in 1793, the state of parties had undergone considerable change. The Whigs, at least the more timid amongst them, had become alarmists, and a section of them under the Duke of Portland were preparing already for the coalition with Mr. Pitt, which finally took place in 1794. Fox not only withheld his name from the Society of the Friends of the People, but privately exerted himself to check its proceedings; and it had become popular to stigmatize men of liberal principles as Jacobins and levellers, if not atheists. The temptation to temporise with the question of reform was great, but Mr. Grey rose above it. On the 6th of May, 1793, he presented a petition from the Society of the Friends of the People, which elaborately exposed the defects and evils of the existing system of parliamentary representation, and in a striking speech, in which however he did not put forth any plan, he demanded a recurrence to the principles of the constitution. It would appear from the replies of those who spoke against the motion, that Mr. Grey was ready to adopt universal suffrage, though in the abstract he disapproved of it, rather than that the existing defects in the representation should remain uncorrected. The motion was lost by 282 to 41. On the 25th of May an address was moved in support of a proclamation which the government had issued against seditious writings, when Mr. Grey assailed the minister and read the resolutions in favour of reform, which Mr. Pitt, with Cartwright and Horne Tooke, had agreed to ten years before at the Thatched House Tavern.

For many years, especially during the panic which existed in this country respecting 'French principles,' and in the midst of the extravagance in the public expenditure occasioned by the war, it was an arduous if not a thankless task which an earnest lover of constitutional rights like Mr. Grey was called upon by his sense of duty to discharge. The country was frequently in a critical state; the minister was supported by overwhelming majorities; and events perhaps occasionally warranted the executive in adopting bold and vigorous steps which were not precisely constitutional. Mr. Grey's opposition to the measures of the minister was at the time fruitless; but the vigilance of the small band of which he was the most active leader probably preserved the country from more daring inroads upon its liberties. In 1794 Mr. Grey endeavoured, though unsuccessfully, to obtain an inquiry into the conduct of government in bringing foreign troops into England without the consent of Parliament; and he was most zealous in opposing the suspension of the Habeas Corpus Act, which the government passed through all its stages up to the third reading in one day. In 1795 he opposed with equal vigour a bill which was calculated to limit if not to prohibit the holding of public meetings. On the 10th of March, 1796, he moved for a committee on the state of the nation, in which he animadverted on the enormous expenditure, the large advances made by the Bank, and the application of money to purposes different from those for which it had been voted by Parliament. On the 6th of May he brought forward a charge of misapplication of public money, in which false accounts had been made to conceal the malversation. In December he exposed another instance of the unconstitutional appropriation of the public money, in which 1,200,000*l.* had been advanced by the minister to the Emperor of Germany without the consent of the House of Commons, though Parliament was then sitting. In 1797 he was one of the committee of secrecy appointed to inquire into the circumstances connected with the stoppage of the Bank, and he dissented from the report which that committee made. In May he arraigned the minister for his conduct respecting the advances made to the government by the Bank, and accused him of having deluded the country by boasts of prosperity at a time when the Bank was on the verge of insolvency. On the 26th of the same month he again brought forward a motion for Parliamentary reform; and proposed that 113 members should be returned by the counties, each for one division, and that the franchise should be extended from freeholders to leaseholders and copyholders. The remaining 400 members were to be returned by household suffrage, and the elections were to take place on one and the same day. He intimated that if such a measure of reform were carried, he would, but not otherwise, shorten the duration of Parliament to three years. In the course of his address he intimated the likelihood of his not again taking part in the business of the House if his motion was rejected. On a division it was lost by 258 to 93; and it was not until 1799 that he again made his appearance in the House as a speaker, for the purpose of opposing the first propositions that were made for the union with Ireland. He was opposed throughout to this measure, but submitted a plan for securing the independence of the Irish members by abolishing forty rotten boroughs in Ireland; and he proposed that the addition of Irish members should not increase the numbers of the House of Commons.

The death of Mr. Pitt, in 1806, led to the formation of a Whig ministry under Lord Grenville. Mr. Grey, now become Lord Howick by his father's elevation, was appointed first lord of the Admiralty, and Fox held the seals of the Foreign Office. On the death of Fox in September, the office which he had held was filled by Lord Howick, who met Parliament in December as leader of the House of Commons. He and Lord Grenville were now at the head of the Whig party. The cabinet was broken up in March, 1807; but during its brief existence Lord Howick had carried through the House of Commons the Act for the Abolition of the Slave-Trade.

In November, 1807, on the death of his father, Lord Howick became Earl Grey, after nearly twenty years of his public life had been spent in the House of Commons. In the House of Lords he and Lord Grenville were the leaders of the opposition. One of his first acts as a peer was to protest against the attack upon Copenhagen in the previous year.

In 1809 Lords Grey and Grenville were invited by Mr. Perceval to join his administration, which had been just weakened by the retirement of Mr. Canning and Lord Castlereagh, but the offer was at once declined. On the Prince of Wales being appointed regent, Lords Grey and Grenville prepared, at his request, the answer to be returned to the addresses of parliament; but the prince, in the end, did not make use of it. Early in 1812 the regent addressed a letter to the Duke of York which he was authorized to communicate to the above two noble lords, in which he expressed a wish that 'some of those persons with whom the early habits of his public life were formed would strengthen his hands and constitute part of his government.' But as neither Lord Grey nor Lord Grenville could join the existing administration without a sacrifice of principle, it is needless to add that the prince's wish was not complied with. Again, on the death of Mr. Perceval, fresh negotiations were set on foot. The regent wished the cabinet to be composed of Lords Wellesley, Moira, Erskine, and Mr. Canning, and the terms offered to Lords Grey and Grenville were that they should be allowed to nominate four out of twelve, or five, if the cabinet were composed of thirteen ministers. On the ground that an administration formed on this principle would be inconsistent with the prosecution of any uniform course of policy, these conditions were not accepted. Lord Moira was then empowered to treat with the two noble lords unconditionally; but the negotiations were broken off in consequence of Lord Moira not being authorised to make the power of removing the great officers of the household a part of the arrangement. Something having occurred which induced Earl Grey to believe that he was personally obnoxious to the regent, his lordship expressed his willingness for his friends to take office without him, and promised them his cordial support in parliament. The negotiations eventually terminated in the formation of the Liverpool administration.

On the return of Napoleon from Elba, in 1815, Earl Grey was averse to hastily plunging into another war, and on this occasion he and Lord Grenville took opposite views. Earl Grey's character as a constitutional statesman never shone brighter than during the period of discontent and distress which the country experienced in the first few years after the peace. Force and terror appeared to be the main reliance of the government, but as Earl Grey had opposed this system when fear of the moral influence of the French revolution had led the minister to resort to it, so was he now equally desirous of showing that the best way of defending the constitution was to conciliate the affection and esteem of the people, and he urged that the natural mode of removing the discontent of the country was to remove its causes. He therefore condemned the measures of coercion adopted by the government. He moved for an inquiry into the conduct of the government respecting what has been called the 'Manchester massacre,' and though the motion was rejected by 34 to 155, two members of the royal family, the Dukes of Kent and Sussex, voted with the minority. He was strongly opposed to the punishment of transportation for seditious libel, from its liability to become a dangerous means of persecution and proscription. Earl Grey took an active part in the trial of Queen Caroline, and in opposing the Bill of Pains and Penalties which had been brought in against her. The Act for the Emancipation of the Roman Catholics, which was passed in 1829, realized one of the great objects of his political life. He gave his support to Mr. Huskisson's measures of commercial reform.

When Mr. Canning became prime minister, early in 1827, he was supported by most of the leaders of the Whig party; but Earl Grey, so far from joining his party in this course, bitterly attacked Mr. Canning and treated with contempt his pretended liberalism. Himself the model of a severe and inflexible patrician, with high connexions and a lofty public character, he seemed as if he regarded the prime minister as a brilliant and dexterous adventurer. The only persons who listened with pleasure to this speech were men whose principles Earl Grey's public life had been devoted to opposing; and yet no one supposed that this attack on the minister proceeded from any other than a sense of duty and a lofty moral tone combined with a peculiar temperament. This at the same time led him into a disdain of popular opinion which was no less a feature of his character. In the same session he supported the amendment of the Duke of Wellington which led to the abandonment of Mr. Canning's corn bill. He knew how unpopular his vote on this occasion would be; but 'if,' he said, 'there should come a contest between this house and a great portion of the people, my part is taken; and with that order to which I belong I will stand or fall;' and, he added, 'I will maintain to the last hour of my existence the privileges and independence of this House.'

The period was now approaching when, as the crowning act of his long political life, he was to undertake the amendment of the representative system, the object for which his earliest energies had been exerted in unfavourable times. Up to 1830 the slightest measure of parliamentary reform had been resolutely denied. The Duke of Wellington, who was prime minister when the Parliament met which was elected on the death of George IV., affirmed, in allusion to something which Earl Grey had said, that 'the legislature and the system of representation possess the full and entire confidence of the country, and deservedly possess that confidence.' But the second revolution in France, which had just occurred, had given a great impulse to questions of political reform; a new reign and a new parliament had commenced under these influences; and the country generally was in a disturbed and excited state. The duke's administration was compelled to yield to the influence of these circumstances and resigned office. Earl Grey was sent for by William IV. and requested to form a new cabinet. He announced as prime minister that 'Peace, Retrenchment, and Reform' would be the objects of his policy. On the 1st of March, 1831, Lord John Russell, as the organ of the cabinet, introduced the first Reform Bill into the House of Commons. A brief history of this measure is given in WILLIAM IV., P. C., vol. xxvii. p. 401. On the 7th of May, 1832, Lord Lyndhurst carried an important motion, which, it was considered by the cabinet, placed the Reform Bill in peril, and they immediately resigned office. The ministerial interregnum was terminated on May 17 by the return of Earl Grey to power. The independence of the House of Lords was for the time virtually destroyed, and means were used, with the king's consent, to prevent the peers who were opposed to the Reform Bill from attending in their places to vote against it. This may have been an inconsistency in Earl Grey, who had so lately pledged himself in favour of the independence of the House of Lords; but he had to choose between successfully carrying out his plan of parliamentary reform and a violent political convulsion. On the 4th of June the Lords passed the bill by 106 to 22, and three days afterwards it received the royal assent.

The first Reformed Parliament met on the 29th of Jan. 1833, and its first measures were the abolition of colonial slavery, the abolition of the East India Company's monopoly, the reform of the Irish church, and the reform of the poor law. The cabinet was early shaken by some personal changes. In March, 1833, Lord Durham was compelled to resign from illness. At the end of May, 1834, Mr. (now Lord) Stanley, Sir James Graham, the Earl of Ripon, and the Duke of Richmond, left the ministry on account of differences with their colleagues. Earl Grey had considered a Coercion Act necessary for Ireland, and a misunderstanding arose with Mr. O'Connell on the subject, which in July led to his lordship's resignation and that of Lord Althorpe. Lord Althorpe returned to office in about a week, but the cabinet, which no longer possessed the confidence of William IV., was dismissed in the following November, when Lord Althorpe, by the death of his father Earl Spencer, was removed to the House of Lords.

For one or two years after his retirement from office Earl Grey occasionally attended the House of Lords, but the last ten years of his life were passed in retirement surrounded by a numerous family and honoured by the general respect and veneration of his countrymen. He died at his seat, Howick House, in Northumberland, July 17, 1845, in his eighty-second year. The personal appearance of Earl Grey was stately and commanding; his action graceful and animated; and his voice strong, flexible, and sonorous. As a speaker his style was pure and his manner free from affectation. He was married on the 18th of November, 1784, to Mary Elizabeth, only daughter of the Right Honourable William Brabazon Ponsonby, afterwards first Lord Ponsonby, and by her he had ten sons and six daughters. His widow, eight of his sons, and four of his daughters, survived him. Henry George, now third Earl Grey, better known as Lord Howick, was for some time a member of Lord Melbourne's cabinet.

GRIAS, a genus of plants belonging to the natural order Myrtaceæ. It has the tube of the calyx adhering to the ovarium; the limb small, 4-cleft, obtuse; the petals 4, coriaceous; the stamens numerous, inserted in a square disk; the filaments joined into 5 series at the base; the inner ones very short; the anthers kidney-shaped, small; the style wanting; the stigma cruciate, hidden in the incurved stamens; the fruit ovate, 8-furrowed, crowned by the calyx. There is but one species, *G. cauliflora*, the Anchovy pear. It is a tall little-branched tree with very long oblong leaves, and large white flowers seated on short many-flowered peduncles. It is a native of subalpine districts of Jamaica in boggy places. The fruit is an ovate berry the size of an alligator's egg, and of a brownish russet colour, and is pickled and eaten in the same way as the mango. It is readily propagated by seeds, and the young plants must be kept in a moist heat. It grows best in a loamy soil, and may also be propagated by large cuttings placed under a hand-glass in heat.

(Don, *Gardener's Dictionary*.)

GRIFFITH, WILLIAM, was born in the year 1810, and having been destined for the medical profession, he completed his education at University College, then called the London University. He distinguished himself in the medical classes, but more especially in that of botany, of which Dr. Lindley was the professor. He went out to India as an assistant-surgeon on the Madras establishment, where he arrived on the 24th of September, 1832. Shortly after his arrival he was appointed by the Bengal government to examine the botany of Tenasserim. In 1835 he and Dr. M'Clelland were selected to accompany Dr. Wallich into Assam for the purpose of reporting upon the growth of the tea-plant. From Assam he proceeded in company with Dr. Bayfield to examine the then unexplored tracts which lie beyond Luddya and Ava, on the extreme frontier of the eastern territories of Great Britain. In 1837 he was appointed to accompany Captain Pemberton on his mission to Bootan. Two years afterwards, in 1839, he was sent with the army of the Indus to examine the character of the vegetation of Afghanistan. During these several journeys he lost no opportunity of making observations and collecting objects in natural history. Although his appointments mostly had regard to his botanical knowledge, his reports, and letters written during his journeys, as well as his papers, show that there was little of interest to the naturalist that escaped his notice. In his travels he collected both plants and animals. In collecting plants he had the object in view of writing a Flora of India, and to this great work he never ceased to devote himself. Many of his zoological specimens have been sent to Europe, and have been described and published by various naturalists. He devoted much time to the fresh-water fishes of India, of which he made a large collection, and an account of them has been given in the 'Calcutta Journal of Natural History.' At the time of his death his collection of birds consisted of about six hundred specimens, affording perhaps one of the most extensive and instructive illustrations of the geographical distribution of the birds of India extant.

In 1841 Griffith was appointed to the medical duties at Malacca, and upon Dr. Wallich's absence owing to illness, he was appointed to the superintendence of the Botanical Garden at Calcutta, and the duties of the Professor of Botany in the Medical College. On the return of Dr. Wallich he resumed his place at Malacca, and was there seized with the disease of his liver, which terminated his existence on the 9th of February, 1845.

Griffith's was rather a life of promise than fulfilment. He was educated in England at a time when the blind deference which was paid to the authority of Linnæus as the end of botanical inquiry was beginning to pass away under the influence of the writing and teaching of the present professor of botany at University College; and when the genius and profoundly philosophical views of Robert Brown were becoming appreciated by his countrymen. He saw the right direction of botanical investigation, and in the wide field for research which his residence in India afforded aimed at something more than the collecting of specimens and the descriptions of species. His life was too short to observe much, and his death-illness too rapid to afford opportunity for publishing many of the results of his observations. He has however left papers scattered in journals and Transactions, which indicate very extraordinary powers of observation, and throw much light on the subjects on which they treat. Of these papers those which are at present best known are three 'On the Ovulum of Santalum, Osyris, Loranthus, and Viscum,' in the 18th and 19th volumes of the Transactions of the Linnæan Society. These papers consist of an account of a series of microscopical observations on the development of the embryo in the ovule of the plants named. [EMBRYON, P. C. S.]

During the last session (1844-5) of the Linnæan Society he contributed a paper on the structure and relations of the various forms of Rhizanths. In this paper he pointed out the relation of these plants to certain exogenous forms of vegetation, and advocated the abolition of the Rhizantheæ as a distinct class in the vegetable kingdom. This paper is not yet published. Amongst other contributions to botany by Griffith may be named—A Memoir on the structure of Salvinia and Azolla, in the 'Calcutta Journal of Natural History;' a description of two genera of Hamamelidæ, two species of Podostemon, and one species of Kaulfussia, in the 'Asiatic Researches;' on the family of Rhizophoreæ, and a report on the tea-plant of Upper Assam, in the Transactions of the Agricultural Society of Calcutta.

The materials collected by Griffith for his work on the Flora of India, as well as his zoological museum, have been consigned to the Directors of the East India Company; and it is to be hoped that they will not be entirely lost to science by the death of their able and indefatigable collector.

GRIMALDI, GIOVANNI FRANCESCO, called *Il Bolognese*, a celebrated Bolognese painter, born in 1606, was the pupil and relation of the Carracci. He was particularly excellent in landscape, both as a painter and an etcher: he etched some of the landscapes of Titian. He painted also history and portrait, and was employed by Louis XIV. and the Cardinal Mazarin for three years at Paris, painting in the Louvre and in the cardinal's palace. He was also much employed by Innocent X. at Rome, in the Vatican, in the Palazzo Quirinale, and in the Church of San Martino a' Monti; and there are some good landscapes by him in the Colonna Palace. He died at Rome in 1680: Pietro Santo Bartoli married one of his daughters. His son Alessandro assisted him in some of his works; he was a good painter in a similar style as his father.

(Malvasia, *Felsina Pittrice;* Gandellini, *Notizie Istoriche degli Intagliatori;* Lanzi, *Storia Pittorica*, &c.)

GRIMALDI, FRANCESCO MARIA, an Italian philosopher, and a member of the order of Jesuits, was born at Bologna, in 1619. His education being completed, he was, according to Montucla, employed during several years in giving instruction in the belles-lettres; and during the latter part of his life he applied himself to the study of astronomy and optics. He died at Bologna, in 1663, in the forty-fourth year of his age.

Grimaldi was associated with Riccioli in making astronomical observations, and he gave particular descriptions of the spots on the moon's disk. It was asserted by Montucla that Grimaldi gave to those spots the designations by which they are now distinguished among astronomers; thus superseding the names of the mountains and seas of the earth which had been given to them by Hevelius: but this is apparently a mistake.

That which has given celebrity to Grimaldi is his work entitled 'Physico-mathesis de Lumine, Coloribus, et Iride aliisque annexis,' which was published at Bologna, in 4to., in 1665. The greater part of the work consists of a tedious discussion concerning the nature of light, the conclusion of which is that light is not a substantial but an accidental quality; the rest, however, possesses the highest interest, since it contains accounts of numerous experiments relating to the interferences of the rays of light. A description of the work is given in the 'Philosophical Transactions' for that year.

Grimaldi, having admitted the sun's light into a dark room, through a small aperture, remarked that the breadths of the shadows of slender objects, as needles and hairs, on a screen, were much greater than they would have been if the rays of light had passed by them in straight lines. He observed also that the circle of light formed on a screen by the rays passing through a very small perforation in a plate of lead was greater than it would be if its magnitude depended solely on the divergency of the rays; and he arrived at the conclusion that the rays of light suffer a change of direction in passing near the edges of objects: this effect he designated 'diffraction.' By Newton it was, subsequently, called 'inflexion.' He found that the shadow of a small body was surrounded by three coloured streaks or bands which became narrower as they receded from the centre of the shadow; and, when the light was strong, he perceived similar coloured bands within the shadow: there appeared to be two or more of these, the number increasing in proportion as the shadow was farther from the body.

Having admitted the sun's rays into a room through two small circular apertures, Grimaldi received the cones of light on a screen beyond the place where they overlapped each other; and he observed, as might be expected, that, within the space on which the rays from both apertures fell, the screen was more strongly enlightened than it would have been by one cone of light; but he was surprised to find that the boundaries of the penumbral portions which overlaid one another were darker than the corresponding portions in which there was no overlaying. This phenomenon of interference was, at the time, enunciated as a proposition:—'That a body actually enlightened may become obscure by adding new light to that which it has already received.'

Grimaldi also observed the elongation of the image, when a pencil of light from the sun is made to pass through a glass prism: but he ascribed the dispersion of the light to irregularities in the material of which the prism was formed; and he was far from suspecting the different refrangibilities of the rays. The discovery of this fact, which has led to so many important consequences in physical optics, was reserved for Newton.

(*Biographie Universelle;* Montucla, *Histoire des Mathématiques.*)

GRISTHORP BAY, a locality on the coast of Yorkshire, famous for the occurrence there, more remarkably than elsewhere, of numerous Cycadeöid plants, Lycopodites, Ferns, &c., in strata of the Bath oolite series.

GROATS, or GRITS. [AVENA, P. C. S.]

GROS, ANTOINE JEAN, BARON, one of the most distinguished of the recent French painters, was born at Paris in 1771. He was the pupil of David, and some of his earlier pictures are in the dry manner of that painter. One of his first works of note was Bonaparte on the bridge of Arcola, in the celebrated battle of that place, exhibited at the Louvre in 1801. In 1804 he exhibited his celebrated large picture of the Plague of Jaffa, with Bonaparte visiting the sick, to whom he has given a most disgusting appearance, though the whole displays great vigour and power: it is now at Versailles: there is a large print of it by Laugier. He painted also several other large pictures, as—the Battle of Aboukir; the Battle of the Pyramids; Napoleon visiting the Field of Eylau, after the battle; the Battle of Wagram; the Capture of Madrid by Napoleon; and other subjects from the history of France during the eventful years of the early part of this century. His masterpiece, however, is considered the Cupola of St. Geneviève, at Paris, executed in oil, in 1824, and for which he was created Baron; it exhibits the saint as guardian of the throne of France, which is represented by Clovis, Charlemagne, St. Louis, and Louis XVIII.; but though gorgeous and effective, it belongs strictly to the school of ornamental art: the drawing is correct, and the colouring is florid, but the composition and expression are very ordinary.

The pictures of Gros generally are conspicuous for vigour and facility of execution, but they are at the same time extremely coarse, sometimes in treatment as well as handling; they show little or no delicacy of feeling, and they are quite void of all pictorial refinement of tone and modelling, and are equally void of sentiment. Perhaps Sappho leaping from the promontory of Leucate, on the Island of Leucas, may be considered an exception to his prevailing style: there is a good print of it by Laugier. His picture also of the Visit of Francis I. and Charles V. to the Abbey of St. Denis is executed in a very superior style to his battle-pieces and similar large works: it has been admirably engraved by Forster. This and the Battle-field of Eylau are in the Louvre. Gros has painted also some excellent portraits.

He died at Paris, June 26, 1835. He was professor of painting at the Ecole Royale des Beaux Arts; member of the Institute; officer of the Légion d'Honneur; and knight of the order of St. Michel.

(Gabet, *Dictionnaire des Artistes de l'Ecole Française, au dix-neuvième Siècle;* Réveil et Duchesne, *Musée de Peinture et de Sculpture,* &c.; *Notice des Tableaux exposés dans le Musée Royal,* 1841; *Kunstblatt,* 1836.

GROTIUS, WILLIAM, was born in 1597, at the Hague. He was the younger brother of Hugo Grotius, who directed his studies, and always behaved towards him with the greatest kindness. William Grotius became a learned and prosperous lawyer. He died at the Hague in 1662.

William Grotius collected and published at Leyden, in 1617, the Latin poems of his brother, in 12mo. He himself wrote 'Isagoge ad Praxin Fori Batavici,' Amsterdam, 1655, 4to.; 'Enchiridion de Principiis Juris Naturalis, Hague, 1667, 4to.; 'Vitæ Jurisconsultorum quorum in Pandectis extant Nomina,' Leyden, 1690, 4to.

(*Biographie Universelle;* Watt's *Bibliotheca Britannica.*)

GROWING CROPS. [EMBLEMENTS, P. C. and P. C. S.]

GUANO (from the Peruvian word *huanu,* which signifies dung) is the excrement of sea-fowl, and was used as a manure probably for ages before Peru was visited by the Spaniards. It is spoken of by Herrera in a work published at Madrid in 1601; by Garcilaso de la Vega in his 'Memoriales Reales,' published at Lisbon in 1609; and by Ulloa in his 'Voyage.' Garcilaso de la Vega says that 'in the time of the Incas there was so much vigilance in guarding these birds (the sea-fowl), that during the rearing season no person was allowed to visit the islands which they frequented, under pain of death, in order that they might not be frightened and driven away from their nests. Neither was it allowed to kill them at any time, either on or off the islands, under the same penalty. Each district or territory had a portion of these islands allotted to it.' A recent German traveller, Meyer, in his 'Reise um die Welt,' says, 'Along almost the whole coast of Peru this excrementitious matter covers the small islands and cliffs near the coast, and on some spots lies in such enormous beds as could only be produced by the accumulation of thousands of years.' The same writer states that guano is an important article of commerce in Peru. Mr. Thairlwall, of Richmond, Yorkshire, who has visited the western coast of South America, describes a small island, about three miles in circumference, in 13° 44′ S. lat., on which guano is deposited in a solid mass two hundred feet in depth. The surface is coated over with a thick incrustation of almost pure muriate of ammonia; and when the bulk is disturbed, the ammonia given out is so strong as to affect respiration, and to cause an unpleasant sensation in the eyes. Peruvian guano is imported into England only by two co-agents, one at Liverpool and the other in London. About the commencement of 1843 guano was discovered on the island of Ichaboe, about two miles and a half from the mainland of Africa, in 26° 13′ S. lat. and 14° 15′ E. long. The place soon attracted notice, and by the end of 1844 the whole of the guano had been carried away. As many as three hundred and fifty ships have been anchored off the island at the same time. The guano was from thirty-five to thirty-eight feet in depth, and the deposit extended to a length of about 1100 feet, with an average width of 400 feet. Towards the close of 1844 another guano island (Malagas) was discovered at the entrance of Saldanha Bay. The guano covers an extent of about eight miles, and gradually increases in thickness from about four yards to eight yards. It is obtained for shipment by a licence from the collector of customs at Cape Town. In October, 1845, a cargo of guano was brought to this country from Patagonia. It has been supposed that the excrement of the sea-fowl which swarm on some parts of the coast of Great Britain might be used as a fertilizer with the same results as Peruvian or African guano; but the quantity which could be collected is comparatively small, as the annual accumulation is in most cases washed away by the rains, and the valuable properties of that which remains are dissipated by the changeable nature of our climate. In South America and Africa the dryness of the climate allows the guano deposits of successive years to accumulate, and the heat of the sun produces a coating of the surface which preserves its virtue as a manure. The superiority of the Peruvian over the African guano is owing chiefly to the greater dryness of the climate.

The value of guano is to be estimated according to the proportions which it contains of—1, ammonia; 2, phosphates; 3, organic matter. The result of a number of analyses of Peruvian and African guano show the following variations in their composition:

	Peruvian.	African.
Water	12 to 15	25 to 30
Organic matter .	50 to 60	25 to 30
containing	12 to 15 parts of ammonia	5 to 9 parts of ammonia
Phosphate of lime	15 to 25	25 to 30
Fixed salts . .	—	8 to 10

African guano has the largest proportion of soluble matter, and that from Peru is remarkable for the quantity of uric acid that it contains, an element which dissolves very slowly. African guano may therefore act with greater rapidity, but the effect of Peruvian is felt for a longer period.

Good Peruvian guano sells at 10*l.* or 11*l.* per ton, and African at 7*l.* or 7*l.* 10*s.* The article is extensively adulterated, and instances have occurred in which the adulterated matter prevailed to the extent of 97 per cent. Umber, stone, ground into a fine powder, various earths, old mortar, and partially decomposed saw-dust, are employed for this purpose. The mixture is moistened with putrid urine and re-dried. Even genuine guano differs so frequently in quality, that it is never advisable to purchase it without a satisfactory analysis. Purchasers are often deluded with false analyses, and those who deal only with importers are not always safe. Dr. Ure advises the farmer before he buys to obtain an analysis of a competent chemist, and then to cork up a sample in a bottle, and in the event of his crops disappointing reasonable expectation he is in a better position for obtaining satisfaction for any fraud which may have been practised upon him. Farmers' clubs might retain a respectable chemist at a salary on condition that he should perform analyses for the members at a moderate fee. This is what in effect is done by the Agricultural Chemistry Association of Scotland, and the consequence is that scarcely a single sample of adulterated guano has been offered for sale in that country.

Artificial guano may be easily compounded by an admixture of the constituents of natural guano, all of which, with the exception of bone-dust, may be procured of any druggist. Professor Johnson gives the following recipe for an artificial manure which will produce an effect about equal to one cwt. of natural guano :—78¾ lbs. bone-dust, 25 lbs. sulphate of ammonia, 1½ lb. of pearlash, 25 lbs. common salt, 2¼ lbs. dry sulphate of soda; total, 132½ lbs. The following artificial substitute for guano has been successfully used, at the rate of 5 cwts. per acre :—

Bones, dissolved in spirits of salt instead of oil of vitriol		18¾ lbs.
Charcoal powder	about	18¾
Sulphate of ammonia (gas salt)	about	9½
Common salt	about	9½
Gypsum		9½
Wood ashes	about	46
Nitrate of soda (cubic petre)		28
Sulphate of soda (Glauber salts)		10
Sulphate of magnesia (Epsom salts)		10
		158 lbs.

It said that 4 cwts. of guano, which is the usual quantity applied to one acre, are equal in effect to fifteen tons of farm-yard dung. Mr. Lawes, an experienced agricultural chemist, gives the following table of the constituents of these two quantities :—

Guano.

Phosphate of lime	112 lbs.
Ammonia	54
Organic matter	171
Potash, soda	30

Dung.

Phosphate of lime	100 lbs.
Ammonia	195
Organic matter	8505
Potash, soda, and silica	1335

Experiments have been made, the results of which showed that 3 cwts. of good Peruvian guano were equal to twenty tons of good farm-yard dung; but much more is required to be known of guano and other hand-tillages recently introduced, before their exact value can be fully settled; and this can only be ascertained by extensive experiments under every variety of local circumstances. The question may also arise, whether guano and other stimulating fertilizers do not exhaust the land while they produce great immediate results. This has been the result in California, according to a statement recently published, and though such deterioration of the soil is comparatively of little consequence where there is abundance of wild land, the state in which guano leaves the soil is an important consideration in a country like England. There are other points for consideration, of the real nature of which little is at present known; but it may be sufficient to allude to some analyses undertaken in 1844, by the Agricultural Chemistry Association of Scotland, in which it was found that turnips raised respectively by means of dung and guano presented remarkable differences in their chemical constituents; and it was further ascertained that the cattle which fed on the dung-grown turnips throve more rapidly.

In the application of guano care should be taken to prevent its coming in contact with the seed. The guano must be mixed with three times its bulk of finely pulverized earth, burnt clay, mineral ashes, &c.; but for cold soils the proportion of guano may be increased, and the quantity to be applied per acre may vary from two to four cwts., according to the nature and quality of the soil. It is important that rain should follow the application of guano within a short time, and a wet season is generally considered most favourable to its success. For various crops the guano answers best after vegetation has commenced; and it is useful in some cases to apportion the quantity intended to be used per acre into two or three portions for sowing at intervals, but the intervals most favourable are not fully determined. For small allotments or gardens it is often most convenient to use guano in a liquid state, in which case 4 lbs. of guano may be mixed with twelve gallons of water, and used after it has stood twelve hours, and the proportion per acre may be from a half to one cwt. of guano to 160 gallons of water.

In the year ending the 5th of July, 1844, the quantity of guano imported into the United Kingdom was 36,628 tons, which would cost nearly 300,000*l.* to the agriculturist.

(*Supplement to* Rham's *Dictionary of the Farm; see also Journal of the Royal Agricultural Society; Journal of the Highland and Agricultural Society; Gardener's Chronicle*, edited by Dr. Lindley.)

GU'BBIO, ODERI'GI DA. [ROMAN SCHOOL OF PAINTING, P. C., p. 76.]

GUERIN, PIERRE NARCISSE, BARON, a distinguished French painter, born at Paris in 1774, was the pupil of J. B. Regnault. His works are the perfection of manner in imitation of the antique; they display notwithstanding great skill and perseverence. By antique manner in painting is meant what may be termed a literal translation into colour of the common characteristic ideal forms of Greek sculpture and bassi-rilievi, without giving them life or motion; such pictures are evidently paint, and sometimes have the effect of a show of painted statues, in which each figure is independent of its neighbour. The works of Guerin may be justly censured for this defect, even more so than those of David; but it is perhaps made more obvious in the works of Guerin, as his subjects are mostly antique and in antique costume. The following are his principal works:—The first which attracted general attention was—Marcus Sextus, having escaped the proscriptions of Sulla, returns, and finds his daughter weeping by the side of her dead mother: exhibited in 1798: in 1802, he exhibited an Offering to Æsculapius, and Hippolytus accused by Phaedra, brought before Theseus; in 1808, Bonaparte pardoning those who had revolted at Cairo; in 1810, Pyrrhus and Andromache, and Cephalus and Aurora; in 1817, Dido listening to the story of Æneas, Ægisthus urging Clytemnestra to murder Agamemnon, and St. Geneviève. All these works have been engraved; the Cephalus and Aurora by Forster: this subject is suited to Guerin's style, and it is one of the most beautiful of his works; it is in the Somariva collection. Æneas recounting the fate of Troy to Dido, likewise engraved by Forster, is a gorgeous and elaborate work, especially in costume and accessaries; but it wants chiaroscuro, and has the defect already noticed in the highest degree; every thing is of the same substance and texture; it wants dramatic effect wholly; Æneas is not relating nor is Dido listening; it is a mere juxtaposition of four elaborately painted figures, Æneas, Dido, Ascanius, and Anna: it is now in the Louvre. The following five works are also in the Louvre—Marcus Sextus, Phaedra and Hippolytus, the Offering to Æsculapius, Clytemnestra, and Andromache. The 'Révoltés du Caire' is at Versailles.

Guerin was appointed a professor in the Ecole Royale des Beaux-Arts, in 1814; and he was some years director of the French Academy at Rome: he was created Baron after his return from Rome in 1829. He died at Rome, July 16, 1833, whither he had returned for the sake of his health, which was delicate. He was member of the Institute and many foreign academies, and chevalier of the Legion d'Honneur and of the order of St. Michel.

(Gabet, *Dictionnaire des Artistes de l'Ecole Française au XIX^e. Siècle;* Réveil et Duchesne, *Musée de Peinture et de Sculpture; Notice des Tableaux exposés dans le Musée Royal*, 1841.)

GUERNSEY. Since the publication of this article in the 'Penny Cyclopædia' some very important changes have taken place in the laws and constitution of that island. In the year 1838 a petition, signed by several hundred rate-payers, was presented to the Bailiff and jurats, praying for a reformation in the law of wills and inheritance. According to the then existing law, chiefly derived from the old Norman code, real property descended as follows: two-thirds of it were divided among the sons, and one-third among the daughters, with a provision that, in no case, could a daughter's share exceed that of a son. The eldest son had the additional privilege of choosing about half a vergee of land (about one-fifth of an English acre), estimated as naked ground, and consequently he might select in the different parts of the estate the portions of land on which stood the most valuable buildings. This right was termed 'le Préciput.' In particular cases, likewise, all the sons were together entitled to the twentieth part of the estate, called 'Le Vingtième,' in addition to their ordinary share. In collateral successions a sister could not inherit real property from a brother or sister, so long as there were other brothers or their descendants living, and, as real property could not be left by will, cases of occasional hardship occurred. This last circumstance chiefly gave rise to the petition above alluded to; the principal points contained in it were sanctioned by the States of the island, and on the 3rd of August, 1840, an order of the Queen in Council was registered on the records of the court, which materially modified the law of real property in Guernsey. The following are the most important changes:—The right of 'vingtième' was abolished for all sons who had not attained their fourteenth year when the law was passed. The eldest son's right to the 'préciput' was continued, subject however to certain modifications, the principal of which was, the obligation to take it in a single enclosure, even should that enclosure not contain the quantity of land usually assigned as a 'préciput.' In collateral successions to inherited real property, neither males nor descendants shall in future exclude females or their descendants, but the relatives of both sexes belonging to the line whence the property descends, shall divide the estate by branches, in the same proportion as in successions in the direct line. In collateral successions to *personal* and *purchased real* property, neither males nor their descendants shall exclude females nor their descendants, in parity of degree, but the nearest of kin to the deceased, in parity of degree, both males and females, shall share the property in the same proportion as property of this nature, whether personal or real, would be shared in succession of the direct line. Ascendants, having no descendants living, shall inherit the *personal* and *purchased* real property of the last of their descendants.

Coincident with these changes in the law of inheritance was a reform in the law of wills. The feudal law, which was till lately that which chiefly guided the division of property in the island, was opposed to the principle of wills. By the antient law, a person who left neither wife nor children, could dispose by will of all his personal property, but he could never give more than one-third of his real property by deed of gift during his lifetime, whether he had inherited or purchased it; under no circumstance could he leave by will any portion of his real property. At present, a person who leaves neither wife nor descendants is allowed not only to dispose of all his personal property by will, but he may do the same with his *purchased* real property, and even with real property *inherited*, provided he leaves no relations within the second degree in a collateral line.

The above are the principal changes which have taken place in the laws of the island. The information may be useful to those who visit the Channel Islands, and who are induced to reside there from the many advantages they enjoy, not the least of which is the prevailing custom to exempt from local taxation strangers not possessed of real property in the island, and not carrying on any trade or profession, and the absence of all duties on imported goods, with the exception of a small duty on spirits.

The constitution of the States of the Island has likewise undergone a material reform. The States of Deliberation were formerly composed of thirty-two members, as mentioned in the former article on Guernsey. The grievance complained of was the comparatively small influence of the town parish in that assembly. With a population greater than half that of the entire island, it sent but one representative to the States; whereas the nine country parishes had each their representative. To counterbalance in some measure the preponderating influence of the country, it was proposed by the States, and finally sanctioned by an order of the Queen in Council, dated December 13th, 1844, to divide the town parish into four cantons or districts, without however interfering with the antient corporation now called the Central Douzaine, and which is composed of twenty-two members, including the two constables or chief police officers. The rate-payers in each of the four cantons choose twelve members for life to represent them in the States of Election for the choice of a Jurat, and these twelve members select one of their body to represent them at each assembly of the States of Deliberation, and the Central Douzaine two members. Thus the representation of St. Peter's Port was increased from one to six members in the States of Deliberation, making the entire number thirty-seven; and from twenty-two to seventy in the States of Election, making the entire number 222. The constables by this new arrangement ceased to be 'ex-officio' the representatives of their respective douzaines; each douzaine throughout the island was in future to send, at every assembly of the States, any one member they might choose out of their body. It was likewise provided in the order in council, that no general tax should be raised by the States of Deliberation except with the consent of a majority of two-thirds of the members present; and no tax exceeding one penny on every twenty pounds capital, except with the consent of her Majesty in Council, signified through one of the principal secretaries of state.

Considerable improvements have taken place in the island within the last twenty years. Good macadamized carriage-roads now lead from the town to almost every part of the country. Many buildings, both public and private, have been erected. The number of houses in St. Peter's Port, which in 1831 was 1810, had risen in 1841 to 2212. The population of the whole island during that period has increased from 24,349 to 26,705, and including the adjacent islands belonging to the bailiwick, Alderney, Sark, Herm, and Jethou, to 28,578. The effective strength of the militia is about 2600 men from sixteen to forty-five years of age, and is divided into four regiments and an artillery battalion. The total number of births in St. Peter's Port from October, 1843, to October, 1844, was 188, and of deaths 141; and in the whole island, 462 births to 322 deaths; thus, taking the population of the island at that period at 27,000, the annual mortality, as appears by an extract from the Registry Office, is only about one in eighty-three, or more nearly one in eighty-four. The climate, no doubt, is the chief cause of this low rate of mortality; it nearly resembles that of the coast of the south-west of England, the prevailing winds being westerly, though the east wind is frequent in spring. The cold in winter is moderate; many winters passing without snow, and frosts of long continuance are rare. The mean winter temperature has been ascertained to be about 41° 62′, which is 5° 11′ higher than that of London; that of the summer at 60° 7′, which is about 1° lower.

In the town of St. Peter's Port a Mechanics' Institution was established in 1831; it has now nearly 300 members, and its library contains upwards of 3000 volumes. The savings-bank has a rapidly increasing number of depositors; the total amount of investments up to the year ending August 20th, 1845, being 82,392*l.*, divided among 3137 depositors. There are also two well-established joint-stock banks, conducted chiefly on the Scotch system, and issuing one pound notes; every individual shareholder is, by the law of the island, liable to the full extent of his property, both real and personal. The shipowners established in 1838 a mutual insurance society, and the amount of shipping insured during the present year is 84,870*l.* Some idea of the increasing wealth of this island may be formed from the fact that in the year 1740 the total amount of property taxed in the town of St. Peter's Port was only 21,894 quarters, which represents a capital of 437,980*l.*; the highest tax was rated at 600 quarters, or 12,000*l.* belonging to a single individual. Whereas in 1844 the same parish was rated at 150,355 quarters, or 3,007,100*l.*; the highest individual tax being rated at 8000 quarters, or 160,000*l.* It must moreover be borne in mind that the above does not represent the full amount of property, as a great number of persons having only seven or eight quarters are not rated.

The annual net revenue of the States in 1843 was 7554*l.*; raised chiefly by a duty on spirituous liquors of one shilling per gallon. There is however a debt incurred of about 89,000*l.*, the greater part of which sum has been expended on public buildings.

The state of trade is not at present very flourishing, and in that respect this island is very far behind its neighbour Jersey. In the year 1844 St. Peter's Port possessed 125 vessels, the largest measuring 288 tons. In the same year there were 26,414 imperial quarters of foreign wheat imported, and 11,317 exported. There is almost daily steam communication between the Channel Islands and the port of Southampton, from whence the English mail is conveyed three times a week, and those of Plymouth and Torquay, and also between St. Maloes and Granville in France.

Great attention is paid to agriculture, and many improvements have been introduced by means of an agricultural and also a horticultural society, established, the former in 1816, and the latter in 1832; the land is divided into a large number of freehold estates, many of not more than four or five English acres in extent, and none larger than seventy; very few being above forty. Long leasehold tenure is unknown, but a great part of the land is heavily burdened with a species of irredeemable mortgage peculiar to the Channel Islands. The value of land is extremely high, the rent may be said to average from 5*l.* to 7*l.* the English acre; building-ground near the town is sold at very high price; in the town itself it has been known to fetch at the rate of 30,000*l.* the English acre. Owing to the care taken in the cultivation the produce is great; as much as fifty-four Winchester bushels of wheat have been raised on an acre. The ashes of sea-weed is the manure chiefly used for corn crops; the cost of manuring with it is about 2*l.* 10*s.* the English acre.

The ecclesiastical condition of the island has likewise undergone a favourable change. A new district has been formed out of the town parish, in which a church, dedicated to St. John, together with a residence for the minister, has been built by subscription, the district now forming a perpetual curacy, the patronage of which is in the gift of five trustees. The parish church of St. Peter's, which, in point of internal architecture, is considered one of the finest in the diocese of Winchester, consists of a chancel, nave, north and south aisles and transepts, with a square tower at their intersection; it appears to have been built at the commencement of the fourteenth century, the style is the later Gothic of France, termed 'le Flamboyant;' several of its fine windows have lately been restored: it is capable of containing about 1200 persons. There are in the parish of St. Peter's Port, besides these two churches, three other churches or chapels-of-ease, and a licensed room. The value of the livings in the island has been increased by a grant of the crown of 100*l.* to the parish of St. Peter's Port, and 50*l.* per annum to each of the country parishes; and the tithe on fish has been commuted to 20*l.* for the parish of St. Michael's-in-the-vale, and 10*l.* for each of the other parishes, except St. Andrew's, which does not border the sea. The present annual income of St. Peter's Port may be estimated at about 480*l.*; that of the country parishes varying from 170*l.* to 100*l.* per annum. Baptismal fonts have within a few years been erected in every parish church; the surplice in reading the Liturgy is now universally used in town, and also in some of the country churches. Since the Reformation, the first confirmation was held in 1818. The present bishop of the diocese has already visited the Channel Islands on four occasions, and each time has administered the rite of confirmation and held a visitation of the clergy. Dissenters are numerous, chiefly of the Wesleyan denomination; there are nine dissenting places of worship in town, besides chapels in every parish in the island, also a Roman Catholic chapel, and a meeting-house of Friends.

The late Admiral Lord de Saumarez was a native of Guernsey, as were also Major-General Le Marchant and Sir Isaac Brock, the former of whom fell at Salamanca, and the latter in Canada: to these names may be added Sir Edmund Andros, governor of Virginia in 1691; the late Rev. P. P. Dobree, regius professor of Greek at Cambridge; Sir John Jeremie, governor of Sierra Leone; and Dr. John Macculloch, F.R.S.

The present lieutenant-governor is Major-General W. F. P. Napier, C.B., the distinguished author of the 'History of the Peninsular War;' and the present bailiff or chief magistrate is Peter Stafford Carey, Esq., late recorder of Dartmouth, and a native of the island.

Further information respecting Guernsey may be obtained in Dicey, Berry, Jacobs, and Duncan's 'History of Guernsey,' the last published in 1841; Inglis's 'Channel Islands;' Warburton's 'Treatise on the Laws and Customs of Guernsey;' and Jeremie's 'Essay on the Laws of Real Property,' published in 1841.

GUEVINA. [Xylomelum, P. C.]

GUILDHALL, London. [Dance, P. C. S.]

GUN. A description of the principal varieties of fire-arms, both large and small, with notices respecting the dates of their invention, is given under Arms, P. C., pp. 372-376, and Artillery, P. C., p. 418; and under Cannon, P. C., p. 242, is an account of the manufacture of great guns. We shall here supply a notice of the manufacture of the smaller kinds of fire-arms, to which the names of musket or musquet, fowling-piece, rifle, &c. are applied.

The rise of the gun-manufacture in Birmingham, which is its principal seat in this country, appears to date from about the commencement of the eighteenth century. Hutton, in his 'History of Birmingham' (pp. 78, 79, of the edition of 1781), relates that, according to tradition, King William III. was once lamenting that guns were not manufactured in his own dominions, but that he was obliged to procure them, at great expense, and with greater difficulty, from Holland; when Sir Richard Newdigate, one of the members for the county, who happened to hear him, observed that genius resided in Warwickshire, and that he thought his constituents would answer his majesty's wishes. The king being pleased with the remark, the member posted to Birmingham, where the pattern was executed in such a manner as to give entire satisfaction. Large orders were immediately given, and these were so frequently repeated, that, to quote Hutton's quaint expression, the manufacturers never lost their road. From notices in Macpherson's 'Annals of Commerce' it appears that about 1787 the manufacture was prosecuted with great activity for the supply of foreign markets, the manufacture of Birmingham guns for the African market being estimated to give employment to between four and five thousand persons. By one of the strange perversities of taste, of which many examples may be found in the history of manufactures, guns marked 'London' were long preferred to those marked 'Birmingham,' notwithstanding the well-known fact that Birmingham was the chief seat of the manufacture. The Birmingham manufacturers were thus induced to stamp their goods as if made in London; and when, in 1813, a bill was brought into the House of Commons to compel every manufacturer of fire-arms to mark them with his real name and address, they took the alarm, petitioned against the bill, and instantly subscribed a large sum to defray the expense of opposing it, urging that they made the component parts of the London guns, which were, in fact, only put together and marked in the metropolis. The bill was defeated, and shortly afterwards the Birmingham gun-makers were allowed to erect a proof-house of their own, and to mark their guns, after being subjected to the proof required by the Board of Ordnance, with a distinguishing stamp. Holland, in the work referred to at the close of this article, gives some curious information respecting the extent of the gun-manufacture of Birmingham, both during the protracted war in which England was involved at the commencement of the present century, and more recently, when English artizans have been employed to meet the demands of foreign states. From his statements, founded upon authorized returns, it appears that more than two-thirds of the fire-arms made for the Board of Ordnance were supplied from Birmingham, and that the stands of arms fabricated there for the British government in the years 1812 and 1813 amounted respectively to 288,741 and 320,643. During the period of greatest activity it is said that the Birmingham manufacturers produced a musket per minute, which is not an extravagant assertion, seeing that, supposing the work to be carried on for sixteen hours every day in the year, Sundays excepted, the number produced at that rate would be 300,240, or rather under the number supplied to the government alone in 1813. The contract price at that time was 36*s.* a gun; but with the peace came a great falling off in the demand, which led many gunsmiths to abandon the trade, and caused a great reduction of price. In 1830 the Birmingham gun-makers contracted with the French government for the supply of 140,000 stands of arms at the price of about 28 francs, or rather under 23*s.* per gun, and even that price, Holland states, was considered liberal. It has been repeatedly stated by M'Culloch and others, that between the years 1804 and 1818 Birmingham supplied to government and the private trade nearly 5,000,000 fire-arms; and Barlow, quoting from authentic documents, shows that between 1803 and 1816 the number of fire-arms received and issued by the British government amounted to 3,227,716 muskets, 118,103 carbines, 27,895 rifles, and 203,266 pistols. In 1813 our allies alone were furnished with 500,000 muskets.

Before proceeding to notice some of the more interesting features of this manufacture, it may be well, to prevent misapprehension, to quote Mr. Dodd's remark, in the work referred to below, that in the great seat of the gun manufacture 'there is no such trade as a gun-maker, properly so called, or, at least,' 'there is no gun-factory; all the establishments, however large they may be, being devoted to the production of parts only of a gun.' 'The same gun,' observes this writer, 'travels about from factory to factory, from shop to shop, before it assumes its finished form; and the only person who could consistently be called a gun-maker is he who has the gun finished by putting the several pieces together.'

The most essential part of a gun is the *barrel*, or cylindrical iron tube, closed at one end, in which the explosion of the gunpowder is produced, and through which the ball or shot is projected. The interior of the barrel, which is technically called the bore, is usually a perfect and smooth cylinder, but the exterior is made slightly conical, in order that the thickness of the metal may be increased towards the *breech*, or closed end, where the explosion takes place, and where, consequently, greater strength is required than towards the *muzzle*, or open end. The very severe trials to which the barrel of a gun is exposed in use, and the fearful results which attend its bursting, render it in the highest degree important to use none but iron of good quality in the manufacture, and to work it in such a way as to render the chance of failure as remote as possible.

Military muskets generally, and the cheaper descriptions of other guns, have their barrels formed of tenacious soft iron, which is wrought or rolled into the form of flat bars, called *skelps*, each of which is sufficient to form a single barrel. The length of a skelp is usually about three feet, and the breadth about four inches at one end, where also it has increased thickness or substance to form the breech of the barrel, but gradually tapering to about two inches and a half at the other end, which is to form the muzzle. Until about the year 1811 skelps were usually manufactured by means of the forge-hammer; and as considerable skill was required to ensure the regular gradation from the thicker to the thinner end, the workmen employed in forging them were able to command good wages. In the above year, however, in consequence of a strike among the skelp-forgers for what was considered an exorbitant advance of wages, a method of fashioning them by rollers was introduced, it occurring to the inventor, according to Babbage's account, 'that if the circumference of the rollers between which the bar-iron was rolled, were to be made equal to the length of a skelp, or of a musket barrel, and if also the groove in which the iron was compressed, instead of being of the same width and depth throughout (as in the ordinary manufacture of bar-iron by rolling), were cut gradually deeper and wider from a point on the rollers, until it returned to the same point, then the bar-iron passing between such rollers, instead of being uniform in width and thickness, would have the form of a skelp.' The experiment succeeded, not only in effecting a great saving of labour, and rendering the manufacturers independent of the refractory workmen, but also in producing skelps of superior quality. 'The pure metallic particles,' according to Holland's account of this invention, for which a patent was obtained by a Staffordshire ironmaster named Bradley, 'being compressed by the rollers both edgeways and flatways at the same time, cohere more closely together; nor are the skelps so liable to veins or flaws as those which are edged up in a less hot state under a forge-hammer.' The barrels made of them are said also to turn clearer and sounder than those forged by hand.

In the old method of welding the skelps into barrels, the thicker end was first heated to redness, and then hammered upon a groove or hollow cavity in the anvil until the edges were turned up. A mandril being then inserted in the concavity between them, the edges were turned over and welded together by the hammer. By the repetition of the like process upon a length of two or three inches at a time, the skelp was gradually converted into a tube or barrel, each of the lengths thus separately welded being exposed to two or three welding operations, with alternating high and low heats, the latter being intended to correct defects occasioned by the former. Several attempts were made to substitute the action of machinery for this tedious and laborious process, in one of which, patented in 1811 by Messrs. James and Jones, and described by Holland, the power was applied by a series of automatic hammers. Little, however, was done in bringing any such process into operation until a combination was found among the welders, similar to that above referred to among the skelp-forgers, and which, if successful, would have caused the completion of a large contract which was then being executed to be attended with a very heavy loss. A method which had been patented some years before by one of the contractors, but which had not then been brought into satisfactory operation, was resorted to under this difficulty, and the result was that barrel-welding by rolling machinery soon, in a great measure, superseded the old process; and the manufacture of iron tubes of lighter character, suitable for gas or water pipes, by a similar process, was subsequently commenced. Babbage, whose account of the introduction of this process we have quoted, observes that the combining workmen were thus permanently reduced to a lower rate of wages, and that as the new method of welding was far less injurious to the texture of the iron than the old, in consequence of the iron being exposed only once, instead of three or four times, to the welding heat, the public derived advantage from the superiority as well as from the economy of the process. Babbage does not mention the name of the person to whom the introduction of this improvement is due; but Greener, in his account of the same circumstances, attributes it to the late Mr. Clive, who was an extensive manufacturer of iron for gun-barrels, and states that the jealous opposition of the trade to his innovation led the Birmingham gun-makers to combine not to use his iron.

The most recent and authentic account we have seen of the modern improved method of barrel-welding is that communicated by Mr. Lovell, Director of the Royal arms manufactory at Enfield Chase, to the 'Supplement' to Dr. Ure's 'Dictionary of Arts,' under the title 'Fire-Arms,' where this method is said to have entirely superseded that of skelp-welding by hand. From this article it appears that, instead of being formed of skelps forged nearly to the intended length of the barrel, barrels are now made from slabs of thoroughly refined flat bar-iron, ten or twelve inches long, and weighing from ten to ten and a half pounds, or less, according to the kind of barrel to be made. These slabs, after being cut from the bars by long shears, are heated, and, to adopt Mr. Lovell's language, 'bent in their whole length, by means of conveniently grooved bending rolls, until they assume the form of rough tubes,' their opposite edges being brought to meet without overlapping. These tubes are laid upon the hearth of a reverberating furnace, in which they are brought to a full welding heat; and as soon as their edges are thus brought to a semi-fluid state, they are taken out and passed between grooved rollers, the grooves of which are rather smaller than the exterior of the tube. By this means the tube is perfectly welded from end to end, and if the heat be properly managed, and the juncture kept clear of dirt and cinders, the iron will become perfectly homogeneous in every part, without any appearance of the seam. The tubes are repeatedly heated, and passed through gradually decreasing grooves in the rollers; and to preserve their tubular form and ensure regularity in the *bore*, or internal dimension, during the welding process, they are taken out of the furnace and applied to the rollers, by means of a mandril consisting of a long iron rod considerably smaller than the bore, but having at the end a short steel treblett made exactly the size that the barrel is intended to be. By a simple contrivance it is arranged that, while the tube is passing between the rollers, the treblett shall always be immediately between them, so as to keep the bore open. The adhesion of the hot metal to the surface of the rolls or rollers is sufficient to draw the tube off the mandril. By a succession of rollings the barrel is elongated to the required length, and brought down to the required degree of tenuity; and if there be any surplus metal, it is cut off from the muzzle end. Gun-barrels formed in this way are found to stand proof better than those wrought by hand, because the heat is more equalized, and, in consequence of the great elongation between the rollers, any imperfections in the original mass of iron are dispersed over a greater surface.

All the processes hitherto described relate to the manufacture of what are termed *plain* barrels; but some of the most curious operations in the gun-maker's art relate to the manufacture of the superior kind of barrel called *twisted*, of which there are many varieties. In all of these the material of which the barrel is composed is rolled or forged into narrow bars, about equal in thickness to the intended substance or thickness of the barrel, and varying in width from about three-eighths of an inch to an inch or more. One of these narrow rods or ribands of metal, being moderately heated to increase its pliancy, is wrapped spirally round a cylindrical mandril about the size of the bore of the intended barrel, in such a way as to form a tube, which may be slipped off the mandril at pleasure. As the rods are not usually made of sufficient length for one to form a barrel, several are usually joined end to end, those which form the breech being thicker than those at the muzzle end. In this state the barrel is a coil of metal somewhat resembling, on a large scale, the kind of spiral spring employed by bell-hangers as a check-spring. It is then heated to welding heat, and forged into a solid or continuous tube partly by hammering upon a mandril, and partly by what is termed *jumping*, or striking the end of the barrel upon the floor, by which the edges of the helical or spiral rod are brought into very close contact, and eventually incorporated together. Many successive heats are, of course, necessary in this operation, and the welding proceeds only two or three inches at a time.

The manufacture of the numerous varieties of twisted barrels is very minutely described in Greener's works, entitled 'The Gun; or a Treatise on the various descriptions of small fire-arms,' and 'The Science of Gunnery, as applied to the use and construction of fire-arms,' especially in the first mentioned, which contains many curious details upon the various kinds of iron employed. From these it appears that considerable difficulty has arisen from the circumstance that, as the progress of science has enabled manufacturers to produce articles of common use of very inferior qualities of iron and steel, the common *scrap* iron and steel, which consists of fragments of such articles when broken or worn out, and which is much sought after by the makers of gun-barrel iron, is very inferior to what was procurable a few years since. Even horse-nails, that is to say, the nails employed for fixing horse-shoes, and which when worn out are collected with avidity as furnishing one of the best descriptions of scrap-iron, under the name of *horse-nail stubs*, are now difficult to be procured of the quality required for making gun-barrels, since many of those used in this country are now made of malleable cast-iron, and a few such mixed with others would spoil the iron for the purposes of the gunsmith. *Wire-twist* is the technical name given to an excellent kind of twisted barrel, which by some ignorant dealers is supposed to be really fabricated of wire. Such barrels are formed of very narrow rods of compound metal, composed of alternate bars of iron and steel forged into one body, and then rolled out to the requisite tenuity, when the edges of the rods, which are brought to the surface of the barrel, will, on the application of a corrosive liquor which acts differently upon the two metals, present a fibrous or wiry appearance. In forming a barrel of such rods care is taken that the adjoining edges of the spiral be alternately composed of iron and steel, so that the pattern may have a uniform appearance, although the difficulty of welding is thereby increased. *Damascus* barrels, or rather such as are manufactured in this country under that name, are composed of similar metal, but the rods are twisted upon their own axes until their component fibres or laminæ have from twelve to fourteen turns in an inch, and the rods are thereby doubled in thickness and proportionately reduced in length. Two such rods are welded together side by side, their respective twists being reversed. Barrels made of rods of Damascus iron have a very pretty appearance; but, as Greener observes, the metal is considerably weakened by the excessive twisting of its fibres, on the same principle, though not to the same degree, as a rope is impaired by over-twisting. Of this point Greener gives illustrations in the results of numerous experiments made by him on the cohesive strength of various kinds of iron. *Stub* barrels are formed of horse-nail stubs, cleaned to brightness by friction in a machine, and mixed with fragments of steel, usually of old coach-springs cut up into little bits resembling the stubs. These stubs and scraps are wedged compactly into a hoop or ring, which holds them together while they are exposed to welding heat in a furnace, and welded into a compact mass called a *bloom*, which is drawn out by rollers into the narrow strips required for making twisted barrels. Greener states that the usual proportions of this compound metal are fifteen pounds of steel to twenty-five pounds of iron-stubs; but he thinks the proportion of steel might be increased with advantage. Attempts to make barrels of steel alone have frequently failed owing to its hardness. 'It is not,' he observes in 'The Gun,' 'sufficiently tenacious of itself, from its fineness of grain, to resist the sudden explosion of gunpowder.' He states that when steel barrels have been found to stand proof, their shooting powers have been found very great, a circumstance which affords encouragement to efforts for introducing them. Some makers have tried to make iron barrels with an inner tube or lining of steel; but this is very objectionable, because the two metals, thus used, could not spring together, although when combined as in wire-twist and stub-iron they may be considered to act as one substance, uniting the hardness of steel with the soft tenacity of iron. These remarks were published in 1835, and in the second work above mentioned, published in 1841, Greener states that much progress had been made in the use of steel since 'The Gun' was published. *Stub Damascus* is a very beautiful kind of iron formed like the Damascus iron above described, but of stub-iron instead of wire-twist, but it is open to the same objection on the ground of over-twisting.

We may here refer to a paper communicated to the Society of Arts in 1825, and published in their 'Transactions,' vol. xliii. pp. 105-108, which contains an account of the process employed at Bombay in making gun-barrels and sword-blades in imitation of those made at Damascus; from which it appears that these barrels are manufactured of iron hoops, obtained from European and chiefly from British casks. The more they are corroded by rust, the more highly are they valued; and if they are not sufficiently oxidated they are exposed to moisture until they become so. Being cut into lengths of about twelve inches, they are formed into a pile an inch or an inch and a half high, the edges being laid straight, so as not to overlap each other, and a longer piece is so fitted as to return over each end, and hold the pile together while in the fire. After being heated the pile is drawn or forged out to a bar about an inch wide and one-third of an inch thick, which is doubled up in three or more lengths, welded together, and again drawn out as before, this operation being repeated three or four times according to the degree of fineness required. The bar is then heated, a small portion at a time, and hammered on the edge so as to flatten it out the contrary way to that of the stratification, by which operation the wire or vein is brought out on the face of the strap or riband of iron. 'The barrel is then forged in the usual way, but,' Captain Bagnold states, 'much more *jumping* is used than in the English method, in order to render the twist finer.' 'The most careful workmen,' he adds, 'always made a practice of covering the part exposed to the fire with a lute composed of mud, clay, and the dung of cows or horses, in order to guard against any unnecessary oxidation of the metal. When the barrel is complete, the twist is raised by laying the barrel from one to five days either in vinegar or a solution of the sulphate of iron, until the twist is raised; this process is called the wire-twist.' 'To produce the *curl*,' he further states, 'the bars or straps are drawn out to bars about three-quarters of an inch square, and twisted, some to the right and others to the left; one of each sort are then welded together, doubled up and drawn out as before; and upon the experience of the workman, any intricacy of twist is produced by this drawing out, doubling, and twisting.' This latter process, it will be observed, resembles that of English workmen, as also does a piece of trickery which Captain Bagnold mentions, consisting in rough-filing a common English barrel, and welding a strap of Damascus iron spirally round it, or applying several such straps longitudinally, and welding them on; a fraud which must be severely condemned as impairing the barrel in a similar way to the attempted union of iron and steel above alluded to. It is important to notice that the native Indian artists never work with coal under any consideration, but use solely charcoal from light woods.

Greener describes many other varieties of gun-barrel iron than are mentioned above, but these need not be further noticed, excepting to remark that the inferior twisted barrels are usually formed of wider rods than the better sorts, and are consequently weaker from the necessarily oblique direction of the twist, and from the circumstance that large rods do not get so thoroughly rolled as small ones, as well as from the inferior quality of the metal itself. He also describes numerous ways, often very ingenious, in which frauds are committed by unprincipled gunmakers, to avoid not only the increased cost of the superior kinds of metal, but also the increased charges for labour in almost every department upon barrels of the best quality. In some cases a strip of inferior iron will even be introduced into the heart of rods or bars of Damascus iron, by which, owing to the different expansive powers of the two metals, the gun will be impaired more than by the diminution of strength and intrinsic value.

The great amount of welding required in twisted barrels requires a very large fire, and Greener states that several hours should be spent in forging inferior barrels before the fire can be brought to a fit state for those of the best quality. Hence, he considers, the London barrel-forgers do not attain such perfection in this operation as those of Birmingham, because they do not generally make the inferior barrels necessary to bring the fire into a good state. The junction of the several lengths of rod necessary to make a twisted barrel is often effected by cutting each off in a sloping direction, and leaving them to be joined in the general welding operation; but it is better to weld them together before the twisting is completed. After welding the barrels are re-heated to a welding heat, a few inches at a time, and hammered in a groove to the required size. Sometimes they receive a subsequent hammer-hardening in like way, when cold; but though this improves them much, it is often neglected.

After welding the barrels are very carefully examined, and if needful, straightened by a few blows of the hammer. Holland states that their soundness is tried also, by placing one end in a bucket of water, and sucking with the mouth at the other end, until the barrel is full of water, when, if there be any crack or flaw extending through the substance of the metal, it may be detected by the appearance of moisture on the outside. They are then bored in a machine with an angular plug of tempered steel [BORING INSTRUMENTS, P. C. S., p. 225], which is caused to revolve rapidly within the barrel, a stream of cold water being directed upon the outside to check the heat generated by the excessive friction of the tool. Greener states that the barrels are not annealed for this purpose, as Dr. Ure has represented in the 'Dictionary of Arts.' The outside of the barrel needs also to be made smooth and even, which was formerly done by applying it to the surface of a large grindstone, the workman allowing the barrel to roll slowly through his hands, so as to present every part of the surface successively to the stone; but this process is now in a great measure superseded by turning in lathes, a method which claims great economy, as well as superiority in point of accuracy, and the advantage of doing away with a most unwholesome business, and one by no means unattended with danger. In a lathe it is easy to ensure the perfect concentricity of the inner and outer surfaces of the barrel, and the perfect rotundity of the exterior surface, whereas under the old plan of grinding the sides of the gun were often very unequal in thickness, one side being in some instances nearly twice as thick as the other. In all cases it is advisable to forge the barrels as nearly as possible to their intended dimensions, in order that as little as possible of the surface, which has been condensed by hammering, may have to be removed. After the first or rough boring the interior is fine-bored with an instrument having but one cutting angle, which is kept to its work by strips of soft wood attached beside it. Generally speaking barrels are bored with a perfectly equal cylindrical bore; but some gun-makers prefer enlarging the bore a little towards the breech, under the idea that the consequent contraction of the muzzle will cause the shot to fly more closely. The breech end of the barrel is then tapped with a screw-thread, to receive the breech-plug, which closes it at that end, and forms the abutment for the explosive force of the powder, and in which, in many cases, is formed the chamber to hold the powder, and the narrow passage by which that chamber is connected with the touch-hole. The best form of this chamber, and of the connection with the touch-hole, is a matter upon which gun-makers differ widely.

The barrels are then ready for *proving*, which consists in firing them in a building in which their explosion can do no harm, with a charge four or five times as great as they will have to bear when in use. A great number of barrels are fired at once, by laying them upon a strong framework of wood, with their touch-holes downwards, and connected with a train of powder which is conducted outside the building, within which is laid a heap of sand to receive the bullets. Greener, who considers the present mode of proving to be very unsatisfactory, and recommends, among other improvements, the testing of barrels by the hydraulic pump or press, states that common barrels are so fixed as to prevent any recoil in proving, while twisted barrels are allowed to fly back into a mass of sand laid at the back of the frame, by which the severity and security of the test are very materially lessened. Common barrels, he says, are allowed to lie twenty-four hours in the proof-house untouched, in order that, by the action of the nitre in the gunpowder, any crack or flaw may be rendered visible. They are then carefully examined, and such as show any defect, or have bulged with the explosion, are returned to be reforged, after which they must be proved again, while such as have stood the test satisfactorily are stamped with a distinguishing mark. Notwithstanding the strict regulations which require every barrel to be thus tested, Greener thinks that in many cases the proof-mark is forged, and states that sometimes a cheat is committed by welding unproved tubes on to pistol barrels which have been proved, so as to convert them into gun-barrels, for the sake of saving the difference of a few pence in the cost of proving.

Sporting guns are very often made with two barrels fixed side by side upon one stock. Such barrels are made separately, and have their adjacent sides filed flat in order that they may lie close together. They are secured together by ribs running between them from end to end, and filling up the spandril-shaped grooves formed by their contact. For general sporting Greener says that they should not be mounted with the bores perfectly parallel with each other, but slightly converging, so that their line of fire may meet at a given distance; but opinions differ as to the best inclination or degree of convergence.

The wooden *stocks* upon which the barrel or barrels are mounted is most commonly made of walnut-tree, though bird's-eye maple and a few other woods are occasionally used. This is fitted to the barrel so accurately as to leave as little as possible to depend upon the metal fastenings by which they are connected together. Great care should be taken to adapt the weight, length, and curvature of the stock to the person for whose use it is intended. Greener observes that it is very common to make the stocks of sporting guns too short and too crooked; and Colonel Hawker, in a passage quoted by Holland, says that 'the length, bend, and casting of a stock must, of course, be fitted to the shooter, who should have his measure for them as carefully entered in his gunmaker's books as that for a suit of clothes on those of his tailor.' 'He has then,' the colonel adds, 'only to direct that his guns may be well balanced, to do which the maker will introduce lead in proportion to their weight; so that, on holding each of them flat on the left hand, with the end of the feather-spring about half an inch from the little finger, he will find a sufficient equilibrium to make the gun rest perfectly steady on the hand.' When the shaping of the stock is completed, it is shod with brass, the trigger-guard and other metallic fittings and ornaments are let into the wood, and every part is fitted with suitable screws and fastenings, after which the whole is taken to pieces; the woodwork is finished by staining and polishing, the brasswork is filed and polished, and the barrels are sent to be finished, which is done in various ways.

When intended to be bright externally, barrels are filed all over with smooth files, and then polished with a steel burnisher. Military muskets were formerly polished in this way, but the time and labour required to maintain the polish proved so harassing during service, that the Duke of Wellington, during the Peninsular war, dispensed with it, and allowed the muskets to be browned. Of the various methods of browning or staining barrels we may notice two, in the first of which, described by Holland, the solution employed consists of half an ounce each of nitric acid and sweet spirits of nitre, one ounce of spirits of wine, two ounces of blue vitriol, and one ounce of tincture of steel. These ingredients are mixed, the vitriol being previously dissolved in sufficient water to make, with the other fluids, a quart of mixture. The barrel, being first thoroughly cleaned from grease and dirt, and having the muzzle and vent stopped up with wood, is wetted all over with this mixture, applied with a sponge or rag, and then exposed to the air for twenty-four hours, after which it is rubbed with a hard brush to remove the oxide formed on the surface. These operations may, if requisite, be repeated two or three times, until the barrel becomes perfectly brown. It is then carefully brushed, wiped, and immersed in boiling water, which holds a quantity of alkaline matter in solution, in order that the further action of the acid mixture may be prevented. The barrel is then dried, rubbed smooth with a burnisher of hard wood, and heated to about the temperature of boiling water, after which it is coated with a varnish composed of spirits of wine, one quart; pulverized dragon's blood, three drachms; and bruised shell-lac, one ounce. When this is dry the barrel is finally rubbed with the burnisher to give it a smooth glossy face. The second method we shall allude to is called *smoke brown* or stain, and is recommended by Greener as one of the best preventives of fraud in the manufacture of twist barrels, since it brings out the grain or pattern in a way which, to say the least, it is not easy to imitate. For producing it, the barrels are anointed with a little vitriolic acid, which is washed off, and the surface rubbed dry. A forge fire is then lighted and blown up, with coals containing as much hydrogen gas and as little sulphur as possible. When the coals are burnt until they give out a clear white flame, without any black smoke, the barrels are passed gradually backwards and forwards through the flame until they are covered with a black sooty covering. They are then placed for eighteen hours in a damp cool cellar, by which the iron particles will become coated with a red rust, while the steel retains it original sooty coat. The rust and soot being brushed off with a brush of steel wire, the barrels are washed and polished with a linen cloth dipped in water and fine washed emery, by which the two metals become very distinct, the iron being dark and the steel bright and polished. After drying, the smoking is repeated, and the barrels are left in the cellar for twelve hours, and treated as before; and thus the process is repeated until the barrel becomes as dark as may be wished, the darkest colour attainable being a fine purple-black on the iron, with a copper tinge on the steel.

The progressive steps in the invention of the fire-lock, or that contrivance attached to the breech of a gun by which the powder in the touch-hole is ignited, are noticed under **Arms**, P. C. The essential qualities of a gun-lock are, first, that it should work easily and efficiently, so that the force required to move the trigger and release the spring by which the hammer, or striking part of the lock, is moved, shall not be sufficient to interfere with accuracy of aim and rapidity of firing; secondly, that it should not be liable to go off at half-cock (a position in which the lock should always be kept until actually preparing to fire, and in which even the application of force to the trigger has no effect upon it), or in any other way accidentally; and, thirdly, that when the piece is on full cock the pulling of the trigger should cause the gun to fire with certainty. The delicate workmanship of modern locks, the manufacture of which forms a distinct trade, which is carried on chiefly at and in the neighbourhood of Wolverhampton, leaves nothing to be desired in efficiency and ease of working, while the ingenuity which has been devoted to this branch of mechanical science has provided numerous admirable plans for lessening the risk of accident by means of tumblers or other contrivances for securing those parts of the lock which might occasion danger by their accidental removal. Some such contrivances, to give a fair account of which would require too much space in this article, are illustrated by Holland, and in Dr. Ure's 'Dictionary of Arts.' Until a comparatively recent period all military guns, and most of those used for sporting purposes, were made with flint-locks, in which the ignition of the priming-powder was effected by the sudden stroke of a wedge-shaped flint against a piece of steel, by which a stream of sparks was directed into the pan containing the priming; and the great number of flints required for this use caused the cutting, or rather breaking, of them to be a considerable branch of industry, of which a full account is given in the 'Encyclopædia Metropolitana.' When the first attempt was made to substitute for this contrivance the use of a fulminating or detonating powder, which, being ignited by simple percussion, should set fire to the ordinary gunpowder in the touch-hole, we are not aware, but, according to the work just referred to, the first percussion-lock was invented by the Rev. Mr. Forsyth, of Belhevie, in Scotland. The improvement has however led to alterations in the construction of gun-locks which, as Holland observes, are hardly inferior to that which took place on the substitution of the modern flint for the antient fire-match. The pan which contained the priming-powder, and the cover which shielded it until the moment of preparing to fire, are rendered unnecessary, their place being supplied by a small upright nipple, the perforation of which coincides with, and forms a continuation of, the touch-hole of the barrel. The cock, or striking part of the lock, instead of carrying a clamp to hold the flint, becomes a simple hammer, with a snout adapted to fall exactly upon the top of the nipple. The fulminating substance is usually placed, for convenience, in a small copper capsule or cap, resembling a thimble in shape, which fits on to the nipple, and, if not blown to pieces by the explosion, is removed previous to reloading. The hammer is provided with a shield to prevent any fragments of the copper cap from flying against the face of the shooter. The great superiority of the percussion principle in safety and certainty of action has at length led to its adoption, after experiments most decisive as to its superiority, especially in wet weather, over the flint-lock, for all the muskets of the British army. A long article relating to the compounding and use of percussion-powders made with fulminate of mercury, which forms the base of most such compositions, is given under 'Fulminates,' in Dr. Ure's 'Dictionary of Arts;' and in the Supplement to that work, under 'Musquet,' are representations of the details of the new percussion-guns supplied to the British army, copied from the illustrations to a pamphlet of instructions for cleaning and managing them, compiled by Mr. Lovell, of the Royal Arms Manufactory.

Rifled guns are described under **Rifle**, P. C., p. 11.

(Greener, *The Gun*, and *Treatise on Gunnery*; Holland, *Manufactures in Metal*, in Lardner's 'Cabinet Cyclopædia,' vol. ii. pp. 94-123; Barlow, *Treatise on Machinery and Manufactures*, in the 'Encyclopædia Metropolitana;' Dodd, *British Manufactures—Metals*, in Knight's 'Weekly Volume,' pp. 102-107; Dr. Ure, *Dictionary of Arts*, and *Supplement*, art. 'Fire-arms,' &c.; Babbage, *Economy of Machinery and Manufactures*, sec. 362, 363.)

GUNST, PIETER VAN, an excellent Dutch portrait engraver, who however possessed more patience than ability, was born at Amsterdam about 1667. He engraved a set of ten full-length portraits, after Vandyck, from drawings made in England in 1713 by Arnold Houbraken, who received one hundred florins each for them. He also engraved a set of portraits after Vander Werff, for Larrey's History of England; and he engraved the portrait of Franciscus Junius, after Vander Werff, which is inserted as a frontispiece to the 'Pictura Veterum,' Rotterdam, 1694. His works are extremely neat in execution, especially the heads; he appears to have studied the works of the Drevets. Among his historical or figure pieces, which are inferior to his portraits, are nine Loves of the Gods, after Titian. The date of his death is not known.

(Vertue, *Catalogue of Engravers*; Huber, *Manuel des Amateurs*, &c.)

GUNTER'S SCALE. [**Sliding Scale**, P. C.]

GUTHRY, HENRY, a Scottish ecclesiastic, was the son of John Guthry, clergyman of Cupar Angus in Forfarshire, where he was born soon after the commencement of the seventeenth century. He studied at St. Andrews, and when he became capable of holding a benefice, he was presented to the church of Stirling. In 1638 he subscribed the Covenant, but he is said never to have had much sympathy with its promoters, and he was inclined to neutrality in the discussions which followed. In 1647 he was one of those who joined the 'Engagement' for the support of Charles I. against the Parliament, a course of conduct which occasioned his deposition from the ministry. He was succeeded by a celebrated namesake, apparently a member of the same family, James Guthry, who having shown a resolute hostility to Charles II., his followers, and his ecclesiastical polity, was beheaded after having been convicted on a charge of high treason in 1661. The more moderate or cautious Henry was then restored to the benefice. He conformed to the re-establishment of Episcopacy, and was appointed bishop of Dunkeld in 1665. He died in 1676, leaving behind him a MS. History of his Own Time, which was published in 1748.

(*Life*, by George Crawford, prefixed to *Memoirs of Henry Guthry, late Bishop of Dunkeld.*)

GYMNADE'NIA, a genus of plants belonging to the natural order Orchidaceæ and the tribe Ophrydineæ. It is distinguished from the genus Orchis by the glands of the pollen masses being without a pouch. There are two British species, *G. conopsea* with equal lobes of the lip, and *G. albida* with unequal lobes of the lip. They are found in mountainous and hilly pastures, and blossom in June and July.

(Babington, *Manual of British Botany.*)

GYMNO'CLADUS (from *γύμνος*, 'naked,' and *κλάδος*, 'a branch'), a genus of plants belonging to the natural order Leguminosæ. It has diœcious flowers; the calyx tubular, 5-cleft; the petals five, equal, oblong, exserted from the tube; the stamens ten, enclosed; the legume oblong, thick, filled with pulp inside. There is but one species, *G. Canadensis*, the Kentucky Coffee-tree. It is an upright deciduous tree, with compound alternate, stipulate, bipinnate leaves, and white flowers in terminal racemes. The branches of this tree are without any appearance of buds, which, during the winter, gives it the aspect of a dead tree, and hence the Canadian name *chicot*, or stump-tree. The wood is hard, compact, and of a fine rose colour. In America it is used in cabinet-making and carpentry. It has the property of rapidly converting its sap-wood into heart-wood, so that the smallest trees may be converted to useful purposes. The seeds were at one time roasted and ground as a substitute for coffee in Kentucky and Tennessee; but they are not often used in this way at the present day. The pods, preserved in the same way as the tamarind, are said to be wholesome and aperient. This tree grows well in Great Britain, but does not ripen its seeds. It is best propagated by imported seeds, but it will also grow freely from cuttings of the roots. It requires a rich, deep, free soil.

(Loudon, *Encyclopædia of Trees and Shrubs.*)

GYRACA'NTHUS, a genus of fossil Placoid fishes, from the mountain limestone and coal strata: four British species. (Agassiz.)

GY'RODUS, a genus of fossil Ganoid fishes, from the oolitic and cretaceous strata chiefly: ten British species. (Agassiz.)

GYRO'LEPIS, a genus of fossil Ganoid fishes, from the new red-sandstone strata and bone-beds of the lias: three British species. (Agassiz.)

GYRO'NCHUS, a genus of fossil Ganoid fishes, from the oolite of Stonesfield. (Agassiz.)

GYROPHORA. [Liverworts, P. C. S.]

GYROPRI'STIS, a genus of fossil Placoid fishes, from the red-sandstone near Belfast. (Agassiz.)

GYRO'STEUS, a genus of fossil Ganoid fishes, from the lias. (Agassiz.)

INDEX TO THE LETTER G.

VOLUME I

Gaddi, page 627
Gaertner, Johann Andreas, 627
Gágea, 628
Gaillonílla, 628
Galanínio, 628
Galashiels [Selkirkshire, P. C.]
Galeopsis, 628
Galileo, 628
Gálium, 630
Galla [Abyssinia, P.C.S., p. 23]
Gallery, 631
Gallus, C. Aquilius, 633
Gallus, Aelius, 633
Gallus, Aelius [Arabia, P. C. p. 215]
Gallus, Julius Aquila, 633
Galt, John, 633
Game Laws, 634
Gaming, 637
Gandon, James, 638
Gánodus, 639
Ganoid, 639
Gans, Edward, 639
Gaol [Transportation, P. C.]
Gardenia, 640
Garnishee [Attachment, P. C.]
Garófalo, 641
Garrya, 641
Gascoigne, George, 641
Gascoygne, William, 642
Gases, Liquification of [Chemistry, P. C. S.]
Gasse, Stefano and Luigi, 642
Gasteromycétes, 642
Gasterobranchus [Myxine, P. C. S.]
Gatti, Bernardino, 643
Gauden, John, 643
Gearing, or Geering, 643
Gee, Joshua, 644
Gell, Sir William, 644
General Issue [Pleading, P.C.]
Genèvre, Mont, 644
Genista, 645
Géophila, 646
George, St., 646
George of Denmark, Prince, 646
Geránium, 648
Gerard, François, Baron, 648
Gerbier d'Ouvilly, Sir Balthasar, 648
German Silver [Copper, P. C., p. 504]
Germen [Pistil, P. C.]
Gesénius, Friedrich Heinrich Wilhelm, 648
Ghisi [Mantuano, P.C.S.]
Giamberti [San Gallo, P. C.]
Gibson, Richard, 649
Gilbertsocrinus, 649
Gill, John, D.D., 649
Gillenia, 649
Gillies, John, LL.D., 650
Gillray, James, 650
Gin, or Gyn, 651
Ginkell, Godart de, First of Athlone, 651
Giocondo, Fra Giovanni, 651
Gioffrédo, Mario Gaetano, 652
Giraud, Count Giovanni, 652
Girder [Trussing, P. C.; Floor, P. C. S.]
Girodet Trioson, Anne Louis, 652
Girvan, 653
Glacier, 653
Glass, John, 654
Glass Painting, 654
Glaucium, 654
Glaux, 654
Gleaning, 654
Gleditschia, 655
Gleeman's Song [Saxon Language and Literature, P. C.]
Glycéria, 655
Glycerin [Chemistry, P. C. S.]
Glýcine [Wistaria, P. C.]
Glyphis, 655
Glyptocéphalus, 655
Glyptósteus, 655
Glyptography [Electro-Metallurgy, P. C. S.]
Gnaphálium, 655
Gnetáceæ, 655
Góbius, 656
Goes, Hugo vander, 656
Gold-Beaters' Skin, 656
Gold-Beating, 657
Golding, Arthur, 658
Gomer-Chamber [Chamber, P. C.]
Gomera, 658
Gondar, 658
Goniógnathus, 659
Gonióphorus, 659
Goods and Chattels [Chattels, P. C.]
Goodyera, 659
Gooseberry [Ribes, P. C.]
Gorcum, or Gorinchem, 659
Gordon, Robert, 659
Gorse [Ulex, P. C.]
Gosson, Stephen, 659
Goujon, Jean, 659
Goyen, Jan van, 660
Gozzoli, Benozzo, 660
Gracillaria [Sea-Weeds, P. C.]
Gradients [Railway, P. C., p. 250]
Graham, John, Viscount Dundee, 660
Graham, Robert, 660
Graham, Sir Thomas [Lynedoch, Lord, P. C. S.]
Graham, Maria [Calcott, Sir Augustus, P. C. S.]
Granáteæ, 661
Granger, Rev. James, 661
Grant, Anne, 661
Graphis [Liverworts, P. C. S.]
Graphite [Plumbago, P. C.]
Graptólepis, 661
Gravelot, Hubert François d'Anville, 661
Green, Valentine, 661
Greene, Robert, 662
Gregório, Rosário, 662
Gregory, Olinthus Gilbert, 663
Grenadiers, 663
Greuze, Jean Baptiste, 664
Grevile, Sir Fulke, 664
Grey, Charles, second Earl Grey, 665
Grias, 667
Griffith, William, 667
Grimaldi, Giovanni Francesco, 667
Grimaldi, Francesco Maria, 667
Gristhorp Bay, 668
Groats, or Grits [Avena, P.C.S.]
Gros, Antoine Jean, Baron, 668
Grotius, William, 668
Growing Crops [Emblements, P. C. and P. C. S.]
Guano, 668
Gubbio, Oderigi da [Roman School of Painting, P. C., p. 76]
Guerin, Pierre Narcisse, Baron, 669
Guernsey, 669
Guevina [Xylomelum, P. C.]
Guildhall, London [Dance, P. C. S.]
Gun, 671
Gunst, Pieter van, 675
Gunter's Scale [Sliding Scale, P. C.]
Guthry, Henry, 675
Gymnadénia, 675
Gymnócladus, 675
Gyracánthus, 675
Gýrodus, 675
Gyrólepis, 675
Gyrónchus, 676
Gyróphora [Liverworts, P.C S.]
Gyroprístis, 676
Gyrósteus, 676

End of the First Volume.

London: Printed by William Tyler, Bolt-court.

3 2044 102 813 680

LEIGHT
SON &
HODGE.
SHOE LANE
LONDON.